TWELFTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL
CONVENTION IN WASHINGTON, D. C.
SEPTEMBER 28-29 AND OCTOBER 1, 1923

COMPILED BY
IVAN C. WELD, Secretary-Treasurer
1120 CONNECTICUT AVENUE
WASHINGTON, D. C.

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"Protect the public against any wrongdoing at any place, at all times."
—President Calvin Coolidge.

COMPILED BY
IVAN C. WELD, Secretary-Treasurer
1120 CONNECTICUT AVENUE
WASHINGTON, D. C.

Price Two Dollars

International Association of Dairy and Milk Inspectors

CONSTITUTION AND BY-LAWS

CONSTITUTION

ADOPTED OCTOBER 16, 1911

NAME

This Association shall be known as the International Association of Dairy and Milk Inspectors.

OBJECT

The object of this Association shall be to develop uniform and efficient inspection of dairy farms, milk establishments, milk and milk products, and to place the inspection of the same in the hands of men who have a thorough knowledge of dairy work.

MEMBERSHIP

The membership of this Association shall be composed of men who now are or who have been actively engaged in dairy or milk inspection. Any person who now is or who has been so engaged may make application to the Secretary-Treasurer and if application is accepted by the Membership Committee, said applicant may become a member of the Association upon payment of the annual dues of five dollars ($5.00).

OFFICERS

The officers of this Association shall be a President, three Vice-Presidents, a Secretary-Treasurer, and two Auditors, who shall be elected by a majority ballot at the Annual Meeting of the Association, and shall hold office for one year or until their successors are elected. An Executive Board, which shall direct the affairs of the Association when not in Annual Session, shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

AMENDMENTS

This Constitution may be amended at any Annual Meeting by a two-thirds vote of the entire membership of the Association. Any member proposing amendments must submit the same in writing to the Secretary-Treasurer at least sixty days before the date of the Annual Meeting, and the Secretary-Treasurer shall at once notify all members of such proposed amendments. All members voting on such proposed amendments shall register their vote with the Secretary-Treasurer on blanks provided by the Association before the date of the Annual Meeting.

BY-LAWS

ADOPTED OCTOBER 25, 1913

ORGANIZATION

The Constitution shall be the basis of government of this Association.

ARTICLE 1

MEMBERSHIP

SECTION 1. Any person eligible for membership under the Constitution who shall file an official application, accompanied by the first annual membership dues of five dollars, and whose application for membership shall have the approval of the Membership Committee, may become a member of the Association for one year.

SECTION 2. Any person having once become a member may continue membership in the Association so long as the annual membership dues are paid. Any member who shall fail to pay annual dues within thirty days after having been notified by the Secretary that said dues are due and payable, shall be dropped from membership. Any member so dropped may, within ninety days, be reinstated by the Membership Committee, upon application filed in due form and accompanied by the annual membership dues for that year.

SECTION 3. A member of the Association may be expelled for due cause upon recommendation of the Membership Committee, and a majority vote of the members at any annual meeting. Any member so expelled shall have refunded such *pro rata* part of his membership dues as may not be covered by his term of membership.

HONORARY MEMBERS[1]

SECTION 4. Members of the Association may elect as honorary members, at any stated meeting, on the recommendation of the Membership Committee, those whose labors have substantially added to the scientific knowledge of milk supply betterment, or those who have been of pronounced practical influence in the improvement of the milk industry. From such members no dues shall be required. They shall have the privilege of attending the meetings of the Association, but they shall not be entitled to vote.

ARTICLE 2

OFFICERS

SECTION 1. The officers of this Association shall be a President, a First, Second and Third Vice-President, a Secretary-Treasurer, and two Auditors, who shall be chosen by ballot at the annual meeting of the Association, and shall hold office for one year, or until their successors are duly elected.

SECTION 2. The Executive Board shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

SECTION 3. The Membership Committee shall consist of the President, the three Vice-Presidents, and the Secretary-Treasurer.

ARTICLE 3

DUTIES OF OFFICERS

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association. He shall examine and approve all bills previous to their payment, appoint all committees unless otherwise directed by vote of the Association, and perform such other duties as usually de-

[1] Adopted October 29, 1915.

volve upon a presiding officer, or are required of him by the Association.

SECTION 2. The Vice-Presidents, in the order of their selection, shall perform the duties of the President in his absence.

SECTION 3. The Secretary-Treasurer shall record the proceedings of the Association. He shall keep a list of members, and collect all moneys due the Association, giving his receipt therefor. He shall record the amount of each payment, with the name and address of the person so paying. He shall faithfully care for all moneys entrusted to his keeping, paying out the same only with the approval of the President, and taking a receipt therefor. He shall, immediately after his election to office, file with the President of the Association a bond in the sum of five hundred dollars, the expense of which shall be borne by the Association. He shall, at the annual meeting, make a detailed statement of the financial condition of the Association.

It shall also be the duty of the Secretary-Treasurer to assist in making arrangements and preparing a program for the annual meeting, and to compile and prepare for publication all papers, addresses, discussions and other matter worthy of publication, as soon as possible after the annual meeting.

SECTION 4. The full management of the affairs of the Association when the Association is not in session shall be in the hands of the Executive Board, as provided in the Constitution.

SECTION 5. It shall be the duty of the Auditors to examine and audit the accounts of the Secretary-Treasurer, and all other financial accounts of the Association, and to make a full report of the condition of the same at the annual meeting.

ARTICLE 4

MEETINGS

SECTION 1. The annual meeting of the Association shall be held at such time and place during the month of October of each year or at such other time as shall be designated by the Executive Board.

SECTION 2. Special meetings of the Association may be called by the Executive Board, of which due notice shall be given to the members by the Secretary.

SECTION 3. Quorum.—Twenty-five per cent of the membership shall constitute a quorum for transaction of business at any annual meeting. Voting by proxy shall not be permitted.

ARTICLE 5

These By-Laws may be altered or amended at any annual meeting of the Association. Any member proposing amendments must seasonably submit the same in writing to the Secretary-Treasurer, who shall then give notice of the proposed amendments by mail to each member of the Association at least thirty days previous to the date of the annual meeting.

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Estes, Howard R.	Dairy and Food Inspector, Health Department	Flint, Michigan
Evans, Dr. Fred	Veterinarian	Sioux Falls, S. D.
Evenson, Oscar L.	Asst. Chemist, U. S. Bureau of Chemistry	Washington, D. C.
Fee, Kenneth F.	Director, Bureau of Dairy Products, Department of Farms and Markets	Albany, N. Y.
Flanagan, Geo. A.	Food and Milk Inspector	City Hall, Lynn, Mass.
Flanagan, Thomas F.	Food and Milk Inspector	9 Oak St., Hartford, Conn.
Forrest, Augustus	Bureau of Food and Dairy Inspection	Birmingham, Ala.
Foster, J. E.	Chief Dairy and Milk Inspector	City Hall, Houston, Texas
Frey, J. J.	Supt. of Dairy Service, Dept. of Agriculture, State of California	Route 4, Box 954, Sacramento, Calif.
Foelschow, G. W., D.V.M.	Chief Milk and Dairy Inspector	San Diego, Calif.
Frank, Dr. Leslie C.	Associate Sanitary Engineer, in charge, Milk Investigations, U. S. Public Health Service	119 Conti St., Mobile, Ala.
Fuller, Caleb A.	Deputy Inspector of Milk	71 Chas. Field St., Providence, R. I.

Gaddis, A. R.......Chief, Div. of Dairy Farm Inspection ....2600 Kate Ave., Baltimore, Md.

Gamble, Prof. James A. ....Professor of Dairy Husbandry, University of Maryland. College Park, Md.

Gauhn, Emmett R...Chief Milk Inspector ....Rochester, N. Y.

Gibbons, John F....Farm Inspector, Dept. of Health ....Room 10, City Hall, New Haven, Conn.

Grapp, Dr. G. H....State Dairy Inspector....... 816 Fidelity Bldg., Baltimore, Md.

Gray, Dr. J. R. T.,Jr.City Bacteriologist ....Chester, Pa.

Grim, Dr. Geo. W...Milk Control Officer, Board of Health, Lower Merion, Haverford, Narberth, Pa...Ardmore, Pa.

Hamilton, Jesse H..Food and Dairy Inspector...Box 185, Orlando, Fla.

Harding, Dr. H. A..Chief, Dairy Research Division, F. C. Mathews Co.......P. O. Box 834, Detroit, Mich.

Hartnett, Daniel P..Inspector of Milk............City Hall Annex, Holyoke, Mass.

Hay, Dr. L.........Dairy Inspector ....Faribault, Minn.

Hiscock, Ira V......Instructor in Public Health, Yale University, School of Medicine ....New Haven, Conn.

Holford, F. D., D.V.M. ....Chief Veterinarian, Borden's Farm Products Co. ....110 Hudson St., New York City

Hollingsworth, Dr. J. B. ....Chief Food Inspector, ...City Hall, Ottawa, Canada

Holt, Thomas ......State Dairy and Food Commissioner ....Hartford, Conn.

Holzman, J. A......Chief Dairy Inspector ......Dallas, Texas.

Hornaday, W. A., D.V.M. ....Dairy and Milk Inspector....Greensboro, N. C.

Hoxie, Mrs. G. H...Chairman of Milk Committee, Kansas City, Missouri, Consumers' League ....3719 Penn St., Kansas City, Mo.

Huffman, R. P.....Food and Dairy Inspector...Wilmington, N. C.

Hulquist, J. A......Dairy Inspector and Sanitary Inspector ....Jamestown, N. Y.

Irvine, George .....City Milk Inspector ....Care Y. M. C. A., Ann Arbor, Mich.

Irwin, Ralph E.....Asst. Engineer, State Dept. of Health .... Harrisburg, Pa.

James, J. C.........Director Laboratory and Food Inspector, Durham County Board of Health..........Durham, N. C.

Jennings, J. R......State Dairy Commissioner...State House, Phoenix, Ariz.

Johnson, F. H......Chief of Milk and Food Division, Health Dept.........Louisville, Ky.

Jones, Dr. A. C.....Meat and Dairy Inspector...High Point, N. C.

Jones, Fred E......Health Commissioner and Inspector of Milk ....Quincy, Mass.

Jordan, G. W.......Milk Inspector ....785 20th St., Detroit, Mich.

Jordan, Prof. James O. ....Inspector of Milk ....Room 1104, City Hall Annex, Boston, Mass.

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Krause, C. A........Dairy Inspector ....Portsmouth, Va.

Kresse, O. A........Milk and Dairy Inspector...City Hall, Houston, Texas

Krehl, E. C.........With Detroit Creamery Co...Detroit, Mich.

Lacy, Maurice J.....Supt. Food and Sanitation, City Board of Health.....New Orleans, La.

Lane, Prof. C. B....With Supplee-Wills-Jones Milk Company ....26th & Jefferson Sts., Philadelphia, Pa.

Ledbetter, D. ......Milk and Dairy Inspector for Biltmore Dairy Farm.....Biltmore, N. C.

Lees, Dr. A. F......Dairy Inspector ....Red Wing, Minn.

Leete, C. Sidney... Market Milk Specialist, U. S. Dept. of Agriculture, Dairy Division ....Washington, D. C.

Leman, Dr. H......Agriculture, Dairy and Milk Chemist and Bacteriologist.Rua Sao Jose No. 106, Sao Paulo, Brazil

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Le Fevre, Peter E...Asst. Market Milk Specialist, Dairy Div., B.A.I., U. S. Dept. of Agriculture.......Washington, D. C.

Lockwood, Ralph F., M.D. ....Health Officer and Milk Inspector ....Lakewood, R. I.

Lockwood, Prof. W. P. B...........Head Dairy Dept., Mass. Agricultural College ......Amherst, Mass.

Lombard, Alfred W..Mass. Dept. of Agriculture... 136 State House, Boston, Mass.

Loomis, Frank J....Inspector of Milk and Meat..Watertown, N. Y.

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Marquardt, O. R.	Milk Inspector	2221 Canton Ave., Detroit, Mich.
Maughan, M. O.	Secretary, National Dairy Council	910 S. Michigan Ave., Chicago, Ill.
Melican, Geo. D.	Milk Inspector	Room 6, City Hall, Worcester, Mass.
Melody, George L.	Dairy Veterinarian, Dept. of Public Health	1085 Mission St., San Francisco, Cal.
Miller, John F.	Inspector of Milk Pasteurizing Plants, State Dept. of Health	Albany, N. Y.
Moellenhoff, F. H.	Asst. City Chemist	Room 9, Municipal Courts Bldg., St. Louis, Mo.
Moore, Mrs. Edith Lotz	Bacteriologist and Chemist.	City Hall, Houston, Texas
Murray, R. A.	Milk Inspector	Health Dept., Detroit, Mich.
Myll, Clifton O.	Milk Inspector	Detroit, Mich.
Oakley, Roger W.	Collector of Milk and Dairy Inspector	City Hall, Brockton, Mass.
O'Hara, Philip	Dairy Inspector	113 Ingalls St., Ann Arbor, Mich.
Parker, Horatio N.	City Bacteriologist, Health Dept.	Jacksonville, Fla.
Pearce, C. D.	Chief Veterinarian, The Borden Company	350 Madison Ave., New York, N. Y.

* Deceased January 26, 1923.

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Posson, R. J. ...... Market Milk Specialist, U. S. Dept. of Agriculture....... Washington, D. C.

Price, Dr. Wm. H... Sanitarian Detroit Creamery Company .... Detroit, Mich.

Proper, C. F., M.D.C. Chief Dairy and Food Inspector .... City Hall, El Paso, Texas

Quigley, J. V. ...... Dairy Advisor, Kansas City Consumers' League .... 3706 Penn St., Kansas City, Mo.

Rasmussen, Fred .. President Pennsylvania-Maryland Joint Stock Land Bank .... Harrisburg, Pa.

Rice, Dr. John L.... Health Officer .... City Hall, New Haven, Conn.

Richmond, Dr. C. R. B. .... Chief of the Division of Food Control, Department of Public Health .... Toronto, Canada

Roadhouse, Prof. C. L. .... Professor of Dairy Industry, University of California... University Farm, Davis, Calif.

Robinson, Herbert S. Dairy Inspector, Health Department .... Boston, Mass.

Robertson, Fred L.. Milk Inspector and Chemist.. Health Dept., Springfield, Mass.

Romberger, E. E.... City Milk and Meat Inspector, Reading, Pa.

Rosinek, Ign. Frantisek .... In charge of Bureau for Reorganization and Reconstruction of Sanitary Control of Milk and Milk Products, Ministry of Health... Prague, Vyschrad, Vrahslavova S., Czecho-Slovakia

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Scott, W. M.	Chief Milk Inspector	Auditorium Hotel, Denver, Colo.
Seaman, Carl O.	Milk Inspector	14 South St., Manchester, N. H.
Sharwell, Samuel G.	Chief Dairy and Food Inspector, Dept. of Health	Newark, N. J.
Shoults, W. A., V.S.	Director of Food Division, Provincial Board of Health	Winnipeg, Manitoba, Can.
Shrader, Dr. J. H.	Director, Bureau of Chemistry and Food, City Health Department	311 Courtland St., Baltimore, Md.
Smisek, M. J.	Milk and Dairy Inspector	St. Paul, Minn.
Smith, Dr. Clarence E.	Commissioner of Health	Dept. of Public Health, Greenville, S. C.
Smith, Russell S.	Market Milk Specialist, Dairy Div., U. S. Dept. of Agriculture	Washington, D. C.
Spoon, J. P., D.V.S.	Milk and Meat Inspector	Burlington, N. C.
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Stevenson, A. F.		19 Circle Ave., Ridgewood, N. J.
Strauch, Thomas J.	Chief Dairy Inspector, Bureau of Health	Richmond, Va.
Strickland, Franklin N.	Executive Secretary-Chemist, Board of Food and Drug Commissioners	Providence, R. I.
Sunball, H. R.	Milk Inspector, Board of Health	Detroit, Mich.
Supplee, Dr. G. C.	Director of Research Laboratory, The Dry Milk Co.	Adams, N. Y.
Taylor, Geo. B.	Bacteriologist, Chestnut Farms Dairy	Washington, D. C.
Thomson, James E.	Chief of Div. of Milk Inspection, Dept. of Health	New York, N. Y.
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Vener, Benj.	With Tait Bros.	134 Cass St., Springfield, Mass.
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Walmsley, Dr. F. D.	Vice-President, Borden's Farm Products Company of Illinois	326 W. Madison St., Chicago, Ill.
Ward, Henry A.	General Manager, Wellington City Council Milk Dept., Wellington City Corporation	Wellington, New Zealand
Ward, Willard E.	Agent, Board of Health, for Milk and Food Inspection	14 Town Hall, Brookline, Mass.
Warner, W. J.	State Milk Inspector	R. F. D. 2, Andover, Conn.
Washburn, Prof. R. M.	Director of Laboratories, International Dry Milk Co.	503 Wilmac Bldg., Minneapolis, Minn.
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White, J. T.	Milk Inspector	1130 Seward Ave., Detroit, Mich.
Whittaker, H. A.	Director, Div. of Sanitation, Minnesota Board of Health	Minneapolis, Minn.
Whittlesey, J. M.	Commissioner on Domestic Animals, State of Connecticut	State Capitol, Hartford, Conn.
Widmayer, Fred J.	Food and Milk Inspector	Scranton, Pa.
Wines, E. H.	Dairy Inspector	105 Stevens Ave., Highland Park, Mich.
Wing, Chas. C.	City Veterinarian and Asst. Health Officer	Room 613, City Hall, Oakland, Calif.

Yates, J. W.	Director, Food and Dairy Division, Hospital and Health Board	Kansas City, Mo.
Young, Dr. Hulbert	Manager, Walker-Gordon Laboratory	Linden Ave. and Dolphin St., Baltimore, Md.

HONORARY MEMBERS

Evans, Dr. Wm. A.	Health Editor, Chicago *Tribune*	Chicago, Ill.
Pearson, Dr. Raymond A.	President, Iowa State College	Ames, Iowa
Woodward, Dr. Wm. C.	American Medical Association, Bureau of Legal Medicine and Legislation	535 N. Dearborn St., Chicago, Ill.
Van Norman, Prof. H. E.	President, World's Dairy Congress Association	426 Star Bldg., Washington, D. C.

Twelfth Annual Convention

HOTEL RALEIGH

WASHINGTON, D. C.

FRIDAY, SEPTEMBER 28, 1923

FIRST SESSION

The Twelfth Annual Convention of the International Association of Dairy and Milk Inspectors convened in the Oak Room at the Raleigh Hotel and was called to order by President Bolling at 10.20 A.M.

Dr. Wm. C. Fowler, Health Officer of the District of Columbia, welcomed the Association on behalf of the District government. Vice-President Thos. J. Strauch, of Richmond, speaking for the Association, expressed its appreciation of the cordial welcome extended.

President George E. Bolling, of Brockton, Mass., delivered the presidential address.

The report of the Committee on Dairy Methods was presented. Part I of the report dealt with milk cooling regulations from the standpoint of control agencies and was presented by Mr. Ernest Kelly. Part II dealt with the cooling of milk from the standpoint of the producers and the receiving station, and was presented by Dr. H. A. Harding. Part III dealt with milk temperatures and bacterial content of milk at time of delivery, and was presented by Mr. W. D. Dotterrer. Part IV, "Present Status of the Milk Cooling Problem and Summary and Conclusions of the Committee," was presented by Dr. G. C. Supplee, chairman of the committee.

Mr. E. R. Gauhn, of Rochester, N. Y., presented a paper on the subject, "The Influence of the Area Plan of Tuberculin Testing on Municipal Milk Supplies," after which a recess was taken for luncheon.

SECOND SESSION

President Bolling again occupied the chair and called the convention together at 2 P.M. The report of the Committee on Bovine Diseases—Their Relation to the Milk Supply and to the Public Health, prepared by Vice-President J. B. Hollingsworth, was, in the absence of Dr. Hollingsworth, read by Vice-President Thos. J. Strauch.

"The Influence of Efficient Supervision on a Municipal Milk Supply" was the subject of a paper read by Mr. Charles H. Amerman, Chief Milk Inspector of New Haven, Conn.

Prof. I. V. Hiscock, of the School of Medicine, Yale University, read a paper on the subject, "Our Responsibility for the Education of the Public in Regard to the Value and Care of Milk."

Mr. J. W. Yates, of Kansas City, presented a paper in three parts: (a) "The Effect of Monthly Medical Examination of Milk Handlers"; (b) "The Monthly Physical Examination of Dairy Herds"; (c) "The Annual and Semi-Annual Tuberculin Test of Cattle Producing Milk for the City Supply."

At this point a recess was taken.

THIRD SESSION

The evening session was called to order by President Bolling. Mr. Russell S. Smith, of the U. S. Department of Agriculture, Chairman, read the report of the Committee on Transportation.

Mr. C. E. Clement, Market Milk Specialist of the U. S. Dairy Division, presented the report of the Committee on Milk Plants.

Prof. H. E. Van Norman, President of the World's Dairy Congress Association, was introduced and addressed the Association.

Mr. Ing. Frantisek Rosinek, in charge of the Bureau for Reorganization and Reconstruction of Sanitary Control of Milk and Milk Products, Ministry of Health, Czechoslovakia, presented a paper on "The Dairy Industry in Czechoslovakia and Conditions Influencing it at the Present Time."

The Association expressed its appreciation of Mr. Rosinek's paper by a vote of thanks.

The convention took a recess at 9.45 P.M.

Saturday, September 29

FOURTH SESSION

The session was called to order by President Bolling at 10 o'clock. Dr. F. D. Walmsley presented a paper, "Premiums with Special Reference to Quality in a Milk Supply."

The report of the Committee on Pasteurization of Milk and Cream was presented by Dr. Wm. H. Price of Detroit, Chairman.

The report of the Committee on Food Value of Milk and Milk Products, in the absence of Mr. O. M. Camburn, Chairman, was read by Prof. I. V. Hiscock.

Vice-President Thos. J. Strauch, of Richmond, Va., presented a paper on the subject of "Richmond's Standard Dairy Barn."

A recess was taken at this point.

FIFTH SESSION

The convention was called to order by Vice-President Strauch at 2 o'clock. A paper, "What Can the Dairy and Milk Inspector Accomplish for His Community?" was presented by Mr. Carl O. Seaman.

The report of the Committee on Remade Milk was presented by Mr. C. Sidney Leete, Chairman.

The report of the Committee on Serving Milk in Schools, in the absence of Prof. W. P. B. Lockwood, Chairman, was read by Dr. Hulbert Young.

Dr. Leslie C. Frank, Associate Sanitary Engineer, U. S. Public Health Service, presented a paper, "What is the Best Type of Milk Ordinance?"

"The Correct Sampling of Ice Cream" was the subject of a paper prepared by Mr. Benjamin Vener and which in his absence was read by Mr. Howard R. Estes; after which a recess was taken.

SIXTH SESSION

The convention was called to order at 8 P.M. by Vice-President Strauch. The report of the Committee on Methods of Bacterial Analysis of Milk and Milk Products was presented by its chairman, President George E. Bolling, of Brockton, Mass.

"Some Observations on High Counts in Milk Freshly Pasteurized under Commercial Conditions" was the subject of a paper read by Mr. W. D. Dotterrer.

Dr. J. J. Frey, of the State Department of Agriculture of California, presented a paper on "A Comprehensive System of Dairy Inspection."

Miss Sarah H. Vance, of Louisville, Ky., read a paper entitled "A Clean Milk Supply for a Small Town," after which a recess was declared until Monday morning.

MONDAY, OCTOBER 1

SEVENTH SESSION

The convention was called to order at 10 o'clock. The first paper of the morning was presented by Prof. C. L. Roadhouse of California, who discussed "The Relation of Acidity to Butterfat Content in Milk and Cream."

Dr. H. A. Harding, of Detroit, presented a paper, "What Should an Inspector Look for at the Farm as the Cause of High Count Raw Milk?"

Mr. J. W. Yates, of Kansas City, read a paper entitled "The Pin Point Colonies Observed in the Bacterial Examination of Milk; Their Resistance to Heat and Growth in Different Culture Media."

Mr. L. C. Bulmer, Chief of the Division of Food and Dairy Inspection, Birmingham, Ala., read a paper on "Fundamentals of a Practical Milk Ordinance." The convention then took a recess.

EIGHTH SESSION

The convention was called to order at 2 o'clock by President George E. Bolling, who introduced Dr. Taliaferro Clark, Surgeon, Medical Officer in Charge Field Investigations in Child Hygiene, U. S. Public Health Service, who presented a paper, "Dried Milk Powder in Infant Feeding."

Mr. Russell S. Smith, of the Dairy Division, U. S. Department of Agriculture, presented a paper, "Observations on the Washing and Sterilizing of Milk Bottles."

Mr. Karl L. Ford, of the Glass Container Association, read a paper on "The Glass Container."

Prof. Dr. Masayoshi Sato, of the Hokkaido Imperial University, Sapporo, Japan, read a paper entitled, "Of the Regulation for the Control of the Trade in Cows' Milk."

Mr. W. S. Frisbie, of Washington, presented a paper, "What the U. S. Department of Agriculture is Doing to Secure Uniformity in Dairy and Milk Inspection Methods."

A recess was taken, and the session for the transaction of business was called to order at 4 P.M. by President Bolling, who first recognized Mr. Thos. J. Strauch of Richmond. Mr. Strauch proceeded to assume the role of prosecuting attorney, jury and judge, and to arrest, try and convict the Secretary and to find him guilty of working too much and playing too little. In assuming the role of judge, he sentenced the Secretary to play the game of golf frequently, and by way of emphasis in passing this sentence, and in behalf of the Association, he presented the Secretary with a complete and beautiful set of golf clubs, together with a bag and full equipment. Secretary Weld accepted the gift and expressed his appreciation of the gift and the splendid spirit which prompted the givers in providing golf clubs and outfit and suggesting their frequent use.

President Bolling reported briefly, expressing appreciation of the increased growth and usefulness of the organization.

The report of the Secretary-Treasurer was received. The auditors reported they had examined the Secretary-Treasurer's accounts and found them to be correct.

Dr. Wm. H. Price, Chairman of the Committee on Resolutions, reported, and the following resolutions were adopted:

1. WHEREAS, This Association has profited and been greatly benefited by the contribution to the program of men not included in its membership; be it

Resolved, That the International Association of Dairy and Milk Inspectors in annual convention assembled extends its appreciation and thanks to Dr. W. C. Fowler, Prof. H. E. Van Norman, Mr. Karl L. Ford, Dr. Taliaferro Clark, Mr. W. S. Frisbie, Mr. Ing. Frantisek Rosinek, Dr. Leslie C. Frank, Miss Alice C. Evans, Dr. E. C. Schroeder, Dr. J. A. Kiernan, Prof. Dr. Masayoshi Sato, Hon. T. Philip Sze, and other non-members who have contributed papers.

2. WHEREAS, Properly supervised pasteurization is of invaluable human service in protecting and conserving milk supplies in the following respects, namely:

1. Pasteurization facilitates maintenance of abundant supplies of milk on the market; and

2. Pasteurization is the only adequate safeguard for milk supplies; and

3. Pasteurization assists in maintenance of abundant supplies of safe milk at prices lower than would otherwise be required; and

WHEREAS, There have been offered for sale, or free, a variety of appliances and methods, as substitutes, or alternatives, for holding pasteurization; and

WHEREAS, These substitutes, or alternatives, offer variation in temperature of heating, or in time of holding, from those defined in this resolution, and may even suggest elimination of heating, or elimination of holding, altogether; and

WHEREAS, This Association knows no safe and satisfactory substitute or alternative for properly supervised holding pasteurization; therefore, be it

Resolved, That the International Association of Dairy and Milk Inspectors, in annual convention assembled, defines pasteurization as follows:

Pasteurization is the process of heating milk to a temperature of approximately 145° F., never lower than 142° F., holding every portion of the milk at that temperature for a period of at least 30 minutes, and then promptly cooling below 50°F. Invariable recording of temperature and holding period by a tested thermograph is imperative, as is also protection against subsequent contamination by filling into adequately sterilized final containers immediately after pasteurization and at the place thereof, by healthy operators, and storage below 50° F. until delivered to consumers; and further be it

Resolved, That the International Association of Dairy and Milk Inspectors endorses properly supervised holding pasteurization as the only adequate safeguard for milk supplies; and furthermore be it

Resolved, That this Association notifies the public of the inadequacy of substitutes, or alternatives, for pasteurization as herein defined.

3. *Resolved,* That the Committee on Methods of Bacterial Analysis be empowered to hold such conference with representatives of other organizations as will tend to bring about unification and simplification of methods of bacterial analysis of milk and milk products; and furthermore that they be authorized to secure and test the fitness of such dehydrated media as are offered for sale for use in bacterial milk analysis.

The Association then proceeded to the election of officers for the ensuing year, and the following officers were elected:

President, Dr. J. B. Hollingsworth, Ottawa, Canada.

First Vice-President, Thomas J. Strauch, Richmond, Va.

Second Vice-President, Dr. G. C. Supplee, Adams, N. Y.

Third Vice-President, C. H. Chilson, Detroit, Mich.

Secretary-Treasurer, Ivan C. Weld, Washington, D. C.

Auditors, Thomas Holt, Hartford, Conn.; Thomas F. Flanagan, Hartford, Conn.

On recommendation of the Membership Committee, the Association officially recognized the ability and successful leadership of Prof. H. E. Van Norman, President of the World's Dairy Congress, whose labors have substantially added to the general improvement of the dairy industry and to the scientific knowledge resulting in the betterment of milk supplies, and unanimously elected President Van Norman to honorary membership in the Association.

The newly elected officers of the Association who were present were then introduced, and each spoke briefly, pledging his best efforts for the continued success of the organization; after which the business meeting adjourned.

NINTH SESSION

The convention was called to order by President Bolling.

The report of the Committee on Communicable Diseases Affecting Man, prepared by Dr. G. K. Cooke, City Milk Inspector of Berkeley, Calif., Chairman, was, in Dr. Cooke's absence, read by Mr. W. D. Dotterrer.

"The Dangers from Butter as a Carrier of Disease" was the subject of a paper by Dr. E. C. Schroeder, Superintendent of the Experiment Station of the U. S. Bureau of Animal Industry.

Dr. J. A. Kiernan, Chief of the Tuberculosis Eradication Division of the U. S. Bureau of Animal Industry, presented a paper on "The Progress of the Bovine Tuberculosis Eradication Work in the United States."

The final address of the convention was read by Hon. Tsannyoen Philip Sze, Vice-Consul of the Republic of China, New York City. The subject of Dr. Sze's paper was "Milk as a Food for the Chinese."

As all business matters coming before the Association had been attended to, and the program completed, the convention finally adjourned.

PRESIDENTIAL ADDRESS

George E. Bolling, Brockton, Mass.

At this, our twelfth annual convention, we are assembled to discuss pertinent questions relating to milk and its products and to consider the progress of events with reference to these commodities.

That our previous conventions have fulfilled this object is strikingly exemplified by the report of the meeting of a year ago held in St. Paul. Therein is presented a veritable symposium of matters relating to milk and its products. To enumerate but partially:

An exhaustive report on bovine diseases in their relation to the milk supply and public health, with an extensive bibliography.

Various papers on the transportation of milk and milk products.

Municipal and Factory Milk Inspection.

The Cryoscopic Examination of Milk.

Various papers on administrative standards for the control of city milk supplies.

Report of the Committee on Pasteurization of Milk and Cream.

Fat Content of Mothers' Milk.

Serving Milk in Schools.

Various articles on modern milk plants.

Bacterial Analysis of Milk.

Articles on ice cream, effect of pasteurization on the cream line, city milk contests, food value of milk, and treatment of milk cans.

Several articles relating to tuberculosis in livestock and efforts at its suppression, one of the papers giving voluminous specific data as to the methods in vogue throughout all sections of the country.

Talks on the milk supply of London by two authorities from that city.

The admirable work of the Committee on Remade Milk was extended by the addition of another valuable paper on the subject.

Addresses by Professor Van Norman and other well known men.

Numbered among our members are many who are authors of books dealing with the subject of milk in many phases; its production, supervision, marketing and analysis. The most notable book of the past year, "Market Milk," was the joint effort of past President Ernest Kelly and Clarence E. Clement, the chairman of our Milk Plant Committee.

Considering these articles, many of them by men recognized as leaders in their lines, the Association is to be congratulated in being privileged to acquire this information first hand. Little wonder need be felt at the recognition accorded our Annual Report as the most complete compilation of milk inspection activities published and the fact that its well diversified, up-to-the-minute papers occasion its use as a text book where such subjects are taught. Some sixty universities and colleges desire this report supplied to their libraries, and besides its dissemination throughout the United States, it goes to about a dozen foreign countries.

Our program for this convention inspires the feeling that this year's progress will be spread before you in such manner as cannot fail to benefit all who attend our three day session. The benefits accruing from personal attendance are numerous. In many instances the discussion of the papers does not appear in the report; in fact, if it were printed in full, a far too bulky document would be the result.

Any slight ambiguity in the authors' statements or uncertainty of their meaning is clarified by a free-for-all discussion; in fact, the statement is often made at conventions like this that some members feel they have derived the greater benefit from the discussion. Also the opportunity presents itself between the meetings of exchanging ideas with men from other communities. The problem that is perplexing some individual may have been solved by another who would be only too glad to tell of his experience. Therefore by no means hesitate to "talk shop" between sessions.

The present day work of all of us is based upon comparatively recently developed discoveries. Milk inspection had its beginning owing to the belief of many consumers that some dealers were tampering with their product, either by watering or skimming, or both. It was believed that such adulteration was highly inimical to the health of the consumers, hence we find doctors of medicine were almost exclusively in charge of the earlier inspections. Later it became evident that such tampering with milk defrauded the consumer of his money rather than his health and that many other questions entered into the matter of truly efficient inspection, and of recent years a multiplicity of regulations has been inflicted upon milk producers and dealers, some being of a decidedly arduous nature.

The object of a milk ordinance should be to assist the inspector in obtaining a clean, fresh and healthful milk supply for the community he serves. By cooperation with the producer, striving to employ educative rather than punitive measures, the efficient inspector may obtain conditions approximately the ideal, viz.: milk for his community produced by practical dairymen from profitable, healthy cows, economically fed, housed in clean quarters, milked and attended by intelligent and satisfactorily paid milkers; milk which is promptly cooled to and maintained at a low temperature, kept free from contamination and sold at a price which insures legitimate profit without being burdensome to the consumer.

When an inspector observes such conditions obtaining at plants within his jurisdiction he should endeavor to display a proper appreciation of the dairymen's efforts by advertising in all proper ways the excellence of the product of such dairies.

At the speaker's office, for instance, inquiries are constantly being received from consumers, who may have changed residence or for some other reason are contemplating a change in milk dealers, as to the comparative standing of those who do business in their vicinity. This information is truthfully and cheerfully furnished and the man who habitually vends a mediocre product does not benefit thereby. Also the yearly averages of the dealers' records in bacterial count and solids and fats are published in the local newspapers early in the ensuing year. It is a matter of satisfaction to us to observe how interestedly a large part of the consumers scan these yearly reports to ascertain the standing of their particular dealer. Many have been influenced thereby to transfer their patronage to dealers with higher average standing.

As milk inspectors, it should be deemed one of our most important duties to aid in an increased use of milk in our respective communities. The public mind should be instilled with the fact that despite increases in the price of milk, such increases have not kept pace with advances for other foods; that milk, containing protein, sugar, fat, and mineral matter, as it does, and in an easily digested form, is still the ideal and also the cheapest food.

As alluded to before, milk inspection originated from a desire of the suffering consumers to punish milk adulterators. From this beginning to what may properly be termed the science of milk inspection of the present day, hardly more than four decades have sufficed to witness the succession of events leading to the methods and practices now considered of essential importance.

To enumerate a few of these events:

In the 1880's, the first decade, Koch invented solid culture media by means of which various organisms could more easily be isolated and studied, the renowned Pasteur having, since becoming famous a score of years before, confined his work to use of liquid media.

In this period also was made the first extensive and most complete study of disease epidemics due to infected milk, this convincing many doubters that a number of diseases could be actually milkborne.

In the second decade, the 1890's, among the outstanding events were the invention by Babcock of a simple and accurate method of determining the fat content of milk, and the originating of the principles of dairy farm sanitation.

The first medical milk commission was organized.

Milk bacteriologists came into prominence, and under the direction of Professor Sedgwick the first bacterial counts of market milk were made.

Professor Conn began his studies on milk fermentation and Theobald Smith first isolated bovine tubercle bacilli.

The next decade, the 1900's, witnessed the growth of pasteurization and the formation of medical milk commissions.

For the first time an American municipality adopted a bacterial limit regulation for market milk.

The last decade witnessed a lessening of opposition to pasteurization of market milk. One of the most important events of this period has been the discovery of the growth-promoting and protective bodies in milk known as vitamines. Not the least important of events of this decade was the formation of the International Association of Dairy and Milk Inspectors, which held its first convention in Milwaukee in 1912.

To digress for a moment, as it may not be known to those most recently admitted to membership: at that first gathering Ivan C. Weld was elected Secretary-Treasurer, which office he has ever since held. As will be unanimously testified to by all those who have had the honor of presiding over this Association, this latter fact is second in importance only to the institution of the Association itself.

The knowledge gained by these events, thus sketchily narrated, is at present evidenced by organized campaigns for increased use of milk and its general recognition as being more vital to the welfare and health of the human race than any other food.

The fact that these happenings, of so much importance to us all, are of such recent origin, may be but a prelude to more important discoveries yet to come; and it is possible the inspector of four decades hence may find a mild amusement in considering our antiquated methods, apparatus and ideas. The personnel of this association is composed of men and women of sufficient ability to enable them to play a prominent part in the development of all things pertaining to the science of milk inspection, and we confidently expect they will do so.

All of us must realize the force of the axiom that to be satisfied with what we have attained in the past and rest contentedly with that will not enable us to keep up with the procession. The world will keep on moving and those who "rest on the oars" will fall behind.

Our convention of 1923, judging from the program, is to rank second to none of past years. The inspiration we all must gather from our meeting being so closely associated with the World's Dairy Congress will certainly stimulate any whose energy may have seemed to falter and send them home to attack their individual problems with fuller knowledge and renewed vigor.

"Every age has its problem, by solving which humanity is helped forward."

REPORT OF COMMITTEE ON DAIRY METHODS

PART I

Milk Cooling Regulations from the Standpoint of Control Agencies

Ernest Kelly, *Market Milk Specialist,* Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C.

In order to obtain the desired information, your committee has circularized the Health Departments of a number of cities throughout the United States. It was not deemed practicable to circularize all cities, but about twenty places were selected that were considered representative and whose practices would seem to be most helpful.

Replies were received from 15 cities, namely, Baltimore, Md.; Washington, D. C.; Seattle, Washington; Charleston, S. C.; Spokane, Washington; New York City; Los Angeles, Calif.; Cleveland, Ohio; Richmond, Va.; Detroit, Mich.; Springfield, Ill.; Birmingham, Ala.; Boston, Mass.; Winston-Salem, N. C.; and Buffalo, N. Y. Owing to the geographical location and the climatic conditions of these cities, it is not surprising that the replies show a diversity of views on the subject of cooling.

A questionnaire containing ten items was submitted to the Health Departments of the cities named, and supplementary remarks were invited. The replies to this questionnaire will be taken up numerically, all replies including data received previous to August 1, 1923.

1. *What temperature requirements has your city for market milk at various points from farm to consumer?*

A tabulation of the replies shows that 12 of the 15 cities had the following temperature requirements for milk on the dairy farm:

Three cities had no temperature requirements for this point.

Three cities require a temperature of 50 degrees F. and one other city requires this temperature for Grade A milk.

Two cities require a temperature of 55 degrees F.

Three cities require 60 degrees F., with one other city having the same requirement for Grade B milk.

Two cities require that the milk shall be cooled to 70 degrees F. or less on the farm.

One city requires that all milk during transportation to the city shall have a temperature of 60 degrees F. or less, while 14 have no requirements on this point.

One city requires that the milk reach the city at a temperature of 70 degrees F. or less.

At the time of delivery to the consumer either by wagons, stores or restaurants, the following requirements prevail:

7	cities	require	a	temperature	of	50	degrees	or	less.
3	"	"	"	"	"	55	"	"	"
2	"	"	"	"	"	60	"	"	"
1	city	requires	"	"	"	70	"	"	"

2 cities have no regulations.

2. *How long have such requirements been in effect?*

Present temperature requirements have been in existence 19 years and 3 months in one city, and only one month in one city. Leaving out the two cities having no temperature regulations, the average time present temperature requirements have been in force is 8 years and 4 months. It is interesting to note that the city having had the longest period of temperature regulations requires 50 degrees F., while the city having had the shortest period requires only 70 degrees. This would indicate strongly, in spite of somewhat different climatic conditions, that long continued efforts to reduce temperatures have led to the observation of better cooling methods.

3. *Are you able to enforce these requirements rigidly?*

To this question five cities answered "yes" and three "no." Six cities made qualified statements, two of which were to the effect that the ordinance could be enforced if the inspection force were larger, while four stated that the ordinance could be enforced but that certain difficulties were encountered, especially in hot weather, which prevented the 100 per cent observance of the regulations. One city did not answer. The five cities which replied positively that the temperature requirements could be enforced had the following temperature standards: 50 degrees F.; 50 degrees F; 55 degrees F.; 55 degrees F.; 70 degrees F. The cities that stated definitely that the temperature regulations could not be enforced have standards of 55, 50 and 50 degrees F.

4. *At what places do you make temperature observations?*

The following tabulation shows points at which temperature observations are made, some cities making them at two or three different points:

Place	*No. of cities*
Farm	5
Country plants	4
In transit	4
City railroad stations	5
City plants	9
Delivery wagons, stores and restaurants	7

5. *Please give the number of violations of temperature regulations occurring in a given period of time, say, one year; also, the number of official warnings issued and the amount of milk condemned.*

The practices followed along this line vary over a wide range. In two cities milk is condemned or destroyed without warnings being issued. One city did not answer, having no temperature regulations; four cities reported no record of violations, warnings or condemnations; three cities reported frequent or routine warnings, but no condemnations of milk; one city had in one year 200 violations, 200 warnings and 1,000 gallons of milk condemned; another city had about 100 violations per year; another rejected 13,363 gallons of milk in one year; another had 73 violations in seven months and condemned 1,084 gallons of milk which was allowed to be churned into butter at a city plant; in addition, 37 shipments were received in a sour condition and returned to the producers. Another city rejected 13,000 cans, presumably 130,000 gallons of milk, in one year. One city reported 511 violations in a year with no condemnations.

6. *Please give your opinion as to the relative importance of cooling regulations as applied to market milk in various places, such as farm, transit or city.*

Five cities reported that cooling on the farm was the most important factor, while two cities held that cooling on the farm was most important for raw milk. One city expressed the opinion that cooling on the farm and during transportation were of equal importance. Three cities state that cooling at all points is equally essential, while three other cities state that cooling after pasteurization is most important.

7. *Can you give any concrete results showing the improvement in cooling the milk sent to your city?*

Nine cities gave fairly definite instances of improvement in the milk supply which they attributed very largely to better cooling methods. The reasons given are as follows:

Lower bacterial counts; less loss to producers; less complaints from consumers.

A great campaign for ice was conducted in 1921 and 1922.

Only a few degradings in the summer of 1922 and only one in 1923 up to July.

Less than one-tenth of one per cent of milk degraded for high count.

Only one-fourth as much milk condemned for improper cooling as for last year and only one-fourth as much as the average for the last three years. Average count of the pasteurized milk improved three times.

Better cooling on farms has enabled the shipment of Grade A milk from greater distances.

During the first two months of enforcement 50 per cent of the milk was lost. Now very little is lost and that mostly among new shippers.

Average bacterial count of the raw milk from 1918 to 1920 was 789,000 per c.c. In 1922 the average count was 36,000 per c.c.

In 1917 the average bacterial count was 254,000 per c.c. In 1922 it had been reduced to 23,600 per c.c.

8. *What suggestions can you give for future regulations which may improve the cooling situation?*

Curiously enough, most of the cities replying outlined methods which might be used, but did not refer to specific regulations; in fact, one city stated that there were already enough regulations and that their greatest need was for better enforcement. Two suggestions for further regulations were as follows:

Compulsory pasteurization which would so centralize distribution that control measures would be simplified.

The requirement of a running water supply in milk houses with the water started through the coolers at milking time and further regulations for protection during transportation.

Five cities indicated that the greatest results could be secured through educational work. One city suggested increasing the dairy score for cooling and another advised decreasing the temperature limit from time to time as practicable. Another city suggested the use of glass lined refrigerator tanks for the transportation of milk from country stations to the city.

9. *In your vicinity is the available water cold enough to enable producers to meet your temperature regulations or is ice necessary? Over what period is ice necessary?*

Three cities replied that the available water supply was sufficient. These cities have temperature standards of 55, 55 and 70 degrees F. Two cities report that ice is necessary at all times in order to comply with their temperature requirements. These two cities are both located in the South and have temperature standards of 50 degrees F. Nine cities report that ice is necessary to meet their requirements during a portion of the year. Two cities did not specify the length of time that ice was necessary, but the remaining seven cities gave the following periods: 2½ months, 3 months, 4 months, 5 months, 5 months, 6 months, and 7 months.

10. *If your dairymen haul ice from town or other sections, how far does it pay them to haul?*

Only three cities replied to this question and only two gave definite information. One city reports that ice is hauled from 3 to 15 miles, but that the loss is very great in distances over 5 miles. Another city reports that ice can be hauled from a distance of 7 miles. The third city replying states that "we do not know * * * that is not what we are here for. It is our job to see that they have it when they need it."

Additional suggestions called for under the heading of "Remarks" are as follows:

It is well to have a rigid ordinance to cover any emergency but judgment must be used in its enforcement to prevent a constant turmoil in industry.

Country receiving stations equipped for cooling are a big aid in solving the problem.

Pasteurizing plants should make cooling regulations part of their agreement before they will buy milk.

Acquisition of new milk producing territory and the presence of large numbers of farmers who are producing milk as a side line make educational work much more important than compulsory regulations.

The sub-committee has considered and digested the various questionnaires and begs leave to submit the following statements:

ADVANTAGES OF TEMPERATURE REGULATIONS

The advantages of proper cooling of milk and cream are so self-evident that it is needless to advance any arguments for them. Such regulations properly enforced reduce bacteria counts and minimize losses to producers and dealers through inferior product and dissatisfied customers.

PRESENT REGULATIONS

It would seem that the general tendency is to attempt to secure the cooling of milk to a temperature of below 50 degrees F. This, of course, is based on knowledge gained through laboratory findings of the effect of such a temperature on inhibiting bacterial growth. Present regulations, however, vary over a wide range, being controlled more by practical conditions than by the bacteriologically ideal standard. Such practical conditions include atmospheric temperatures, availability of ice supplies, and work with new producers who are not equipped as yet with proper cooling facilities. Only fair success is reported in enforcing the present regulations. This is due in part to the inadequacy of inspection forces and in part to the fact that some temperature regulations are entirely too stringent to be practicable.

PRESENT METHODS OF REGULATION

Regulatory methods, in the main, require cooling at the farm and after pasteurization as most important. Most temperature samples are taken at the city plant as the milk arrives. The committee believes that this is because of the fact that such sampling is much more convenient and can be done in greater bulk by a limited inspection force; however, we wish to call attention to the fact that temperature samples at all steps from farm to consumer are desirable for the purpose of fixing the responsibility for high temperatures and studying methods of limiting such troubles. There seems to be no uniform practice of warning dairymen or of condemning milk which violates temperature regulations. The committee believes that there must be some variation in the practice of the condemnation of milk, but it also believes that there can be a greater amount of uniformity in regard to the methods used for warning those who violate the regulations.

It also seems desirable to allow the use of condemned milk for certain manufacturing purposes or for animal feeding if this can be done under proper supervision to make sure that the milk is not subsequently used for market milk purposes. The amount of milk rejected because of temperature violations is quite large in some cases and it seems unfortunate for such milk to be poured down the sewer or in other ways totally lost.

DIFFICULTIES IN ENFORCING TEMPERATURE REGULATIONS

For the proper cooling of milk, ice is necessary for periods varying between two and a half months and the entire year. Some farmers are so located that available ice supplies are not within distances from which ice can be hauled to the farm without a loss which makes the practice almost prohibitive.

It is the consensus of opinion that it is not practicable to haul ice over five miles in warm weather. One member of the committee does not entirely agree, and believes that ice may be hauled as far as milk. Unfortunately, where the use of ice is most important and must be continued over the longest periods, the temperature of available water supplies is so high that proper cooling is almost impossible without ice.

RECOMMENDATIONS FOR FUTURE PROCEDURE

It would seem that few additional regulations are needed, but there is room for a better enforcement of existing regulations and a gradual reduction of the temperature limit as dairymen become educated to the importance of cooling and provide themselves with proper facilities therefor.

It is believed that the bulk of the work in the future may best be accomplished through educational means, such as personal visits, circulars, lectures, etc., which will acquaint the dairymen with the necessity for proper cooling from a standpoint of economy as well as for the benefit of the public health. It is safe to say that the loss on sour milk and low grade dairy products due to improper cooling is far more than sufficient to pay for ice and cooling facilities to cool the milk properly.

Milk dealers should be impressed with their responsibility in this matter and should not only educate their producers to better cooling methods, but should refuse to receive milk which is not cooled to a reasonable standard.

It is the opinion of the committee that country cooling stations properly located are of inestimable value in dealing with the situation, especially in the southern part of the country and those places where atmospheric temperature is high. Such cooling stations should be established only after a careful survey of conditions to make sure that there is enough milk within hauling distance to warrant such establishment. These stations may either put up or manufacture their own ice, or make arrangements with a local ice plant for a sufficient supply. The milk may be hauled to such stations twice a day soon after milking and properly cooled and stored until shipment.

Improvements may be made in the methods of transporting milk in order to maintain low temperatures. It must not be overlooked, however, that pre-cooling before shipment is vitally necessary even in cases where insulated or refrigerated carriers are provided.

"A difficult job requires a somebody; an easy job, an anybody."

REPORT OF COMMITTEE ON DAIRY METHODS

PART II

Cooling Milk from the Standpoint of the Producers and the Receiving Station

Dr. H. A. Harding, Frederick C. Mathews Company, Detroit, Mich.

Your committee would not fairly represent these two groups if it did not emphasize the importance of limiting the requirements of cooling milk to those practices which result in the best product consistent with prompt and economical delivery. Milk delivery is now so organized that any considerable delay will result in holding the milk over for an additional twenty-four hours and thereby reduce its keeping quality. Likewise, strong pressure is being brought to bear to provide a good milk at the minimum cost to the consumer. It is accordingly important that the effect of every requirement upon the cost of milk should be carefully considered.

The object of the cooling is to preserve the keeping quality, or the ability of the milk to remain sweet and in satisfactory condition. This quality is important not only because the consuming public objects to the taste of souring milk, but also because the entire baby question is likewise involved.

When, in 1908, the official score card for dairies was put into practically its present form, thirteen of the one hundred points were allotted to the cooling of the milk. The added information of the past fifteen years has further emphasized the importance of temperature. Accordingly, if a new card were to be formulated it is probable that at least 25 points would be allotted to cooling.

FUNDAMENTALS INVOLVED

The development of acidity and other undesirable flavors in milk as it ages is due to the growth of germ life. Even under most careful production it is impossible to prevent the entrance of a considerable number of germs. The possibility of controlling the growth of these germs in the milk is practically limited to the control of temperature.

Considering the outstanding importance of temperature control in conserving the keeping quality of milk, there is a surprisingly small amount of data available regarding the influence of temperature upon germ growth. The available information may be summarized as follows:

The germ count of freshly drawn milk as shown by the plate method of counting continues to decrease for some time after it leaves the udder. The length and amount of this decrease is apparently affected by a number of factors among which the temperature at which the milk is held appears to be the only one subject to control. Where the milk is held at blood heat this period of initial decrease may be limited to two to four hours. It is prolonged as the temperature is lowered and at 40° F. it may extend over some days.

When germ growth becomes established in the milk its rate is markedly affected by the temperature. At 50° F. growth normally makes little progress during the first two days; at 60° F. it starts somewhat slowly but soon attains considerable proportions; while at 70° F. the rate of growth is but little slower than at blood heat.

THE EVENING AND THE MORNING MILK

In considering the problem of cooling milk it is well to recognize that where the milk is delivered but once per day there are really two distinct problems, that of the evening and that of the morning milk.

In the case of the evening milk, which is to remain in the hands of the producer for at least twelve hours, the cooling may become the largest factor in determining the germ content at the time of delivery to the receiving station. In the case of such milk there are good grounds for demanding a reasonably prompt reduction in temperature. Since the initial period of falling germ content will persist for more than two hours it is satisfactory if the cooling is accomplished within this period. If the milk is cooled within two hours to 50° F. and held at that temperature, practically no growth will occur before delivery the following morning. If the milk is cooled to only about 55° F. or 60° F. increased growth will take place, though the milk may be receivable if other conditions have been favorable. As the temperature of holding approaches 70° F. the chance of the evening milk arriving at the receiving station in receivable condition becomes remote.

In the case of the morning milk the situation is somewhat different. In many cases the milk can be delivered at the receiving station within less than two hours from the cow. Where delivery is actually made within this period there is evidently no need for cooling at the farm, provided the evening and the morning milk are delivered in separate containers. Where they are mixed at the farm the morning milk should be properly cooled before mixing.

Where delivery may not take place until more than four hours after milking, the desirability of cooling increases with the time interval. After a lapse of eight hours the period of initial decrease may be considered as past and the milk becomes subject to all of the temperature limitations affecting the evening milk.

The object to be attained is the delivery of the highest quality milk which is practicable. This implies the modification of requirements in the light of local conditions. Throughout Canada and the northern portion of the United States it is usually possible to harvest ice, provided bodies of water are available. Accordingly the cost of ice in cooling in these regions should not be prohibitive. Observations in the United States indicate that ice is but little used in cooling milk on dairy farms except in New England and to a limited extent in New York and Pennsylvania. It would be valuable to have measurements of keeping quality which would bring out the added keeping quality actually resulting from such use of ice.

Previous studies have shown that spring or well water is the means most commonly employed in the cooling of milk. Springs supplying water at a temperature below 50° F. are common in the northeastern portion of the United States. Likewise many of the wells in this region supply water at 50° F. during the warmer portion of the year. Under such conditions it is possible to cool the milk to approximately 50° F.

The practice of placing milk cans in wells, however, should not be tolerated under any circumstances. The danger of contaminating the water from foul cans or spilled milk is entirely too great.

In the valley of the Ohio River and southward much of the available well water is at a temperature of 55° F. or above in the summer and the limit of cooling milk in these regions is frequently at or above 55° F. In the extreme south and southwestern portions of the United States the temperature of the ground water is frequently such as to make successful cooling of milk practically impossible.

There has been a feeling that delivery of milk twice per day from the farm to the receiving station was an evidence of primitive conditions. That such delivery is attended with increased cost is beyond question. However, in regions where the ground water is too warm to cool the milk properly this practice should be carefully considered. In the territory tributary to Kansas City the twice daily delivery has become a regular practice during the warmer part of the year. Under such conditions much of the milk reaches the receiving station and is cooled to 40° F. within less than an hour from the cow. Under such conditions no growth takes place before pasteurization. In many portions of the south and southwest the twice daily delivery of the milk from the farm to the receiving station is a necessary part of providing a supply of raw milk of low germ content.

HOW TO COOL MILK

At the receiving station where a large amount of milk must be cooled quickly and in a small space this is usually accomplished by passing the milk over a metallic surface with cold water or brine on the opposite side. While such coolers are effective in cooling milk they are among the utensils most difficult to free from germ life even with an abundance of steam or hot water.

Various similar utensils are available for cooling milk at the farm. Many of these are effective means of cooling milk. On the other hand they present the same difficulties in removing the germ life which is experienced in the receiving station with an added disadvantage when steam and hot water are lacking. On this account their use is ordinarily not to be encouraged except where promptness of cooling is important.

It is practically universal experience that immersing the cans of milk in cold water is a very satisfactory manner of cooling.

The cooling tank should have provision for at least four gallons of water to each gallon of milk and should have a water level high enough so that the cans will be immersed to their necks.

Where ice is to be used, a precooling of the milk with cold water will reduce the amount of ice required. In cooling warm milk to 50° F. about one pound of ice is required to each quart of milk. Where the milk is precooled to 62° F. only about one-third as much ice is required.

The speed of cooling will be materially increased by stirring the milk. A metal disk on the end of a metal rod is the best form of stirrer. However, the tendency to use improperly washed stirrers is such that some commercial companies insist that no stirrer be used.

COOLING TANKS AND THEIR CONSTRUCTION

Upon the selection of proper materials for tank construction depends in no small measure the efficiency of the cooling properties of the tank. Bulletin No. 744 of the U. S. Department of Agriculture states that in order of value of materials for tank construction from the standpoint of efficiency, seven and six-tenths pounds of ice in an insulated tank is equal in cooling value to thirty and five-tenths pounds in a wooden tank, to sixty-one pounds in a concrete tank, or to eighty-four pounds in a galvanized iron tank. A concrete insulated tank with eight-inch walls and bottom, in the center of which two inches of pressed cork should be placed to provide proper insulation, is recommended as being efficient, durable, and sanitary. According to the bulletin just mentioned, by using such a tank a farmer can save the use of two-thirds of the ice ordinarily used for cooling during the year. A sound, substantial, tight-fitting cover on any tank will very greatly increase its cooling efficiency.

TRANSPORTATION PROBLEMS

It is not only important that milk shall be properly cooled at the farm, but it is equally important that it shall not be heated on its way to the receiving station. Fortunately a can of milk absorbs heat slowly. Where transit to the receiving station occupies less than an hour the warming effect is usually negligible. Where a longer interval is necessary care should be taken to protect the milk.

Where the milk remains for some time by the roadside awaiting the truck a covered stand is desirable. Cans on trucks should be covered and moist coverings produce lower temperatures through evaporation.

A troublesome delay in delivery is frequently occasioned by the simultaneous arrival at the receiving station of a number of producers. Some solution of this should be reached, possibly through zoning and allotment of an order of delivery.

"When difficulties are in front of you, as a rule there are inefficiencies behind."

REPORT OF COMMITTEE ON DAIRY METHODS.

PART III

MILK TEMPERATURES AND BACTERIAL CONTENT OF MILK AT TIME OF DELIVERY

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In making a report on such a subject it must be borne in mind that other causes than temperatures are operating to cause variations in the bacterial content of milk. The initial contamination coming from utensils, etc., and the time between milking and the completion of the cooling process are both unknown quantities in this work. If we assume, however, that these unknowns are fairly uniform for milk delivered at various temperatures, we may be able to draw some conclusions of value.

The data included in this report has its origin in counts made by the Breed microscopic method on 890 samples of milk and representing the number of bacteria per c.c. The samples were taken as the milk was delivered at receiving stations. Temperatures were also noted at the same time.

Temperatures varied from 50° to 80° but most of the samples showed temperatures in the middle range of these figures. The counts varied also, 310 being under 200,000; 266 between 200,000 and 2,000,000; 201 between 2,000,000 and 10,000,000; and 123 over 10,000,000.

The relationship between bacteria count and temperature is difficult to explain in any definite manner. Of the 890 samples taken, 343 showed temperatures of 60° and under, while 547 were over 60°. The following table shows the percentage of counts at 60° and over 60° which fall in different groups.

	60° and under	Over 60°
Under 200,000	46.75 per cent	53.25 per cent
200,000 to 2,000,000	41. 7 per cent	58. 3 per cent
2,000,000 to 10,000,000	34. 5 per cent	65. 5 per cent
Over 10,000,000	18. 0 per cent	82. 0 per cent

It is seen that a relationship is shown by the above table. As the count increases the percentage of samples which were 60° and under decreases. The reverse is true of samples over 60°. It is interesting to note that the average temperatures for the various groups of counts are as follows:

Under 200,000	60.1°
200,000 to 2,000,000	60.3°
2,000,000 to 10,000,000	63.2°
Over 10,000,000	68.0°

In another lot of data which was so compiled as to show only the number of counts which were 500,000 and less and those over 500,000, together with average temperature, it is shown that the 368 samples under 500,000 had an average temperature of 62.4° and the 213 samples over 500,000 had an average temperature of 63.1°.

One series of 490 counts on night's milk with an equal number of counts on morning's milk was so arranged that a comparison could be made on counts of night's and morning's milk from the same patron. If it is assumed that the count on the morning's milk represents the initial contamination, one factor of uncertainty is eliminated.

Dividing the samples of night's milk into groups, one with temperatures of 60° and under, the other higher than 60°, shows 266 in the first group and 224 in the second. In the first group 95, or 35.7 per cent, have counts more than double the corresponding counts on morning's milk; 61, or 22.5 per cent, have counts more than four times the count on morning's milk; 171, or 64.6 per cent, have counts less than twice the count on the corresponding sample of morning's milk. Of the 224 counts in the second group, 109, or 48.6 per cent, have counts more than twice as large as the corresponding count on morning's milk; 70, or 31.2 per cent, more than four times the count on the corresponding sample of morning's milk; 115, or 51.3 per cent, have counts less than twice as great as the corresponding count on morning's milk. From this it would appear that there is quite an advantage in having milk cooled to 60° or under.

If, however, 60° is taken as the highest temperature at which night's milk will be received, there will be a large part of the rejected milk which is of good to fair quality from a bacteriological standpoint and considerable milk will be accepted which is not up to a high standard.

Of 343 samples delivered at a temperature of 60° and under, 251, or 73.2 per cent, showed counts of less than 2,000,000. Of 547 samples delivered at a temperature higher than 60°, 315, or 57.5 per cent, showed counts less than 2,000,000. In rejecting milk with a temperature greater than 60°, 57.5 per cent of milk with counts less than 2,000,000 would be rejected.

Using 65° as a basis for receiving milk would result as follows:

Of 663 samples of milk delivered at 65° and under, 437, or 65.9 per cent, have counts of less than 2,000,000. Of 227 samples delivered at a temperature higher than 65°, 129, or 56.8 per cent, were under 2,000,000. Of 547 samples delivered at 60° and under, 160, or 29 per cent, had counts under 200,000.

When the above counts are divided by four to approximate the standard plate count, it is easily seen that a large amount of milk with counts under 500,000 and considerable under 50,000 would be rejected by placing the maximum temperature at 60°. Even at 65° considerable milk of good quality would be rejected. Added to this is the fact that enforcing a temperature requirement does not prevent the receipt of a large amount of very high count milk.

As a criterion for judging milk quality, temperature alone is not adequate. However, it is the only method easily used by which the quality of milk may be improved. There is no doubt that milk promptly cooled and kept cool until delivered is better than milk which has been kept warm. In spite of the fact that much milk delivered at 65° and higher is of good quality, our present knowledge indicates that a lower temperature is desirable. Sixty degrees has been adopted in a great many places as a maximum temperature and it is no doubt desirable to have milk cooled to that temperature. Lower temperatures than 60° are difficult to secure at the farm and in some sections of the country 60° can hardly be obtained. In making these statements ice is not considered, since its use is not common enough to be a great factor in our problem. It is doubtful if rejecting milk above 60° is a just procedure. In view of the fact that much high count milk is below 60° when delivered and that considerable low count milk is above that temperature, it would seem that some more accurate method should be devised.

"Some men make their own opportunities—others make their own difficulties."

REPORT OF COMMITTEE ON DAIRY METHODS

PART IV

Present Status of the Milk Cooling Problem
Summary and Conclusions of the Committee

Dr. G. C. Supplee, *Chairman*

The relation of low temperatures to the bacterial quality of milk is so well known to the members of this Association that it was deemed unnecessary for your committee to dwell at length upon the purely bacteriological phases of the milk cooling question. Therefore, it has been our purpose to present information which would aid in a broader comprehension of certain aspects of this matter. The committee believes that legal temperature regulations, and the consequent duties imposed upon control agencies, producers, dealers and carriers, presupposes a unity of purpose in furnishing the public with milk of acceptable quality at a price commensurate with the service rendered. It is agreed that the viewpoint of the bacteriologist is the proper angle from which this service should be judged, but in view of intricate problems of enforcement, economic considerations and variable climatic conditions it appears that universal and complete adoption of the ideal bacteriological principles is impracticable. However, the inevitable gap between the bacteriological ideal and that which is attainable by practical means is not to be considered as a condition warranting intentional disregard for temperature standards.

The preservation of milk destined for consumption in cities and towns depends primarily upon proper temperature control from the time it is produced until it is consumed. In so far as municipal ordinances can be used for a basis of judgment there appears to be a certain lack of recognition of this necessity. In 1916 a special committee of the American Dairy Science Association reviewed the complete milk regulations of 409 cities and towns in the United States. Of this number 61.3 per cent reported temperature limits for milk at the farm; 49.3 per cent reported temperature limits for common carriers; and 50.8 per cent reported temperature limits for milk in the city. The data recently obtained by your committee from 15 selected cities also indicates considerable diversity and incompleteness of procedure in checking temperatures from the time of production to the time of delivery. Three cities report no temperature requirement for the farm; 14 report no temperature requirement during transportation and two report no temperature limit at the time of delivery to the consumer.

The degree of success in the enforcement of existing temperature regulations is admittedly not entirely satisfactory. This appears to be due in many instances to inadequate inspection forces; in other instances to the extraordinary difficulties imposed by unusual climatic conditions; and in certain cases the regulations are too stringent to be met by practical measures. Even though enforcement of the temperature requirement is difficult, there appears to be no evidence of minimizing its importance. In fact, there are several indications that the ordinance is being extended and made more rigid. Furthermore, several municipalities are able to report distinct and measurable improvement directly attributable to this particular feature.

The committee recognizes the difficulties of obtaining definite assurance that all milk is held at the proper temperature from the time it is produced until it is delivered, but notwithstanding these difficulties, especially as they apply to temperature control at the farm, it is the consensus of opinion that continued effort must be made to assure proper preserving temperatures during all time before delivery. Obviously, the initial responsibility for prompt and effective reduction of temperature rests with the producer, particularly if the milk is not delivered within two or three hours. An investigation of inspection methods, however, reveals that this important point is left almost entirely unprotected; in fact, many ordinances fail to specify temperature standards at the point of production. Irrespective of whether ordinances do or do not specify cooling to a certain degree at the farm, the carrying out of the practice is at the discretion of the farmer, and as yet there is no widely recognized practical means for determining whether the practice is followed consistently. It is the opinion of the committee that the most fruitful efforts of the future looking toward a satisfactory solution of the cooling problem are to be directed to the producing end rather than to the carrier or final distributor. It is significant that the country receiving stations are taking definite steps toward an assumption of greater responsibility in the matter of securing quick cooling after the milk is drawn. In some instances milk buyers are inaugurating twice-a-day deliveries or collection is made by trucks in order to secure quick cooling at the plant; some buyers are employing their own inspectors and field men whose constant duty is among the producers; and campaigns for ice storage and facilities for cooling are being instituted by individual buyers as well as by control officials.

While it is recognized that the temperature of milk as an isolated factor only measures a condition, which if taken by itself proves nothing regarding the quality of the product, it is believed, nevertheless, that to ignore the potentialities indicated by improperly cooled milk would be an utter disregard of the very essentials of dairy science. In routine milk inspection frequent discrepancies are observed between the expected bacterial content and the temperature at the place of sampling. Such discrepancies immediately bring into prominence the validity of temperature regulations as a basis for condemnation. Unquestionably there are cases where condemnation in violation of the temperature regulation alone would have been unjust if the bacterial quality were known. A predominance of such circumstances would be unfortunate as it would tend to jeopardize respect for those criteria most essential in safeguarding a milk supply. Granting the existence of such irregularities, it does not seem to be in the interest of public welfare to advocate at present confirmatory bacteriological findings from individual lots of milk before condemnation or rejection can be effected.

In conclusion the committee desires to submit the following:

Temperature regulations for the control of milk quality are justifiable as a potent agency in safeguarding public welfare and as a means of strengthening the economic status of the milk industry.

Control agencies report that temperature regulations as one of the control features of municipal milk supplies have resulted in measurable improvement.

Many municipalities do not have temperature regulations applicable at any point between the time of production and delivery to the consumer. Among those cities which do have temperature ordinances there is a marked lack of uniformity as to the point of application of this requirement.

Enforcement of existing ordinances has met with variable degrees of success, depending upon such factors as the adequacy and efficiency of the inspection forces, geographical location, degree of education among producers as to the importance of proper holding temperatures and the practicability of meeting the particular requirements.

There is a tendency to extend and increase the rigidity of temperature requirements, particularly in the developed dairy districts.

Immediately after the milk is drawn there is a period of falling germ content followed by a period of pronounced growth. An adequate reduction in temperature before germ growth has become established is fully as essential as subsequent low temperatures. The responsibility of meeting this requirement rests with the producer except in cases where it is shifted to the receiving plant by delivery within that time.

There is a general recognition of the inability of inspection systems to guarantee that proper temperatures have been maintained during the time the milk is in the hands of the producer. This appears to be the principal weakness in the temperature control feature of present regulatory systems.

Further improvement in the matter of temperature control appears to lie primarily at the country producing and receiving station end, especially in view of the limited amount of funds available to the health departments and their consequent inability to cover the production end of the industry. Future progress seems to lie along the line of their specifying in greater detail the essential requirements of the city milk supply and holding the industry responsible. It is believed that the strategic position of the country receiving plant permits a greater degree of attainment in this matter than is possible by the control bureaus, or than is to be expected from the volition of the producer alone.

"It is the day of the fleeting vision. Concentration, thoroughness, the quiet reflection that ripens the judgment, are more difficult than ever."

THE INFLUENCE OF THE AREA PLAN OF TUBERCULIN TESTING ON MUNICIPAL MILK SUPPLIES

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The area plan of tuberculin testing has for its object the eradication of tuberculosis in the quickest and most efficient manner. It has, however, another side apparently little thought of, and it is the purpose of this paper to deal briefly with it.

In the counties surrounding Rochester, in one of which the city is situated, and some of the others from which it draws a part of its supply, the area plan of testing has been in operation in some cases over a period of two years and in others for a shorter time. We find that generally speaking two things have happened. The first has been the discovery by the dairymen, and not only the dairymen supplying the fluid milk market, but the men who deliver milk to factories, and even among people keeping one cow for family use, that milk production did not drop in proportion to the cattle taken out of the county. In other words, while some of the reactors were undoubtedly among the largest producers, generally speaking the disease had apparently lessened milk production. This, of course, had been told and retold, but apparently did not sink in until it became their own experience. Secondly, it was discovered that when the reactors were found on a farm, the visit of the state or county veterinarian and the directions for the cleaning and disinfecting of the stables, water buckets, shallow pools in the pastures, barnyards and every other place where there was a chance to find a latent germ of tuberculosis have brought to whole communities in many cases the first real insight into the reason for real dairy sanitation.

In many of these places, of course, dairy inspectors, veterinarians making physical examinations, milk distributors and many other people had for years been preaching the doctrine of clean milk from healthy cows, but a large percentage of the men, especially those who were not making milk for market, at this time took these talks to mean the other fellow. We had very frequently the spectacle of milk going to a market where the rules were a little more rigid than another, being found in a much better condition from a sanitary standpoint than milk from a neighboring farm shipped to a factory or other place where the rules were somewhat lax.

The community talks on tuberculosis have served not only to call attention to the rapidly increasing menace of this disease to cattle and to human beings, but also to arouse in the community a very lively interest in the bettering of the kind of cattle raised and in generally raising the standard of dairy products. Such an interest cannot fail to aid in accomplishing the desired object, which is the eradication of tuberculosis. Moreover, cities which are supplied with milk from such communities receive a much better quality of milk, and the shipper's losses from the souring of his product are lessened.

Any one thing done by a community as a whole tends to draw attention of all of the people to a common problem, and once that attention has been called, the community spirit, which develops out of this kind of work, raises the general level of farm life. The area plan of testing by putting it up to each community to rid its own locality of the disease and afterward keep it free, by the very spirit it develops helps to make a better general feeling, because, as someone has said, "To know all is to forgive all," and the number of small and futile dissensions which happen in the dairy industry are usually obviated and when they do occur are more easily settled because of the way in which the farmers are brought together doing this class of work.

In our own city last year in the month of November approximately 81 per cent of our total supply arrived at the railroad stations and creamery doors in the city containing less than 50,000 bacteria per c.c.; only 6 per cent of the total supply was over the 300,000 limit set by our ordinance. In the hottest weather of this year 61 per cent of our samples contained less than 50,000 and 18 per cent were above 300,000.

These results were not, of course, directly due to the tuberculin test any more than they were directly due to any one form of propaganda that has been carried on for the past twenty years. The only point that I am trying to make in this paper is that the area plan of tuberculin testing is calling the attention not only of the fluid milk shipper but of the small man to the necessity of paying attention to his cattle. This is a fitting climax to the many years of steady, insistent milk inspection work. The follow-up work, re-tests, accredited herd plan certificates, etc., will serve to keep in the eyes of the producer, the consumer and the distributor the importance of everyday sanitation.

"Perseverence is irresistible."

REPORT OF COMMITTEE ON BOVINE DISEASES —THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

DR. J. B. HOLLINGSWORTH, *Chairman*

The importance of lower animals in relation to human diseases has for many years been thoroughly appreciated, and the theory that man physically was a being quite apart from the rest of the animal creation has now few, if any, adherents. The hypothesis of evolution, while still an hypothesis, is borne out by the fact that there is a marked similarity in the construction of man to that of the lower animals. Their tissues are identical and many diseases to which they are subject are identical or allied to our own. They have been of inestimable value in the manufacture of biological products, and experimentally in the study of diseases, but they have also been directly responsible for terrible scourges.

As transmission of diseases from animal to man may take place by simple contact, inhalation, ingestion, bites, or by healthy carriers, the question of animal disease transmission is a very live one and constitutes a serious menace to humanity. Milk, one of the foods in most general use and one of the most valuable, may also be one of the most dangerous if consumed in a raw state.

In many ways the practitioner of human medicine is better situated and better equipped than anyone else to deal with milk from the standpoint of human food, and there are, therefore, many phases of the question which must properly be left to him.

There are, however, certain conditions, and these neither few nor unimportant, affecting milk before it leaves or at the time of its leaving the cow, in regard to which the special knowledge of the veterinarian is undoubtedly of value.

Leaving aside for a moment the question of the direct transmission of diseases, it must not be forgotten that any abnormality in the cow, either as regards her general health or her diet, is likely to give rise to serious changes in the quality and properties of her milk. Everyone is, I fancy, familiar with the flavor imparted to milk by the feeding of turnips or with even less attractive flavors arising from the eating of other highly flavored vegetables or grasses. Although disagreeable, these are harmless and are mentioned simply to show how easily poisons of various kinds having little or no effect on the cow herself may, through her agency, be transmitted to a perhaps already delicate, and in any case susceptible, infant. There are other conditions undesirable, such as the feeding of cows on distillery swill, the use of colustrum, secreted before and after parturition, and bitter and discolored milk due to bacteria in the teats or to the ingestion of bitter plants or, in the case of discoloration, to the presence of blood from injury to the udder. The milk of cows suffering from any inflammatory or febrile condition is entirely unfit for human food, as it is likely to cause severe disturbance of the digestive system, and especially where the udder is in any way involved, to give rise, through the ingestion of pus-producing germs, to acute gastro-enteritis, more particularly in young children or in persons predisposed to troubles of the kind. A like danger exists in connection with the milk of cows suffering from chronic sepsis of any kind, as, for instance, the condition so commonly following retention of the placental membranes, one which not infrequently persists for a long period, during which the milk of the affected animal may through ignorance be regularly sent to market.

It should be accepted as a general principle that the milk of cows suffering from any febrile, inflammatory or septic condition is unfit for human food. Needless to say, special emphasis should be laid on this rule in the case of any affection of the udder or teats, and this altogether apart from the fear of specific infection, a phase of the question to which some brief attention will shortly be given. Cows which produce milk that contains dangerous disease germs at the time it is drawn are comparatively rare.

Cows which have disease about them which may lead to accidental contamination are very plentiful. Germs are so common, in fact so universal, that the milk may be contaminated in innumerable ways.

In my opinion no disease transmissible through milk from the cow to the human family is of so great importance as tuberculosis. Long before the great pathologist discovered the tubercle bacillus many observant veterinarians, although the fact then appeared incapable of proof, were convinced that not only was tuberculosis of cattle a transmissible disease, but that the cow, and especially the family cow, was responsible for many cases among human beings.

I do not wish to be understood as stating that this belief was in any way general among the members of my profession, but here and there a practitioner perhaps more intelligent, perhaps less conservative and possibly with better opportunities for observation than his fellows, had made up his mind that on no other hypothesis than that of direct transmission was it possible to account for certain occurrences which he himself had witnessed. For such men the happenings of the last twenty years in connection with tuberculosis have naturally had a very special interest.

There is possibly no other infectious disease of animals which has caused so much discussion. It is so widespread, affecting practically all domestic animals and also wild animals in captivity, that its control and eradication is a matter of very great difficulty. The existence of tuberculosis among domestic animals, especially among cattle, is therefore a constant source of anxiety to all who have at heart the interests of the healthy development of animal breeding as one of the essential conditions of profit in agriculture.

Realizing that the work of controlling human tuberculosis is the special duty of the physician, the veterinarian at the same time feels that his practical knowledge of conditions among cattle entails upon him the duty, only slightly less important, of endeavoring to control the bovine form and of preventing, as far as it is possible to do so, its transmission to man. All leading authorities are agreed that in order to rear healthy calves from tubercular dams, it is absolutely necessary to feed them either on pasteurized milk or on milk from healthy nurse cows. In herds of this kind, kept for breeding purposes, no cows with diseased udders or generalized tuberculosis are included, the tuberculous cows referred to being simply reactors without any clinical evidence of disease whatever. Again, our experience in the abattoirs has demonstrated that among hogs fed on the by-products of creameries and cheese factories, such as skim milk, butermilk and whey, the percentage of tubercular infections is very large indeed. As the great majority of these hogs are killed at less than a year old and there are, as a rule, no clinical cases, udder or otherwise, among the herds supplying the milk, it would appear that the danger to human beings, and especially to children, from the use of ordinary milk is greater instead of less than is generally supposed.

To conclude, I may say that I am strongly in favor of a rigid systematic inspection of all dairies, the maintenance of strict cleanliness throughout, the frequent veterinary examination of all cows, and the regular application of the tuberculin test. I would go further and venture to say, backed as I believe by the considered opinion of all men who have a proper appreciation of relative values, that I am in favor of the elimination, in so far as possible, of the tubercular cow. For whether the germs of the dreaded "white plague" be active in her or latent and quiescent, she is still a menace to the health and well-being of the greatest asset of the nation, as well as its greatest delight—the children.

Apart from the question of sentiment, you can't estimate the value of the life of a child in terms of dollars and cents. Although it may and will cost the country much to do away with infected cattle and also to segregate suspected animals or otherwise render them harmless so far as the children are concerned, yet the cost, as compared with the results, is not a matter of serious consideration. Infant mortality is so high that it is urging the close attention of all who appreciate the fact that the rate of a nation's mortality is the gauge of its decrease or the reverse. And, gentlemen, scientific homo-culture, looked at from the viewpoint of the evolution of the race upward, has to combat not only the increasing practice of birth control, but also the alarming rate of decease of those who are born.

With the one side of the question I do not deal. Mr. Herbert Spencer and others of his mind claim that it is better to have one child and properly educate and provide for him than to have children for whom no adequate provision can be made. The answer to this I leave to the moralists and the church.

But with the other side I do deal, for it is my business and that of my confreres to do so, for back of the nation's health lies the food of the nation's babes. Changed conditions have caused the milk of the cow to become the food of the majority of the children from the time that they can take sustenance at all. You will bear me out, I think, when I say that the cost to the nation of doing away with infection, or even the suspicion of infection, in the source of supply of that food is not a matter to be weighed in the balance. And if it is, the nation doing so is to be found "wanting."

I would go farther, however, and point to the need of education as to the care of the infant's food when supplied pure to the home. Already there have been steps taken in this direction, and we cannot speak too highly of the work being done by the established milk stations in our cities, and the competent nurses in charge of them.

It does not matter how pure the milk supply may be; if it is to be taken into a hot, fly-infected kitchen and left by an ignorant and careless mother open to contamination, all efforts towards a pure product at the base of supplies must come to naught. The small consumer, as is always the consumer's hopeless fate, must pay the highest price.

This is, of course, a matter in which legislation as such is helpless. It means simply a continued and continuous campaign of education, the reiteration again and yet again by word, in pamphlets, posters, and the press of the old slogan of the physical welfare of mankind that "Cleanliness to godliness is next."

I would here like to bear my testimony to the work of the press in this respect. The effort for better things in the way of milk products has always been strongly and, it is needless to say, intelligently backed by the newspapers of our country, and their influence cannot be overestimated. Today the papers are very widely read and as an educative factor are to be ranked among the greatest forces in the land. Those of us who are keenly interested in the matters of which I speak appreciate most fully the aid and cooperation of the press.

Gentlemen, if I seem to dwell somewhat at length on this particular phase of our work, I do not apologize, for to me as to you the crux of the matter lies here: the longer a man deals with vital issues as regards the welfare of his fellows, the more naturally does he subordinate personal interests to the ideals of service; else will he, naturally, not serve at all. We who serve the public weal as best we can are ranged with those who fight the battle against physical suffering and the diseases that fret the flesh of man.

Individually it is perhaps not much that we can do, but as an association of scientifically trained and keenly interested workers, we can do something at any rate, be it great or small, for the amelioration of conditions. If at times we seem to make little progress, yet it is something to serve, and if we can in any degree lessen the toll of the lives of the slain of the children of the daughters of our people, we will lessen in some degree

> "The fierce confederate storm
> Of sorrow, barricaded evermore
> Within the walls of Cities."

"Children are the tomorrow of society."

THE INFLUENCE OF EFFICIENT SUPERVISION ON A MUNICIPAL MILK SUPPLY

FRANK W. WRIGHT,[1] ANNA I. VAN SAUN and CHARLES H. AMERMAN, Bureau of Laboratories, Department of Health, New Haven, Connecticut[2]

In every phase of public health work the slogan "Constant vigilance is the price of safety," though trite, would seem to be most appropriate. It is rather particularly applicable to the supervision of municipal milk supplies. Each city seems to be a law unto itself in its method of attack on this problem. Supervision of the milk supply ranges all the way from complete dependence on the State to the provision of a staff of farm and city inspectors backed up by an efficient laboratory service. The hampering influence of lack of funds for the control of the inspection and laboratory service is evident in most municipalities. A few cities have been taught severe lessons through epidemics of milk-borne diseases, with the result that some of them now have large appropriations for the control of their milk supplies. Other cities have, partly by the maintenance of a good inspection service, escaped actual outbreaks of disease, but this would seem to be more a matter of good luck than good management.

It is perhaps a matter of conjecture as to whether or not the infant morbidity and mortality rate is an index of the excellence of a town's milk supply. Opinions differ markedly on this point, though in the long run statistics would seem to show that towns with an excellent, well-guarded

[1] Deceased April 2, 1923.

[2] The authors are indebted to Dr. John L. Rice for kindly suggestions and criticism.

milk supply have a low infant mortality. Certainly many other factors enter into this.

The problem of the human carrier confronts us at every turn. Epidemics of diphtheria have been known to originate at farms producing certified milk, though with proper physical examination of employees such epidemics ought never to occur.

It is quite generally recognized in most countries, but more especially in the United States, that pasteurization offers the best method of control of a city's milk supply. Next in order of efficient methods of control comes the tuberculin testing of cattle. To these two methods we must look for aid in the eradication of bone and joint and intestinal tuberculosis in children.

The City of New Haven has been one of the fortunate cities in that no serious outbreak of milk-borne disease has ever (so far as is known) visited her.[1] For the past twenty years farm and city inspections, though limited in scope through lack of funds, have been regularly made, and from the very first Babcock tests have been made on many samples of milk. These were at first made by the inspectors, but on the installation of a laboratory, the work of testing was turned over to the Bureau of Laboratories. Up to 1919 the only bacterial examination made of the city's milk supply was a microscopic examination of centrifugalized milk sediment. In July of that year the laboratory was equipped for the making of bacterial counts by the plating method and the results indicated the immediate need of an educational campaign among the dealers in and producers of New Haven's milk supply.

At this time there were in the city 71 dealers whose combined daily output was about 61,000 quarts. Of these

[1] Since this article was written New Haven has had a mild attack of typhoid fever which we believe to be milk-borne, as the milk supply in all the cases was from one producer and one dealer. Whether the producer or the retailer was responsible for the epidemic has not as yet been determined.

dealers five pasteurized their milk by the "holding" system and four by the "flash" system, and their daily output was about 34,000 quarts, or about 55 per cent of the total output.

The Board of Health had had in mind for some time an ordinance which would require pasteurization of all raw milk entering the city, save that produced from tuberculin tested cattle. Several of the larger milk dealers, realizing along which direction lay the path of progress, decided to follow it and put in pasteurizers. Up to this time the State had had no specific laws governing pasteurization and the errors committed in the name of this excellent process ran all the way from the use of the "flash" method to the reheating of previously pasteurized milk. Preliminary laboratory work done at this period showed that most of the raw milk averaged counts ranging from 1,000,000 to 20,000,000. Our laboratory assistant, who had been examining milk for the Medical Milk Commission in New York City, was quite sure she must have committed some error in technic when she attempted to count her first plates! Further work, however, confirmed our worst fears, and we embarked on a preliminary campaign of instruction. Our department requested cooperation from the dealers, many of whom were progressive enough to comply. This campaign lasted a year and a half, and when the time came for the promulgation of ordinances, the dealers were with us instead of against us, understanding the commercial as well as sanitary value of an efficiently guarded milk supply.

The education of the public was, of course, quite as important as that of the dealers. The publication of bacterial counts was the first step toward that end. These were published quarterly in the "Monthly Bulletin" issued by the Department of Health and were accompanied by explanatory articles written by various experts in the work. These counts were averages calculated from the results on five or six samples of milk taken at varying intervals from dairies and wagons. After collection such samples were packed in ice in specially prepared boxes on the automobile used in collecting, until they were delivered at the laboratory. At first many dealers thought the high bacterial counts were a joke and refused to take seriously the publication of the averages; but through the schools and welfare workers and through newspaper and "Bulletin" articles, the knowledge was spread of the benefits accruing from a good, clean milk supply and the people soon demanded of the dealers the reasons for their high bacterial counts. Then the dealers became interested and were quite willing to cooperate, with the result that with several series tests of raw milk and milk in the course of pasteurization, we were able to show the necessity for care and cleanliness, even in the smallest details.

Many milk cans were inspected and ordered rewashed and steamed and instructions were given on proper draining before covering. Any number of pieces of pasteurization apparatus were found to be in excellent condition for breeding bacteria.

At the farms the farm inspectors continued to explain the necessity of proper milk rooms, sanitary stables and surroundings, and they also insisted upon the immediate cooling of the milk to at least 55° F. and the holding thereof at a temperature not exceeding 60° until delivery.

To this end, at the suggestion of the farm inspectors, many private icehouses were erected and filled during the cold months, thus insuring a ready supply of ice for warm weather.

Efficient municipal milk control cannot be accomplished without a good deal of aid from the State in follow-up work and in other cooperation. Such excellent cooperation we have received from the State Dairy and Food Commissioner, Mr. Thomas Holt, and his assistants. In 1920 many roadside milk temperatures were taken by them in cooperation with our own inspectors and where these were found to be high a visit was made to the producer's dairy and remedies suggested for better handling of milk.

Frequently high temperatures were found to be due to poor cooling systems or to the desire of the producer to economize in time. It was much easier to take the milk to the station and the children to school in one trip rather than to make a later one with the milk. The milk collector was also guilty, for he very often did not collect the milk until several hours after the time set for the producer to leave his cans at the station.

In 1921 milk temperatures were again taken at roadsides and it was found necessary for the inspectors to turn back to the producers upwards of 40,000 quarts before the producers were convinced that it was necessary to properly cool their milk before allowing it to come into New Ha

The local dealers were also held responsible for all milk found in their possession over the temperature of 60° F., thus making them vitally interested in seeing that it was cooled properly before they received it. Therefore, in 1922, about one-quarter of the number of quarts above mentioned was turned back and a very small amount thus far this year.

New Haven possessed a large number of small retail dairies that were a legacy from the past, and as we had never had specific laws defining the requirements of a dairy, in the matter of apparatus, buildings, etc. (most of our control of the dairies having been accomplished through suggestion rather than through compulsion), a purely educational program became necessary. Combining this with our campaign for the proposed grading of the milk supply brought many changes, slow at first, but steadily for the better and we feel that we now have dairies that compare favorably with any city in the country. The recent enactment by the State of laws for the control of pasteurization plants and the rulings of the Milk Regulation Board, also of recent date, have been of great assistance to us in our campaign for better milk.

milk consumption. Yet the present consumption must be nearly doubled to meet the accepted standard.

In order to safeguard the public, a broad scientific program for milk control is required which shall reach the producer, the middleman, and the consumer. Experience has shown that the majority of dairymen welcome the idea of modern methods of judgment of milk quality, and cooperate willingly with competent heath officials. Likewise the milk dealers have taken a progressive stand to work for good milk as well as more sales, and have shown themselves to be real middlemen in helping to educate the farmers and consumers alike in the character of milk and the methods of handling it. The administrative aspects of this problem deserve the consideration of all those who have a part in supplying our most essential food, especially of the members of the International Association of Dairy and Milk Inspectors.

"We may go forward with a renewed and deepened conviction that our work of saving human life is, in sober truth, one of the great economic as well as humanitarian movements of the age."

THE EFFECT OF MONTHLY MEDICAL EXAMINATIONS OF MILK HANDLERS

J. W. YATES, *Director, Food and Dairy Division,*
Hospital and Health Board, Kansas City, Mo.

Hundreds of epidemics caused by milk, traceable to human contamination that could have been prevented by proper medical examination, convince us that there is no phase of milk control of greater importance than frequent medical examination of all persons who come in contact with milk.

The selection of examiners is an important consideration if the best results are to be obtained. Experience has shown us that where unscrupulous physicians are permitted to make examinations, the particular person for whom the examination is intended avails himself of their services. In every city there are quack doctors who will fill out examination blanks without making an examination. Even the family physician has been known to sympathize with the family and pass subjects unfit to handle milk.

The above facts prove that to carry on a constructive efficient medical examination of milk handlers, the examiners should be directly under the supervision of the office that assumes the responsibility of controlling this work. This may be accomplished either by a regular staff or by a method of certifying or approving certain physicians after a thorough investigation of their methods and standards. Regular blanks should be provided to cover the various phases of the examination, and a comprehensive report of the conditions should be made.

Examinations should be made either at the physician's office or at the milk plant in a well lighted, airy room free from noises. Only one person should be permitted in the room at a time and the same privacy and courtesy should be extended as if he were in a private office.

The person to be examined should be stripped and a general observation should be made, giving special attention to personal cleanliness. A gentle hint brings surprising results. A careful examination should be made, noting temperature, pulse, respiration, condition of skin, head, eyes, ears, throat and nose, noting any abnormality. The teeth should be carefully inspected, and the gums for pyorrhea. The lungs should be examined, and there should be examinations for venereal infection. In cases where there is nasal, throat or urethral discharge, a laboratory examination should be made. Careful questioning as to the history of any sickness at home, no matter how trivial the sickness may be, should be a part of the examination. In this way we have a better check on a possible epidemic.

During the past year we have been making about 1,250 such examinations monthly. We have observed surprising results. The larger employers have found that one healthy employee is worth two sickly employees. There is a noted tendency toward neater appearance and personal cleanliness. The suggestions made by the examining physician have been readily accepted and efficiency has been increased. Medical examinations eliminate unfit employees, men that are ruptured, men with acquired flat feet and other ailments that reduce efficiency. The absences due to slight illness are almost eliminated. One company reports a 75 per cent reduction in absences due to sickness. The employee is benefited, due to the instruction and education he receives from the examiner. Abnormalities are called to his attention that are amenable to treatment. This contact educates him as to the importance of his work. The consumer is benefited by the elimination of undesirable people handling milk and their confidence is increased because they know the person handling it is being examined for their protection.

"Good watch prevents misfortune."

THE MONTHLY PHYSICAL EXAMINATION OF DAIRY HERDS

J. W. YATES, *Director, Food and Dairy Division,* Hospital and Health Board, Kansas City, Mo.

The monthly physical examination of dairy herds is a rather new departure in milk control. After much correspondence and many meetings with the local veterinary associations, we outlined the following rules for veterinarians examining cows:

1. Each cow shall be examined immediately after milking, in her regular stall in the dairy barn.

2. The examination shall consist of a general observation as to physical appearance, history of abortion, etc., and a thorough palpation of the empty udder for tumors, abscesses, ulcers and open lesions.

3. Temporary removal of animals from the supply shall be based upon acute inflammatory disturbance of the mammary glands (one quarter of udder involved being sufficient) that is readily amenable to treatment, or any illness in which the physical condition of the animal is impaired only for a short period. Temporary removals shall be reported and the animals isolated from the herd. Their readmittance shall be governed by the opinion of the examining veterinarian and shall be reported to the Hospital and Health Board.

4. Permanent removal of animals from the supply shall be based upon the diagnosis of any chronic disease such as actinomycosis (generalized), tuberculosis, vaginitis, metritis, mammary tumors, chronic mastitis of one or more quarters and extreme emaciation. Permanent removals shall be reported and isolated and disposed of within ten days of removal, and disposition shall be reported by the owner to the Hospital and Health Board.

5. Animals temporarily or permanently removed from the supply shall be identified by the tuberculin test tag number together with a complete description of the animal, and same shall be furnished the Hospital and Health Board within forty-eight hours of examination.

6. If the visiting veterinarian is doubtful of his diagnosis, confirmation by laboratory procedure may be obtained from the Hospital and Health Board.

The cows are examined strictly in accordance with the above outline, excepting paragraph one, which reads: "Each cow shall be examined immediately after milking in her regular stall in the dairy barn." We have interpreted this to mean before the udder fills and is still pliable to palpation. Further than this, we have made no changes in the outline.

Regular report blanks are furnished from this office, and the following information is recorded by the veterinarian: Name of the dairy, location, address, date, number of cows examined, number rejected, number suspicious, T. T. tag number, weight, description, udder condition, date calved and date expected to calve, of each cow. When rejections are made the cause is noted and the disposition reported. One hundred and seventeen thousand of these examinations are made annually, and an average of 400 rejections is reported, and positively three times that number are voluntarily rejected by the dairymen, and not reported.

The qualifications of the veterinarian making these examinations are as follows: He must be a graduate veterinarian of a recognized school; he must be endorsed after investigation by the veterinarians' association, and must be approved by the Hospital and Health Board. In this way we have eliminated the unethical quack and so-called "horse doctor."

In our jurisdiction there are 16,000 head that are examined semi-annually. These supply milk for pasteurization. Seven thousand supply milk which is used without being pasteurized. Udder infections are responsible for

95 per cent of the rejections. Vaginitis following retained placenta, actinomycosis (generalized) and intestinal derangements are other common causes for rejection.

Particular attention is given to the udder as to boils, cuts or any abrasion, single or multiple nodules in parenchymatous tissues that are discharging or likely to discharge at any time into the milk duct. We have eliminated wet hand milkers.

The benefits derived from the physical examination are outstanding. The veterinarian is viewed in a different light, and in conjunction with his corrective practice is consulted along preventive lines. He has learned more of dairy sanitation and is a big help through his suggestions to the dairyman on animal health hygiene. He has educated the herdsman so that he has become acquainted with physical defects that would cause rejection and the dairyman voluntarily rejects the animals which might be rejected by the veterinarian. He consults the veterinarian when he buys additions to his herd. The dairy animals are more closely watched and respond accordingly in greater production.

Since the advent of physical examinations of dairy herds, bacteria counts have noticeably decreased. The percentage of dairies keeping their counts within the limits of the ordinance has increased from 60 per cent before physical examination was enforced to 92 per cent three months later.

A dairyman whose counts were running high was the first to have his herd examined. A composite test of his milk showed a count of 3,000,000. An examination of the milk from one of his cows showed a count of 20,000,000 colonies. This cow had multiple mammary nodules. She was seeding the whole supply and no amount of inspection or sanitary measures could have stopped the high count. This sort of case is very rare, for when an internal abscess is discharging there is usually soreness and the discharge is noticed in the milk. When the cow was removed from the herd, this dairyman's counts were below 10,000 and he has had only two counts above that in the past year.

DISCUSSION

Prof. I. V. Hiscock, New Haven, Conn.: Can you give us the additional cost of medical examination and physical examination of the herd?

Mr. Yates: Fifty cents a cattle head—which dairymen pay.

Mr. T. J. Strauch, Richmond, Va.: Does this influence the price of milk?

Mr. Yates: It must, but is not noticeable. It involves about $70,000 annually.

"He who does not improve today will grow worse tomorrow."

ANNUAL AND SEMI-ANNUAL TUBERCULIN TESTS OF DAIRY HERDS, KANSAS CITY, MISSOURI

J. W. YATES, *Director, Food and Dairy Division,* Hospital and Health Board, Kansas City, Mo.

For ten years Kansas City has been intensively testing the dairy herds supplying milk. Every cow that is furnishing milk for its supply is tested annually or semi-annually. Where reactors are found a retest is made within 90 days. The veterinarians making these tests are approved by the same procedure as those making the physical examinations.

In the early days of testing there was some opposition from the dairymen, and haphazard methods of unethical veterinarians who made out test charts while sitting in the buggy, together with other unfavorable conditions resulted in our finding more than 10 per cent reaction in the herds tested. With a well organized staff of approximately 60 veterinarians, this has been gradually reduced from year to year, and in 1920 and 1921 the number of reacting cows was 2.5 per cent of the total number tested.

In 1922, the state and federal governments started a free tuberculin test in Jackson County. The object was to give every herd, regardless of size, a free test. About 85 per cent of the total number of cattle in the county were tested, but these tests included all of the milk cows. The first drive ended September 1, 1922. A total of 1,946 herds, containing 25,718 cattle, were tested. Of this number 241 were found to be reactors and 10 were classed as suspicious. From September 1, 1922, until September 1, 1923, 253 were retested. These were the reacting herds of the year previous. Eleven thousand, five hundred and seventy-four cattle were tested. Three hundred and twenty-two were found to be reactors, of which 280 passed for food when slaughtered, 13 were sterilized and 29 were tanked.

It will be noted that Kansas City is very fortunate in its tuberculosis situation. Two groups of veterinarians have examined our herds in the past three years, and find the reacting animals to be practically the same, and less than two per cent. This condition is probably due to the fact that this territory has a mild climate, where the dairyman who keeps his cows in more than 14 to 20 days during the year is an exception. It will also be noted that while the percentage of reacting animals is very small, the actual number is large, and the only conclusion that we can draw regarding our tuberculosis situation is that in Jackson County alone, where we obtain 7,000 gallons of raw milk daily from 3,500 cows, there are constantly in these herds many animals that are afflicted with tuberculosis, and the post mortems show that in almost 10 per cent of the reacting animals the lesions are generalized.

"All is not butter that comes from a cow."

REPORT OF COMMITTEE ON TRANSPORTATION OF MILK AND MILK PRODUCTS

RUSSELL S. SMITH, *Chairman*

In presenting this report as Chairman of the Committee on the Transportation of Milk and Milk Products, I desire to have it understood that no attempt has been made to completely cover so broad a subject. Some phases of the subject can be presented which may be of interest to the members of this association in their endeavors to improve conditions generally.

Due to the war and the long continued inability on the part of the railways to finance the necessary improvements, both production capacity and consuming demands have now advanced beyond transportation facilities. Railway managers under the recent improved conditions are making great effort in financing and expansion of facilities to meet the country's necessities, but full recovery of lost ground must be slow and if the present rate of production and employment is maintained it is vital that there be cooperation with the railway management from both producing and consuming industries to secure the most efficient operation of the railroads. The railways have asked for this cooperation and the trades and industries can make a tremendous contribution to the march of the nation's prosperity if they will undertake it seriously and in an organized way.

The Secretary of Commerce has summed up the principal directions in which such cooperation can be extended by the trades as follows:

(1) The advance storage of their winter coal during light consuming season.

(2) The loading of all cars to full capacity, their prompt loading and discharge.

(3) Reductions of reconsignment shipments and restriction of bills of lading.

(4) Demands for no more cars from the railways than can be promptly used.

If maximum efficiency could be secured in these directions more effective commodity movement would be secured than would be brought about by the addition of approximately 300,000 cars and 3,000 locomotives, and the addition of at least 10 per cent to track mileage and terminal facilities.

Strangulation in movement of commodities through car shortages affects the profits of every individual manufacturer by interruption in his production. Furthermore such strangulation affects price levels in the most definite fashion. The full and smooth movement of all of the productivity of the country would be the greatest contribution that could be made at the present time in checking inflation or increase in price levels. It has been generally conceded that motor trucks must take over the short freight hauls because the terminal handling costs are so high that short hauls are not profitable to railways. In taking over short freight hauls the motor truck becomes the ally, rather than the competitor, of the railway, which finds an ample and legitimate field in the long haul.

Cooperation of all agencies with the railways is essential to the growth of the transportation system of the country.

The dairy industry may not be concerned with car shortages but it can and should help improve existing transportation conditions in many ways.

The principal question which was considered by the committee was "What can the different agencies do to improve transportation conditions?"

There are many factors which might be considered when attempting to answer such a broad question, but it seems that the following few sum up specifically what is desirable and possible for the different agencies:

MILK PRODUCERS

Produce milk of good quality.

Cool it to 50° F. or below. Do not mix cool and warm milk.

Place it in a practically sterile shipping can.

Keep the milk cold while on the farm.

Keep the cans of milk protected from the sun at all times.

Use special shipping cans or jackets on cans when practicable.

Deliver to shipping point on time.

Steam or scald returned empties before using them.

Put up a supply of ice and capitalize on it.

RAILROADS

Refuse to accept milk for a shipment which is above a certain temperature.

Provide insulated cool or iced cars or compartments for maintaining the milk at a temperature equal to that required for milk received for shipment.

Adequate unloading facilities with covered platform at city terminals.

Prompt return of empty containers.

Use of way-bills to avoid loss of containers.

MILK DEALERS

Establish their own receiving and cooling stations in milk producing areas.

Send empty cans back to producers in a condition as near sterile as possible.

Furnish ice to producers at cost.

Use special types of shipping cans when practicable.

Use jackets on cans when practicable.

Ice the cans of milk during transit when practicable.

Combine with other dealers and railroads to secure best service.

Install insulated metal transportation tanks for rail or motor shipments when practicable.

Encourage greater production and consumption of dairy products.

Encourage the establishment of properly equipped and operated country milk receiving stations.

Make frequent visits to shipping points and instruct producers and shippers in cooling and in protecting milk from the sun during transit.

Take temperatures of milk at farms and shipping points as well as at the city terminals and destinations.

Do not return milk having a temperature above the legal requirement until the cause of such a condition is known.

Allow a reasonable tolerance in degree of temperature and in time allowed to make changes.

Assist producers, dealers and transportation agencies in reducing losses from lost or stolen empty milk cans, bottles and cases.

Appoint yourself as a harmonizing agent between all parties concerned in the transportation of milk.

"As nothing truly valuable can be attained without industry, so there can be no persevering industry without a deep sense of the value of time."

REPORT OF COMMITTEE ON MILK PLANTS

C. E. CLEMENT, *Chairman*

The Committee on Milk Plants is a new one, and therefore it feels that it can give considerable elementary information without fear of repeating from reports of previous committees.

City milk plants have often been developed from small beginnings and many of them are not at all well-equipped or well-arranged for the work. The type of building to select naturally depends a good deal on the type of equipment to be used. A plant may be of one, two or three or more stories. A few years ago it was very common for modern plants to be built of three or even more stories. Except when property is very expensive there really is little advantage to build a plant over three stories in height. If desired the gravity flow system can be used as well in a two or three story plant as in one with more floors. Where there are several stories additional labor is required and the cost of operation is necessarily greater. Recently the single story or perhaps story and a half plant has been more common. With some of the recently developed types of equipment the one-story plant is well adapted. Often where the plant is of only one story the pasteurizing equipment may be placed on a raised or mezzanine floor, so that the milk may flow from it by gravity over the cooler to the fillers. Much labor can often be saved when the plant is of only one story. Plants of three or more stories require considerable extra labor and a foreman is usually required for each floor. Some plants of three or more stories have encountered considerable difficulty by having the bottle-washing room, bottle-filling room and cold-storage rooms on different floors. For economy of labor it is usually desirable that these should all be on the ground floor.

While a plant of only one or two stories will require the use of one or more milk pumps, this should not be a serious objection provided the pumps are of proper design and construction, are kept properly cleaned and the milk is pumped at the proper temperatures. The creaming ability of milk is usually not injured where cold raw milk or hot pasteurized milk is pumped. It would only be necessary in a plant of one or two stories to pump the raw milk and again pump the hot pasteurized milk to the cooler. Recent experiments have indicated that pumping the pasteurized milk after it has been cooled to 100° F. or below may injure the cream layer of the milk, but there is no injury at 145° F. All milk pumps should be simple and of sanitary construction so that they can be easily cleaned, and they should be thoroughly cleaned and steamed after each use.

A questionnaire was recently sent out from the Dairy Division of the U. S. Department of Agriculture to the leading milk dealers of the country asking them what type of plant, as regards number of stories, they preferred. The answers received are summarized in the following table, the plants being grouped according to size:

TYPE OF PLANT PREFERRED BY VARIOUS DEALERS

Size of plant. (No. of gallons handled daily)	*Number of dealers favoring* 1 story	2 stories	3 stories	4 stories	Total
Less than 100	3	1	..	..	4
100–250	5	1	..	..	6
250–500	9	10	..	..	19
500–1,000	8	14	2	..	24
1,000–1,500	7	13	4	..	24
1,500–2,000	6	7	3	..	16
2,000–3,000	3	7	1	..	11
3,000–5000	8	10	8	..	26
5,000–8,000	5	8	11	..	24
8,000–10,000	1	2	3	..	6
10,000–15,000	4	1	3	..	8
15,000 or over	2	5	4	2	13
	61	79	39	2	181

It will be noted that 140 of the total of 181 dealers favored plants of one or two stories. It is interesting to note the comparatively large number of large dealers who preferred plants of only one story, there being 20 dealers handling 3,000 or more gallons daily who favored one story and 26 who favored two stories, while 31 preferred three or more stories.

The following are some of the points to be considered before building a milk plant:

1. Favorable location. Pure air and clean surroundings are essential. The plant should be so located that it can be approached from at least two sides so that the milk can be received and sent out and the returned bottles received without any confusion.

2. Large plants are usually of two or three stories, although recently quite a few one-story plants have been built, and considerable labor saving has been effected. Plants of three or more stories require extra labor.

3. Modern plants are usually constructed of brick, concrete or hollow tile.

4. Inside walls should have a smooth finish. Tile or enamel brick is desirable for the pasteurizing and bottling rooms.

5. Concrete floors give good results. They should have a slope of about one-fourth inch to the foot and be properly connected to the sewer. Iron plates imbedded in the cement will aid in preserving the floors where cans and trucks are being constantly handled.

EQUIPMENT

The straight-away system of handling the bottles has been developed to a large extent in recent years, and this fits in well with the one-story plant. Bottle washers have been developed which cool the bottles after washing so that they pass directly to the fillers. Cooling devices for the older types of washers have also been developed so that the bottles can pass from them directly to the fillers. In this way less handling of bottles and cases is required, thus saving considerable labor.

Standard sanitary fittings for use in milk plants have recently been approved and adopted by all the manufacturers of sanitary fittings in the country and these standard fittings will soon be placed on the market.

OPERATION

Pasteurization. The milk dealer pasteurizes milk to make it safe and to improve its keeping qualities. He must bear in mind several factors in carrying out the process; among these are:

1. Economy of operation as regards equipment, labor and steam and power used.

2. Protection against injury to the flavor or creaming ability of the milk.

In order to properly pasteurize the milk he must heat it to the required temperature for the required time and must see that all the milk is held for the required time at the pasteurizing temperature. The milk should be cooled immediately after pasteurizing to 45° F. and placed in the cold room until time for delivery. All apparatus that comes in contact with the milk either during or after pasteurization must be thoroughly cleaned and sterilized.

While pasteurization at 145° F. for 30 minutes may cause some decrease in the cream layer of the milk, provided the process is properly performed this decrease will not be enough to be of very great importance.

Mr. A. R. Tolland, a member of this committee, has supplied the following report of conditions in Boston milk plants:

"When the final count of bacteria is high, one of three causes is usually responsible for this condition: improper heating, incubation, or unclean equipment; hence the need of supervision of pasteurization and efficiency tests by the milk plant manager and the milk inspector.

"Large dealers are equipped to carry on efficiency tests but the small dealer has to depend on the milk inspector; in fact he very seldom knows the bacteria count in his final product and as a rule does not try to find out until he is notified by the milk inspector that his product is high in bacteria.

"The large dealer employs a sanitarian and has a well equipped laboratory. His field men look after the raw product in the country. He runs weekly checks on his output and is able to locate the defects and remedy them. In checking up 20 dealers, large, medium and small, it will be noticed that the large dealer consistently showed a higher efficiency. The average efficiency of the four large dealers is 95.1 per cent. The average efficiency of the three medium dealers is 92.5 per cent. The average efficiency of the 13 small dealers is 89.4 per cent.

"As a rule the large dealer holds milk for pasteurization for 30 minutes; occasionally he is troubled with air in the heaters, leaky temperature control, or faulty refrigeration. Generally a check thermometer is attached to holders and when this is the case recorders do not show a great variance. In checking up recorders operated by the small dealers it was found that they have varied from 4 to 20 degrees. The appended table shows all large dealers holding for 30 minutes at proper pasteurizing temperature. The same is true of the medium dealers. Nine small dealers were holding for 30 minutes at proper pasteurizing temperature, and four small dealers were holding for less than 30 minutes (ranging from 20 to 28 minutes) at temperatures ranging from 142° to 146°.

"While the milk inspector can not center his attention on the small dealer, the paucity of equipment in this class brings about many plant troubles which the large dealer is more likely to escape. The dealer running a few teams uses a vat pasteurization and upright cooler. City water is run through the upper coils and ice water through lower. He generally uses a rotary filler and depends on ice for storing. There are times when the cooling and storing of the final product is inefficient. The larger dealer equipped with modern refrigeration will very rarely experience this trouble.

"Many dealers running a few teams operate a bottle washer which allows cases to be pushed through instead of a regulated washer, and when rushed cases may be pushed through too hurriedly, the result being unclean bottles which undo the results accomplished by pasteurization. Large regulated washing machines must be inspected regularly to make sure that none of the jets in the various washes are plugged.

"In some instances a dealer's business grows rapidly and through lack of foresight or financial barriers no allowances are made for this condition. Eventually the plant is run over capacity, storage facilities become inadequate, the double handling of the product and the rush to process and store the daily output may be the means of letting many things slip by, and the result is milk high in bacteria.

"Today Boston's supply is 93 per cent pasteurized, and about 75 dealers are pasteurizing. As yet the Department is not equipped to check up all these dealers weekly, but considering the working force available, efficiency tests are frequently made and the dealers visited regularly and our supply is improving."

EFFICIENCY TESTS ON TWENTY BOSTON DEALERS ARRANGED ACCORDING TO OUTPUT

Dealer	Pasteurizing Outfit	Heated to Degrees F.	Time held (Minutes)	Efficiency (Per cent)
1	Heater and holder	145	30	93.6
2	"	145	30	93.4
3	"	145	30	97.5
4	Vats	145	30	96.1
5	"	146	30	96.1
6	"	144	30	83.3
7	Heater and holder	145	30	98.2
8	"	145	30	97.1
9	"	145	30	98.1
10	Vats	142	30	92.0
11	"	145	30	97.2
12	"	145	30	96.7
13	"	146	26	80.5
14	"	145	20	88.0
15	"	143	28	64.5
16	"	146	30	96.1
17	"	145	31	93.4
18	"	145	30	97.7
19	"	144	30	84.5
20	"	142	27	77.0

Mr. C. S. MacBride, a member of this committee, has supplied the following report on country milk stations:

"*Location.* From an economic standpoint the most important factor to be taken in consideration in establishing a country receiving station is its location. A poorly located station is a liability to a milk distributor. Points to be considered in choosing a location may be enumerated as follows:

"Dairy cows in convenient area.
"Road and shipping facilities.
"Proximity to other large cities.
"Competition.
"Water supply and sewage disposal.
"Proximity to distributing center.

"*Dairy cows in convenient area.* It is self evident that a receiving station cannot operate without dairy cows and these should be close enough to the station so that long hauls are not necessary to bring the milk to the station. Such hauls jeopardize the quality of the milk and add to the expense.

"*Road and shipping facilities.* Every country receiving station should be located on a railroad line if possible and close to a good road leading to the distributing plant. With the advent of the glass-lined insulated tank truck as an ideal method of transporting milk the proximity of a good road is of paramount importance. Location on a railway is necessary in case of the crippling of the truck transportation system.

"*Proximity to other large cities.* This means competition with outside markets and at times a differential in price may cause a loss of a large portion of the patronage of the station. At equal prices it will mean a division of the supply, and unless the production of milk in the area is very large, a corresponding increase in the cost of station operation per unit of milk received.

"*Competition.* The location of a receiving station near one of a rival distributor means a division of the supply and the possible engendering of a rivalry that may be carried to the city plant. Condensaries, creameries and cheese factories cannot as a rule pay the prices for milk that the city distributor does and cannot be classed as strong competition.

"*Water supply and sewage disposal.* An adequate supply of cold uncontaminated water is necessary for the successful operation of a receiving station. Sewage and waste disposal should be provided for, as this subject is receiving the attention of health authorities. There is no system as yet evolved to take care of creamery waste except to allow it to run into a nearby stream or on a field where it will not become a public nuisance. The septic tank is worthless as a means of disposal of creamery waste.

"*Proximity to distributing center.* It would seem paradoxical to say that it were better if a receiving station were not located too near the distributing center. As large cities grow the city constantly encroaches on the farming district and a close-in station diminishes in size. Also a close-in station is subject to constant raiding by unscrupulous small dealers who will drive trucks into the country and pick up milk at any cost when they need it. A station located at some distance is not subject to this raiding as the cost of hauling is too high for the small amount of milk needed.

"*Construction.* The term 'country station' as used in this article is taken to mean a small milk handling station having a capacity of from 50 to 2,000 gallons of milk daily. This milk is pumped over a cooler after receiving it from the farmer and either canned or pumped into a tank truck. The term does not include any station manufacturing dairy products.

"The country station should be simple in construction. A small frame and concrete structure of one story so arranged that the milk handling operations can be carried on by one, or at the most two men, is desirable.

"The floors should be of concrete with a wall of concrete to a height of at least three feet. They should be well drained. The rest of the structure can be of frame construction. One large room, one part of which has an enclosed raised receiving deck, can be used for all milk handling operations. A small shed attached to the main building can be used for coal bunkers and a boiler or hot water heating room. Plenty of light and ventilation should be provided.

"*Equipment.* The equipment of a country station must be easy to operate by the average man, as it is not possible to get trained men to operate the receiving station and keep the expense within reasonable limits. Such equipment should be of such construction as to make cleaning simple and easy.

"The following equipment should be ample for the receiving and handling of 2,000 gallons or less daily:

"Scales, two-compartment weigh cans, receiving vat, pump, cooler, holding vat, cooling system, hot water heater or steam boiler.

"The size of the holding vat used in connection with the cooler will depend on whether the milk is canned or pumped into a tank truck. When pumped into a tank truck a smaller holding vat may be used.

"A steam boiler or hot water heater is necessary for cleaning purposes. It is a question to the writer as to whether the hot water heater is not preferable to the steam boiler in the hands of the average country station operator. Too often where a boiler is used the equipment is given a washing in cold water and then a superficial steaming with a steam hose.

"In the natural ice belt a circulating ice water system connected to the cooler makes a very satisfactory method of cooling the milk. This method is easy of operation and economical. Out of the ice belt, unless a very cold water supply is available, a small ice machine with a brine tank should be installed.

"*Conclusion.* Where a large number of country stations are operated by one company it would be better to standardize in construction and equipment. A 2,000 gallon station should be so constructed and equipped that it can be operated by one man. A standardization of equipment makes for interchangeability between stations and ease of replacement."

Mr. W. E. Ward, a member of this committee, has submitted the following report on sanitary conditions at country stations in New England:

"Three years ago I found that no adequate inspection was being given such plants and a thorough and personal investigation was made. We found conditions so bad at some of the creameries that we gave hearings to the proprietors and, where corrections were not immediately made, the products were excluded from the Boston market. The most serious conditions were the use of polluted water from streams and ponds, lack of toilet facilities, lack of proper can washing and sterilizing facilities, lack of screens, excessive infestation with cockroaches and water bugs, and the receiving of milk at too high a temperature. Some of the above applied to about 80 per cent of the plants visited. Through cooperative efforts by inspectors in the Metropolitan District of Boston, a recent compilation shows a reduction to 10 per cent which we can now class as having serious sanitary defects.

"A study of conditions at country receiving and processing plants clearly indicates that, as far as New England is concerned, the necessity for their more adequate supervision is not generally realized. Health officials fail to consider that it is fundamentally wrong to concentrate almost their entire efforts on the inspection of dairy products, especially milk and cream, during their distribution in the cities, and pay so little attention to country receiving and processing stations. If milk and cream are polluted at unsanitary country plants it not only does not sufficiently protect the public, but it injures the industry to prosecute retail dealers or attempt to condemn polluted supplies after the product has reached distributing centers.

"My experience has shown that fully 75 per cent of the milk brought into these country plants showed a temperature of more than 60 degrees, much of the morning milk being as high as 70 degrees. Only about 20 per cent of the creameries make the acidity test.

"The so-called cooperative creameries are the worst offenders in regard to receiving warm or dirty milk, for it is very hard for a manager to reject supplies of producers who own an interest in the plant. Both as regards cooperative creameries and others the personnel of the managers has much to do with the quality of products received, processed and shipped at creameries.

"Many instances were noted where no expense had been spared to provide modern processing facilities and yet the plants were managed in such a slipshod manner as to cause serious deterioration in the quality of products shipped.

"On the other hand, other creameries were noted where the facilities and equipment were not adequate, but where the manager did not hesitate to send back warm or dirty milk and took unusual precautions to protect the product while undergoing processing. I have found in many cases that results could only be obtained through insisting upon a change in management. Many of the managers of these latter plants had made every effort to have their employers supply them with adequate sanitary equipment and welcomed our orders to proprietors to immediately install it.

"The majority of country plants are owned by retail distributors in cities, consequently the proprietors do not keep in touch with their sanitary conditions. In many cases the suggestion that a sanitary expert be employed by the dealer to give his whole time to the plants has been adopted. In such cases the improvement in both plant and product has been so marked that I now consider it a fundamental necessity. In the case of small dealers I find that the insistence upon giving their country stations more of their personal attention is equally beneficial.

"In our endeavors to obtain sanitary corrections, especially at plants where polluted water was used, it was found impossible to obtain the cooperation of the State officials in States where the dairy industry predominated. This is but natural, as in such States the farmers' votes are in the majority and the adoption of any progressive sanitary measure affecting the dairy industry is impossible. It can thus be seen that the health officials from the distributing centers must provide the necessary machinery and funds for practically all country inspection service.

"The plants we inspected and upon which this report is based were all more than 60 miles from the distributing centers, varying in distance to plants in Canada, 325 miles away. The receiving and processing plants in and around the Metropolitan District of Boston receive quite adequate inspection, and I feel that it is quite as important, if not more so, to extend the inspection work to those in the country.

"I have just received 50 or more creamery scores. It may be helpful to state that the country milk plants inspected thus far this year show an average score of 62.5 against an average of about 42 three years ago, when this work was just started. However, I am not a firm believer in basing a standard for quality or sanitation upon the scores, for some of the creameries using polluted water and several where fecal deposits in large quantities were found in bushes behind buildings, were finely equipped, well managed, and aside from the defects mentioned, gave a high score.

"In regard to screens, three years ago only 14 per cent of the creameries made any pretense at screening. This year, so far, more than 90 per cent of these plants are fairly efficiently screened, and in addition many of them have adopted our suggestions for the elimination of such flies as will invariably get into a creamery by using fly traps on the receiving platforms, fly paper, the use of fans on the inside, and exercising more care in having the premises clean and dry between processing periods."

For further information regarding construction, equipment and operation of milk plants reference is made to the following publications:

U. S. Dept. Agr. Bul. 849, "City Milk Plants, Construction and Arrangement."

U. S. Dept. Agr. Bul. 890, "Milk Plant Equipment."

U. S. Dept. Agr. Bul. 973, "Milk Plant Operation."

Cornell Extension Bulletin No. 30, "Country Milk Stations."

"He who understands most is the other man's master."

THE DAIRY INDUSTRY IN CZECHO-SLOVAKIA AND CONDITIONS INFLUENCING IT AT THE PRESENT TIME

ING. FRANTISEK ROSINEK, *in charge of Bureau for Reorganization and Reconstruction of Sanitary Control of Milk and Milk Products, Ministry of Health,*
Prague, Czecho-Slovakia.

Czecho-Slovakia is a new republic in central Europe, existing now five years, comprising Bohemia, Moravia, part of Silesia and the northern part of Hungary—so-called Slovakia—territories of the old monarchy of Austria-Hungary. The population is about 14,000,000 on the area of 56,300 square miles.

The dairy industry is about 80 years old and is mostly farmers' cooperative. Before the war we had on our territory 345 cooperative dairy associations, with creameries and cheese factories, and about 250 to 300 private dairies and creameries located in cities and on big estates. The number of milch cows before the war was 2,380,000, giving 836,000,000 gallons of milk per year; 479,000 milking goats, giving 34,500,000 gallons of milk per year (75 gallons one goat per year); 530,700 milking sheep (all were 1,231,300), giving 6,634,000 gallons of milk per year. Summarized, it was produced in our countries before the war 877,700,000 gallons of milk, having the value of $140,432,000. About 55 per cent of this milk was utilized in liquid form, other part was manufactured to butter and cheeses or condensed in condensaries (milk powder factories). We were able to cover the demand for butter with our own and yet we could export the surplus to Balkan States as Greece, Bulgaria, then to Asia Minor and north Africa. Before the war there were manufactured in our country all kinds of cheeses, being at that time on the

European market as Swiss cheese, Edam, Gouda, several soft cheeses as Roquefort, Camembert, besides our domestic cheeses as beer cheese, cream cheese and sheep's cheese. Our domestic cheeses enjoyed good demand in Austrian countries.

The consumption of milk per capita per day was of course very low in comparison with the amount produced. It was less than one-third of one litre in cities, less than a half of one litre in the country outside the city. It was consumed mainly by small children. Elder children and adults consumed it in coffee. I must admit that there was a low understanding for this kind of food. The people recognized it not till in the war when it was hard to obtain.

On account of the war 170 cooperative creameries were put out entirely of existence. Some others changed the line and manufactured marmalades, preserved fruits and vegetables. In the whole about 50 per cent of all co-operative creameries were out of business at the end of the war. The number of milch cows decreased for one-third of the pre-war number. The remainder was under-fed and gave lower amount of milk with lower fat content. In the whole the damage which caused the war to our dairy industry can be estimated on $120,000,000. After the war the conditions improved very quickly. Thus at the end of 1920 there was counted in our country 96 per cent of all cattle as compared with the pre-war estate. And it is estimated that this year the pre-war number of milch cows is just reached.

But what helped that we so quickly improved from the war conditions? The hard experience of the war taught us that the milk is the best food for the nation and especially for the youngest of the nation. Our State Department of Agriculture understood it very well and therefore it loaned money to the disabled creameries and cheese factories to buy new machinery and repair the old.

It stimulated the selective breeding in cattle and sheep among the farmers, organizing courses and public lectures for the farmers, organizing annually dairy exhibitions in districts and whole States exhibitions. The farmers producing the best, richest and cleanest milk are awarded by money, either by government or central dairy association. The same is also with manufacturers of the best butter or cheese. There are organized courses for buttermakers and cheesemakers where they are taught to manufacture the products of the same uniform quality in the whole state that they can successfully compete with foreign products. The "barn control," analogous to your cow testing associations or extension service, is strengthened and the farmers are advised by the barn inspectors how to feed the cows to get the richest milk. Experiment stations are established in those parts of the republic where the dairying is the chief industry. State Department of Health studies the sanitary conditions and introduces new methods of control; stimulates bigger consumption of the milk by means of exhibitions and public lectures. The government sends young university and college men to study the phases of the dairy industry in foreign countries. In every respect we understand very well the importance of this industry in our country. It gives to us five times bigger income than sugar beet raising, one and one-half times higher income than wheat and barley raising, and also bigger income than our coal mines and iron foundries. In one word, we are going to make it our "National Industry." At present time it cannot be compared with the American industry, but I hope that in few years our experiences and knowledge collected in American countries in this line will prove very efficient and satisfactory for the benefit of our people, appreciating the American friendship and spirit so much.

"It isn't your position, but your disposition, that makes you happy or unhappy."

ADDRESS

PROF. H. E. VAN NORMAN, *President,* World's Dairy Congress Association, Washington, D. C.

I feel some way a slip was made in labeling my remarks as an address. "Wayside notes" will be a better subject.

From my point of view I am impressed with the progress that results from coming together. Do you realize how important these meetings are ? When I was in Europe a year ago someone commented on our improved ways of doing things. The reason for this, as I see it, is that we are a mixed people. If we were to call the roll of nations where our grandfathers were born, many nationalities would be represented, British, Irish, French, Dutch, German, Danish, Swedish, and many others. Coming as we do from many places, we have learned from each other. One, two, three, four, five or more generations in Europe are still living on the old places.

The second reason is, we are the most organized people in the world. We form unions of all kinds and organizations within many industries. We tell the other fellow where he gets off, and then we go away and do as we please. None of the twenty-three organizations in the dairy industry is really old. We learn quickly. The individual profits by getting out of his own place and learning from others. We see some fellow going down the road with a flat tire and he does not know it. We tell him and he sometimes tells us something in return.

Milk men are surprised at the problems of creamery men and creamery men are surprised at the problems of milk men.

I am looking for a multimillionaire who will endow an institute which will educate people to remove from our statute books a lot of foolish laws. We need standardization and simplification of our method of living and doing business. I have no kick against the middleman who is doing a necessary service, and sometimes we pay him for an unnecessary service. Some women may order five cents' worth of potatoes by phone, and expect to have them delivered in thirty minutes. Delivery service, writing bills and collecting them costs money. If, for example, we buy a head of lettuce from a store in a certain locality, it costs about 25 cents. In another neighborhood, perhaps not quite so aristocratic, the price is 20 cents, while at a certain stand in the market lettuce of similar quality can be purchased at 15 cents, and at another stand at another market for 10 cents, while the Dago on the street with his pushcart may be selling lettuce for only five cents. There are a lot of people, however, who want to live near where lettuce is sold for 25 cents per head. There are a lot of unnecessary things in business, and I believe we should try to eliminate some of them.

The World's Dairy Congress will convene in Washington next Tuesday. Forty-three foreign countries will be represented by over 150 official delegates, who are here or en route between their homes and Washington. Forty-seven states and the District of Columbia will be represented by delegates, and we hope you can attend the sessions, where many things worth while will be said. Two hundred and twelve papers will be presented in the Congress, and you will want to hear many of them.

You men are enforcing laws for the purpose of safeguarding milk and milk products. Others are digging out new truths to help you. I urge you to attend as many of the sessions as possible. Several hundred organizations have been invited and will have their representatives here in attendance to receive a message and to carry it back home to the men who cannot come. Men from the Atlantic and Pacific coasts have been in our office today, and we hope in this Congress to learn much through personal contact and exchange of experiences. The more we see of men the better we understand them, and we frequently find some of them to be pretty decent fellows when we come to know them. The world needs a better understanding, and we can all help in our own way to bring it about.

"Humanity in the aggregate is progressing."

PREMIUMS WITH SPECIAL REFERENCE TO QUALITY IN A MILK SUPPLY

DR. F. D. WALMSLEY, *Vice-President,* Borden's Farm Products Company of Illinois, Chicago, Ill.

Notwithstanding the rapid progress of our dairy industry, we are still confronted with the problem of securing further improvement of the quality of the milk supply. Something offered as a recompense for extra effort and care in the production and manufacture of various products has resulted in bettering this quality in a way that otherwise might have been beyond attainment.

It is the purpose of this paper to deal with the plan of a premium system with special reference to stimulating keener interest in improving the quality of a milk supply.

Whenever the question of prizes is brought up for discussion, invariably good arguments are presented on both sides, some contending that the vital points are lost and the prize becomes the central figure, while others are firm believers in some form of prize for the furtherance of almost any proposition, especially where the fate of the question is left almost entirely in the hands of others.

No doubt but that the production of milk as an everyday labor is largely in this second class, and the subject of strict daily adherence to certain prescribed dairy methods is largely in the hands of the milk producer.

During the last year the writer was privileged to observe the workings of a premium system covering the production of milk in a section near Chicago, and the conclusion drawn would seem to justify the payment of premiums to selected lists of dairymen who would by more diligent attention to the smallest details provide the consuming public with a better product. This experiment, by the way, was conducted notwithstanding the fact that there was no specific health department ordinance to serve as a guide in its production.

There are two very outstanding forces in the production of an extra quality milk, namely, cleanliness and cooling. Therefore in locating a supply for the purpose outlined above, it was necessary to take into consideration natural conditions in the territory with reference to the harvesting of a supply of natural ice as cheaply as possible. Manufactured ice seemed out of the question, due to price. Next was studied the natural habits of the dairymen with reference to everyday dependability. Due to its location, many residents of the city spent their vacations in this particular territory during the summer months and visited many of the dairy farms. Probably due to the fact that visitors were almost a daily occurrence, the barns and equipment in this section were maintained on a comparatively high plane.

So far everything seemed to be exceptionally favorable to such an educational campaign. The next step was to arrive at a point where the information which could be gathered would give a picture as to what was being accomplished under present conditions. Therefore the Breed system of microscopic analysis of milk samples was brought into play and samples were taken of each dairyman's delivery without considering any special methods, for the purpose of getting a line on the everyday handling of his product. Samples were taken without any notification to the dairymen and the results were graded as "Good," "Fair" and "Poor."

It was seen at a glance from the results of this work that sterilization and cooling were the items needing attention. Therefore a system of intensive dairy inspection was instituted for several months, at which time each and every individual producer was visited at milking time several times each month, so that methods of procedure in each individual case could be more closely studied, faults corrected, cows examined with special reference to deformed or abnormal udders. Samples were taken from delivery at increasingly shorter intervals until they were taken twice weekly where conditions were constantly improving and oftener as occasion demanded.

It was very interesting to watch the development of this territory as more and more the dairymen habitually became expert in the handling of the product and were more interested in the bacteria count and ready to go to most any end to obtain a proper rating. Where the dairymen were sufficiently interested, they were approached with the question of a special prize for the production of a special milk. It is needless to say that those dairymen who had been consistently in the highest class were very enthusiastic for the chance to compete in such a proposition and interest was lacking only among the groups of careless producers; but as there seemed to be a considerable majority of the former and a considerable number willing to try the experiment, it was decided to put the plan in operation.

Favorable to this was the time closely approaching when a supply of natural ice would be available. There were approximately 90 dairies delivering to this plant at the time, and of course provision had to be made for harvesting a supply of ice on each dairy farm in order to take care of the milk in warm weather. This program entailed the expenditure of approximately $150 for the initial cost of building an ice house holding sufficient ice to cool the milk to a temperature of 50° through the entire year, or, in other words, the harvesting of three tons of ice per cow, allowing for shrinkage. It was deemed advisable to get a closer check on the everyday methods of the dairymen; therefore the Breed system was discarded for the standard plate method of bacteria standards, excepting in cases where counts ran in excess of 100,000. In these cases the Breed method was continued in conjunction with the plate method for tracing the cause of high counts, whether cooling, sterilization of milk utensils, or some neglected methods of milking. In the calving season the fault was often found in some slight abnormal condition of one quarter of a cow's udder. Elimination of these faulty conditions generally resulted in the count again becoming normal.

The substitution of the standard plate method for the microscopic method served two purposes. First, it more definitely placed the dairyman in his proper class because of actual findings, and secondly, it paved the way for a financial return to reimburse him for his efforts in supplying ice houses, milk houses and in using more dependable methods of production. Samples were taken twice each week according to a schedule outlined by the laboratory. The days of sampling were varied to afford results under actual and ordinary operation. In this way it acted as an incentive toward keeping him on his guard all of the time. It has been noted that where sampling took place on days following Sundays, holidays, severe storms, or days on which the ordinary routine of operation was broken or interfered with, the counts invariably increased.

Finally the day came for putting in force the plan of premiums, which in this case was based on merit. Each dairyman who produced a milk having a bacteria count of 10,000 or less, as delivered at the receiving platform, received a premium of 40 cents per hundredweight of milk, and each dairyman producing a milk with a bacteria count of from 10,000 to 25,000 received a premium of 25 cents, with no premium for counts in excess of this amount. A number of dairymen were found who had consistently produced milk with a count considerably in excess of the required amount, and others who from a dairy or construction standpoint were not in condition to meet the strict requirements. To these two classes a time limit was given and the milk was refused at this plant, but hauled to another until the time limit expired. The time limit was given so that each dairyman who was not in a position through choice or necessity to bring the quality of his product in line with these requirements would have sufficient time to either obtain another market or place his production on par with the requirements, because no milk other than that under the plan of supervision was to be received at the plant.

On the day in question, production dropped considerably, due to withdrawals, so that there were scarcely fifty dairymen who delivered their milk on the first day. As time went on, however, it was found that the little things that go toward making a satisfactory product were not difficult but only necessitated everyday strict adherence. The objections of many gave way to curiosity and we had an increasing number of applications from dairymen asking to be placed under trial for this market, until at the present time approximately 90 per cent of the original number of dairies are producing this class of milk, and several outside applications are awaiting an opportunity to avail themselves of this market. The results are very gratifying. The information which has been disseminated has changed the viewpoint of the dairyman and his attitude toward his product. No longer is milk just spelled with four letters. It stands for more than just the bare milking and delivery. Dairymen now discuss the bacterial content and the reasons for high count in milk. A cow showing any abnormal physical symptoms is discarded and the utensils are scalded twice daily. Each dairy farm has plenty of ice and the dairyman cools the milk immediately after milking to a low temperature.

As a result of increased activities on the dairyman's part, it necessarily followed that the plant took on an added responsibility. The entire time of a qualified resident veterinarian was placed at the dairymen's disposal, so that very frequent veterinary, as well as sanitary, inspections and supervision could be given. The veterinarian's duties are many. Should applications be on file from dairymen in the surrounding territory to avail themselves of this market, it is the duty of this veterinarian to personally visit the farm, check up the facilities for the production of milk and its safeguarding. If all basic conditions are favorable, the dairyman is instructed in the fundamentals of milk production from a sanitary standpoint. He advises the dairyman of faulty conditions to correct, arranges for cooling facilities, and upon leaving promises to call again when the dairyman feels he is ready to assume the responsibility of everyday production along these lines. He also has the supervision of the methods employed in the production of milk, and from his laboratory experience has learned to differentiate between one kind of bacterial count and another, thereby becoming more expert in arriving at a cause for any individual high count. Dairymen recognize this, and require his time assisting them in locating and eliminating the causes responsible for any such counts.

As an experiment, the prize or premium plan has proven very successful. Two years ago only about four dairymen harvested any ice, and these not with the idea of using it for cooling dairy products. Today each dairyman has provided himself with a satisfactory location and a proper supply of ice. In some cases ice was not packed sufficiently, due to shortage of sawdust, but this will be corrected with the coming season when ice will again be harvested. Utensils are of proper construction and are scalded with boiling water twice daily. The storing of ice is spreading to other points, and plans are in the making for the erection of several ice houses in different parts of the State simply through the knowledge that the dairymen have gained from this experiment.

The method of scoring of dairies has been materially changed. More credit has been given for the methods a dairyman pursues, and less for the equipment of the dairy. The largest number of points has been given for an apparently healthy cow, as evidenced by repeated physical examinations. Several herds already have been tuberculin tested and preparations are being made to increase this number just as fast as possible, but even so it has been demonstrated that constant physical examinations are essential to detect other abnormal conditions not taken into consideration by the tuberculin test. Clean cans, care of utensils and proper cooling follow in order. Each dairyman soon finds out that cleanliness aids him in obtaining the premium; therefore his stable is clean; he uses a damp cloth to wipe the udders before each milking; keeps his own hands clean and dry, discards the first few streams of milk, strains his milk in the milk house, and in a covered concrete vat immediately cools the milk to a low temperature.

No finished article of commerce is any better than the materials that go to make it up, and this is especially true of a bottle of milk. From these observations and the results obtained, a decided step in advance has been made, and when all is said and done, that is really what we are all striving for. All things being equal, the better the production of the raw material that goes into a product, the better the finished product.

"On the diffusion of education among the people rests the preservation and perpetuation of our free institutions."

REPORT OF COMMITTEE ON PASTEURIZATION OF MILK AND CREAM

DR. WM. H. PRICE, *Chairman*

There was a time, in some places continuing into the present, when communicable diseases occurring on dairy farms were a menace to city milk supplies and were one of the serious problems of city health administration. And there was a time when losses through premature souring made milk transportation from distant sources impossible, resulted in great economic waste, and dissipated food values that were much needed for the proper nutrition of the people.

Various expedients were devised and applied to eliminate these evils. General and specific sanitary measures, including dairy farm and city milk plant inspection, bacterial counting, tuberculin testing, medical inspection, grading, etc., were advocated and applied. All these had their points of advantage; but individually and collectively they were inadequate to meet the public health requirements of the situation.

From small beginnings, hindered by lack of understanding and beset by opposition, pasteurization of milk supplies has pioneered its way through the development of the process to a satisfactory solution of the former problems. It is now determined (1) That holding pasteurization destroys all pathogenic organisms that may be contained in milk, thereby precluding possibility of transmission of milk-borne communicable disease from dairy farms; (2) That it destroys a high proportion of non-pathogens as well, thereby extending the keeping time by 24 hours; and (3)

That holding pasteurization does not appreciably affect the physical, chemical, or nutritional qualities of milk. The fact that vitamin C may be affected is of no material consequence, because milk is a relatively poor source of C and every milk diet should be supplemented by a readily available anti-scorbutic.

Holding pasteurization is the only adequate safeguard for milk supplies. It is the obvious answer to the health officer's problem of the incubating, the mild missed, the suppressed, the convalescent, and the carrier types of communicable diseases occurring on dairy farms. Holding pasteurization facilitates all three of the fundamentals that must be considered in attempts at milk control: it assists in maintenance of abundant supplies, it adequately safeguards, and it restrains price below what would otherwise be required to maintain abundant supplies of safe milk on the market. It goes without saying that pasteurization should be properly done; and, fortunately, it is as easy to pasteurize properly as otherwise.

Previous committees have reported in detail regarding the history, introduction, development, and extension of pasteurization. Our Annual Proceedings contain interesting instructions relative to construction, equipment, and operation of pasteurizing plants, and regarding dead ends, leaky valves, foamy milk, and other errors to be avoided. The Committee of 1920 reported exhaustively regarding these matters; and the Committee of 1921 reported a detailed plan for the collection and recording of data regarding pasteurizing plants and their method of operation.

The Committee of 1922 emphasized the superiority of pasteurization over other procedures for safeguarding milk supplies; and a majority of the committee approved the following definition of pasteurization:

"Pasteurization is a process by which every portion of the milk is heated to a temperature of approximately 145 degrees F., never lower than 142 degrees F., held at that temperature for a period of 30 minutes, and then cooled to a temperature below 50 degrees F. The temperature and time of heating, holding, and cooling must invariably be recorded by a tested thermograph, the records of which should be checked at regular intervals by the health authorities. Immediately after pasteurization, and at the place thereof, the milk should be placed in its final containers, and stored at a temperature lower than 50 degrees F. until delivered to consumers."

Methods of heating and holding which depart from the above should be denied use of the term "pasteurization," so far as application to market milk and cream is concerned.

The committee emphasized the essential factor of prevention of subsequent contamination. The committee did not advocate pasteurization as a substitute for cleanliness in the production and handling of milk; because high initial contamination, or excessive multiplication due to lack of proper cooling, is detrimental and unnecessary in any milk supply.

The present committee concurs in the foregoing conclusions, and takes this opportunity to emphasize the importance of practicable methods of laboratory control to determine the efficiency of pasteurizing equipments and methods. There is urgent need for the development of laboratory methods practicable for application to pasteurizing operations in the smaller communities.

Pasteurization has passed the pioneering stage. It is everywhere accepted as the practical and economical method for safeguarding, and at the same time conserving, milk supplies. There is but little material of an original nature for us to report at this time. It seems that it remains for us only to report on what new light may have been thrown on the subject during the past year.

Dairy Division Bulletin No. 342—The Present Status of Pasteurization of Milk—by Dr. S. Henry Ayers, originally published January 8, 1916, has been revised by its author and republished under date of October 10, 1922. This revision brings up to date the National Dairy Division's summary of the pasteurization situation in the United States. Its statements assume the conservative form typical of publications of the National Dairy Division. It contains valuable information regarding pasteurization, and should be in the hands of every person concerned with processing, distribution, or supervision of milk supplies.

"Market Milk," by Kelly and Clement, published this year by John Wiley and Sons, contains valuable chapters on pasteurization as well as on all other phases of the dairy industry and its supervision. The early experience of both authors, their technical training, and their long continued and intimate observation of the dairy industry in all parts of the country combine to make this volume invaluable to those concerned with the dairy industry and its supervision.

At Endicott, N. Y., during 1922, certain studies were conducted relative to thermal death points of various pathogenic organisms in milk. At the convention of the American Public Health Association in Cleveland in October, 1922, Prof. Milton J. Rosenau reported that none of the pathogenic organisms, including both forms of tubercle bacilli, tested in those studies survived a temperature of 140 degrees F. held 20 minutes. It is understood that these studies have not as yet been published and that the whole matter is under reinvestigation.

The Nation's Health, January 15, 1923, contains an interesting article entitled "Communicable Disease and Pasteurized Milk," by Dr. Edward S. Godfrey, Jr., Director, Division of Communicable Diseases, New York State Department of Health. It seems advisable to summarize that article into this report. Dr. Godfrey writes, in part, as follows:

"Advocates of pasteurization of public milk supplies have been aware that theoretically pasteurized milk may transmit infection unless the process and subsequent handling are under proper supervision. To what extent it has actually done so appears never to have been investigated." * * *

"In order to ascertain how often these (outbreaks of communicable disease) have happened, and in order to discover if possible the faults that have been responsible, an effort has been made to collect all outbreaks of communicable disease attributable to pasteurized milk. An inquiry was addressed to the executive officer of every state health department, to the health officers of twelve of the largest cities in the United States, and to several of the most prominent teachers in public health schools. This inquiry was intended to cover all outbreaks of communicable diseases in which milk that was pasteurized, or even purported to be pasteurized, was found to be or was suspected of being the agent of transmission. The questionnaire covered not only outbreaks occurring in the experience of the person to whom the inquiry was sent, but any that might have occurred in his state or municipality or which he recalled having encountered in the literature."

COMMITTEE NOTE: This was a very severe test indeed. It appears that a general dragnet was thrown out to bring to light any suspected or purported cases, or cases that might be recalled outside the experience of the reporter, as well as authenticated cases. The first conclusion rising out of such method of inquiry is that pasteurization must have been conducting itself in an extremely well-ordered fashion to make such manner of investigation necessary to disclose outbreaks of communicable diseases associated with pasteurized milk supplies.

As the result of these inquiries sixteen outbreaks which were suspected of having been transmitted through pasteurized milk were collected by Dr. Godfrey. He summarizes the available facts regarding these outbreaks, discusses them in such detail as the available data warrant, and arrives at the following conclusions:

"Sixteen instances have been collected of outbreaks of communicable disease attributed to infection by milk, or milk products, which had been—or purported to have been—pasteurized. In one instance the milk probably had nothing to do with transmitting infection. In four instances the milk was pasteurized by the 'flash' system or some other method which failed to conform to the standards of the health authorities. In one instance the thermographic records for several days preceding the outbreak could not be found, hence there is a doubt as to whether a proper temperature was reached and maintained for a proper length of time. In this instance there was also an opportunity for the milk to have become infected subsequent to pasteurization.

"In seven instances in which pasteurization was properly carried out, the evidence as to subsequent infection is conclusive in all but two. This is demonstrated by the fact that milk from the same pasteurizing plant handled by other dealers or drivers or delivered elsewhere than in the sharply defined focus of the outbreak did not spread infection. In one of the two exceptions there was very strong circumstantial evidence of infection by the employee who capped the bottles. In the other the source of infection was not located. Although it could be considered that infection *may* have passed through the pasteurizer, there is no evidence that it did.

"Hence it is a fair conclusion that pasteurization as now commonly defined in health laws and regulations will destroy any infection implanted previous to the process. Since from 85 to 90 per cent of milk outbreaks have been due to infection at the farm, pasteurization will prevent from 85 to 90 per cent of milk-borne infection. With modern dairy machinery which reduces human handling to a minimum and provides ample facilities for the sterilization of utensils, the number of infections occurring through milk will be infinitesimal. The remaining sources of danger are slight except in hotels, restaurants, boarding houses, and in shops where bulk milk is permitted to be dipped."

Committee Note: Pasteurization is not offered as a protection against subsequent infection, which must be guarded against. Neither is the flash method, or heating in the absence of a tested thermograph, recognized as adequate. Dr. Godfrey's data bring further support to the efficiency of properly supervised pasteurization. The following comparison is included in his article:

"Perhaps the most convincing evidence of the benefits of pasteurization from the standpoint here considered is to be found in the contrast between the experience of New York City and New York State, exclusive of the City, since January 1, 1917. Although in 1921 about 54 per cent of the milk supplied 'up state' by licensed dealers was pasteurized, it is probable that, when milk consumed by owners of cows and that sold to neighbors is included, the percentage of pasteurized milk would not exceed 35 per cent. In New York City 98 per cent of the milk is pasteurized. The population of New York City is 15 per cent larger than that of the rest of the State and much of its milk is shipped from considerable distances. During this period the City has had one outbreak—a typhoid outbreak five years ago (infection acquired subsequent to pasteurization)—while thirty-seven have occurred in the rest of the State. This is certainly a remarkable contrast, even making allowance for the fact that outbreaks and their sources are more easily discovered and traced in smaller places than they are in large ones."

Committee Note: The above is conclusive evidence. The area surveyed is large and representative, as to both territory and population; the time factor—four years—is sufficient with so large a population; the data were scientifically collected and interpreted. In the light of such evidence as that given above, one wonders at the strange philosophy of those who give precedence over pasteurization to grading, scoring, tuberculin testing, and low bacterial counts as measures for safeguarding milk supplies, and of those who regard pasteurization as "not the ideal, but only an expedient."

Properly supervised pasteurization finds favor with all those who deal squarely with the three fundamentals of milk supplies in their relation to human service, namely:

1. Pasteurization assists in the maintenance of abundant supplies of milk on the market.

2. Pasteurization is the only adequate safeguard for milk supplies.

3. Pasteurization facilitates maintenance of abundant supplies of safe milk at prices lower than would otherwise be required.

Such virtues as these were certain to attract the attention of the exploiter for private gain, and there have been offered for sale a variety of appliances, or methods, as substitutes or alternatives for pasteurization. These substitutes offer variations in temperature of heating, or in time of holding, from those defined in this report, and they may even suggest elimination of the holding period altogether—which appears to this committee as suspiciously like a return to the discredited "flash" process.

This committee knows no satisfactory substitute for pasteurization as defined in this report, namely:

Pasteurization is the process of heating milk to a temperature of approximately 145 degrees F., never lower than 142 degrees F., holding every portion of the milk at that temperature for a period of 30 minutes, and then promptly cooling below 50 degrees F. Invariable recording with a tested thermograph is imperative, as is also protection against subsequent contamination, by filling into adequately sterilized final containers immediately after pasteurization and at the place thereof, by healthy operatives, and storage below 50 degrees F. until delivered to consumers.

And further, the Committee on Pasteurization invites the attention of the Committee on Resolutions to the efficiency of properly supervised pasteurization as a safeguard for milk supplies, to the end that the Committee on Resolutions may take such action as it deems advisable toward endorsing pasteurization as herein defined and toward protecting the credulous from inadequate substitutes therefor.

One member of the committee did not reply to communications sent him; and one member dissents generally from this report.

"We are only responsible for what we say and do, and not for such interpretations as others may put on it."

REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS

O. M. CAMBURN, *Chairman*

Milk is recognized as the most satisfactory single article of food which is suitable for consumption by man and as indispensable in the diet of infants. Inasmuch as milk is also an excellent nutrient medium for bacterial growth it is obviously essential that to be wholesome it must be produced and handled under the most favorable conditions of modern sanitation. Years ago it was believed by many that milk contained other food values than those revealed by chemical analysis, but there was no proof of this fact. Today, on the other hand, through brilliant researches of such men as Osborne, Mendel, McCollum, Hart and Humphrey the value of those substances found in whole milk which promote growth and perform other important functions in maintaining health, is well known.

The investigations of this problem in different countries have been extensive and fruitful, and the results have led, through educational measures, to increased consumption with beneficial results. Particular stimulus for increased use of milk was received in this country during the war, and data obtained by Professor Raymond Pearl in his study of the nation's food[1] indicate an increase in consumption of dairy products in 1917-1918 of 5.93 per cent over the average annual consumption for six preceding years. More recent information suggests that this increase has in general continued, although in many localities milk consumption is still below the accepted standard of one pint to one quart per capita per day.

The United States Department of Agriculture says[2] that

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[1] Pearl, Raymond. The Nation's Food, W. B. Saunders Co., 1920.
[2] Circular 85, Office of Secretary, U. S. Department of Agriculture, Jan., 1918.

"milk is a food that contains all the elements necessary for the growth and maintenance of the body but also combines them in the proper proportions and is economically produced." It is also easily assimilated and requires no cooking or other preparation for the table. It is a very effective food for supplementing the deficiencies of other substances such as the cereal grains, tubers and fleshy roots, for it is rich in both calcium and phosphorus, while many vegetable foods are relatively poor in both these elements.

The low iron content of milk is its most marked deficiency. The amount of iron is sufficient for the child up to about one year of age, as the newborn mammal is provided with a store of this element in its tissues, sufficient to tide it over the period while it is on an exclusive milk diet; but if a child were confined too long to milk as its sole food, it would suffer from anemia for lack of iron.

Milk contains about 87 per cent of water and 13 per cent of dissolved substances consisting chiefly of proteins, milk sugar and fats. It is obviously too bulky to be satisfactory as the sole food for an adult on account of the amount needed to cover the energy requirements. The fat and milk sugar furnish both heat and reserve material stored as fat or glycogen, either in the liver or muscles. Of the protein matter, 75 per cent consists of casein, one of the most valuable constituents of milk, while in the ash we have some of the most necessary mineral elements of the body, sulphur, phosphorus, chlorine, sodium, potassium, calcium, magnesium, iron and iodine. Some of these elements exist in milk as salts, while others are in combination with organic matter. Comparisons with other foods on the basis of energy value alone are in many cases unfair to one or the other of the foods compared.[1] Milk containing four per cent of fat yields about 660 calories per quart.

[1] Comparative tabulations along these and other lines may be found in Modern Hospital, Vol. III, No. 2, 1921, p. 111, and in Circular 235, Univ. of Ill. Exp. Sta., 1919.

To quote further from the U. S. Department of Agriculture, "Babies who can no longer be nursed by their mothers are forced to depend upon cow's milk as a substitute. Children, invalids and the wounded also depend to a great extent upon milk for nourishment. Being a liquid it is easily taken by both the very young and the sick, when often solid foods cannot be used. In milk are found certain substances called vitamines, necessary for growth, which make it vitally important for children, invalids and wounded. For that reason children who require growth-producing foods, and invalids whose bodies have to combat disease and repair wastes, require milk.

"It has been found that such animal food as milk, eggs, and meat contain these growth-producing substances in quantities sufficient for the rapid growth and development of the body. While these substances are found in certain vegetables and grains they are in quantities so small that often in the ordinary diet sufficient quantities are not consumed to meet the needs of the growing body."

McCollum states[1] that the fats of milk are the most important source in the American and European diet of the dietary essential fat-soluble A. This is not abundant in any seeds, tubers or roots, as compared with the amounts of it contained in butter-fat of good quality. This is the anti-ophthalmic substance, fat-soluble A, which is essential for growth or for normal maintenance.

The studies relating to the anti-scorbutic value of milk are of special interest because of their importance in the nutrition of infants. It was shown some years ago by McCollum and Simmonds[2] that neither the anti-beri-beri substance, water-soluble B, nor the anti-ophthalmic sub-

[1] McCollum, E. V. The Newer Knowledge of Nutrition, Macmillan, New York, 1922.

[2] McCollum, Simmonds, and Pitz: The relation of the unidentified dietary factors, the fat-soluble A and water-soluble B of the diet to the growth-promoting properties of the milk. Jour. Biol. Chem., 1916, XXVII, 133. Also see Amer. Jour. Physiol., 1918, XLVI, 275.

stance, fat-soluble A, are present in the milk unless they are supplied by the diet of the lactating animal. If this should be true of the water-soluble C as well, it is obvious that the nature of the food supply of cows whose milk is to be used for infant feeding, when it serves as the sole source of the protective substance against scurvy, is of great importance. Barnes and Hume,[1] Dutcher, Pierson and Bieder[2] and Hart, Steenbock and Ellis[3] have studied this problem. The last named investigators have reported studies of the anti-scorbutic value of milk of cows which had been kept on dry feed for varying periods, as contrasted with that of cows which were feeding upon green pasture. Summer milk was found to be much richer in this respect than winter milk. When cows were changed to a green pasture after a long period on a dry feed, their milk very promptly improved in a marked degree in its value as an anti-scorbutic agent. Dutcher has recently reported[4] that milk can be heated to the boiling point without destruction of much of its anti-scorbutic property provided it is kept in an undisturbed condition. If it is stirred or shaken, it loses its value in this respect very rapidly, probably due to the destructive effects of oxygen on the vitamine. The committee on milk supply of the American Public Health Association has concluded[5] that any ill effect from the use of pasteurized milk may be remedied by the addition of such common substances as orange juice and potato water, and this covers the point above discussed.

Studies have been made and data presented[6] to indicate that dairy products, milk, skim milk, cottage cheese, and

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[1] Lancet, 1919, Aug. 23.

[2] Jour. Biol. Chem., 1920, XLII, 301.

[3] Jour. Biol. Chem., 1920, XLII, 383.

[4] Science, 1921, LIII, 446, May 6, and Jour. Biol. Chem., 1921, XLVII, 483.

[5] Report of Committee on Milk Supplies, San. Eng. Sec. A. P. H. A., Aug., 1920.

[6] Circular 235, Illinois, *loc cit.*

American cheddar or "store" cheese, have definitely been shown to be among the cheapest foods of animal origin as regards both protein and total energy, and it would be of advantage to the American housewife both from the standpoint of economy and of nourishment to increase their use in the diet.

The value of dried milk powder as food for adults and older children has been repeatedly demonstrated, but except in institutions, only a few studies of any magnitude had been undertaken to establish its usefulness as an exclusive food for infants until that undertaken by the United States Public Health Service in 1919, in Boston, in cooperation with the Boston Baby Hygiene Association, the Boston Health Department, and several other agencies. The conclusions of Dr. Clark and his associates[1] are to the effect that the dried milk powders and their remade products used in the study are safe for infant feeding, and in some cases seem to have distinct therapeutic value.

It is found that pound for pound dry matter, the dried milks are equal to the common liquid milk in most phases; slightly inferior with respect to anti-scorbutic vitamine and somewhat superior from the standpoint of curd formation. From the standpoint of minerals, proteins, energy and vitamins A and B, dried milk is equal to liquid milk, pound for pound dry substance.

Distribution of vitamin A between the watery and fatty portions of cows' milk has not been satisfactorily established in spite of the considerable interest of both practical and theoretical nature involved in the problem. Sherman, MacLeod and Kramer[2] in a preliminary statement have described without detail, experiments in which successful growth of young rats was secured by the use of dried skim milk as sole source of vitamin A, trebling their body weights in three months, and remaining free

[1] Clark, T., and Collins, S. D. P. H. Reports, Oct. 6, 1922.
[2] Proc. Soc. Exper. Biol. Med., 1920, XVII, 41.

from eye disease and in good general condition. They were also able to restore to normal, by use of dried skim milk, rats which had been brought to the typical condition of eye disease and declining weight due to deficiency of fat-soluble vitamins in their food. Quantitative relations were not established, however. Morgan[1] has shown that although dried skim milk and presumably fresh skim milk as well is not altogether lacking in vitamin A, it is impossible to obtain normal growth over a prolonged period by the use of this substance alone. Successful growth on a diet containing both the skim milk and small amounts of butter-fat indicated that the eventual failure on the skim milk diet was probably not due to the presence of toxic or inhibiting substances in the skim milk.

The Maternity Hospital of Minneapolis has been using powdered milk of special fat grade for 2½ years on their babies from birth to any age, using it both as supplement and as complement, using it continuously or interruptedly with breast feeding. Good results, freedom from bowel trouble, uniformity of product, availability, all appeal to the Hospital authorities to such an extent that orders have recently been increased for continued future sales.

The American Institute of Baking, under Dr. Barnard and Dr. Morrison, has been conducting experiments in the use of milk for making commercial bakers' bread which are of interest. Two kinds of bread were prepared, one with milk and the other without milk. On a diet of bread and water, it was found that rats receiving bread which had been made with milk were twice as large and far more healthy at three months of age than rats whose bread was made without milk. These experiments give sufficient promise to seem worthy of further research.

Professor A. C. Smith, chief of the poultry department, Minnesota Agricultural College, in testing powdered milk

[1] Morgan, A. F. Biological Food Tests, II. Vitamin A in Skim Milk, Amer. Jour. Physiology, *64*, 538, 1923.

with laying hens, reports better results from the use of milk than from the use of meat scraps, pound for pound of dry matter, plus the greater thrift of the bird and greater freedom from bowel trouble when using milk.

In order to place information regarding the value of milk and its by-products before the public, Borden's Farm Products Company issues a small pamphlet containing a number of questions and answers. The particular purpose of the pamphlet is for the use of school children. The book is marked "Price 25 cents," although it is not sold but distributed. The idea of the price mark is to impress upon the children the value of the book and prompt them to more carefully preserve it.

Finally, it may be appropriate to mention the value of including milk in the school lunch and serving it during the middle of the morning and afternoon school session. The value of milk as food for children has been demonstrated by results obtained when milk consumption has been increased by means of milk campaigns. When nutrition classes composed of children, selected because they were underweight, were conducted in schools of different States in connection with milk campaigns in which nutrition specialists of the U. S. Dairy Division cooperated, it was found that gains increased after the children received milk regularly each day. Not only did the children who received a pint of milk a day at school in these selected classes show improvement in health by increased weight and better school work, but the physical condition and morale of the children in the entire schools were improved indirectly by the use of more milk at home.

The gains made by children in these nutrition classes were not spectacular except in individual cases of children who were much underweight due to undernourishment, although otherwise physically normal. And yet the gains were substantial and many of the children attained normal weight in a few months. In classes from which children with physical defects were not excluded those without defects made more rapid gains, as would be expected.

In one milk campaign in a city of 75,000 population, 9,696 children were weighed just before a milk campaign was put on. It was found that 14 per cent of these children were 10 per cent or more underweight and that only 37 per cent drank milk regularly every day. Two months after the campaign another survey was made which showed that 54.6 per cent of the children were drinking milk every day and that the per cent of children 10 per cent or more underweight had been reduced to 11.5. Although this may not seem striking at first thought, the number of children 10 per cent or more underweight was reduced by approximately 18 per cent in two months' time, which is considered by experts to be rapid improvement. It will be noted that the per cent of underweight children decreased as the amount of milk drunk at home increased. Although the figures given here do not show it, when the last weights were taken there was also a smaller number of children less than ten per cent underweight.

In another State a nutrition class was organized in each of 20 schools in one county, and although the records of the improvement in these classes is not available, the general results obtained in one grade school of 500 children are quite gratifying. In this school the milk feeding demonstration started the last of September and the various teachers began their intensive work on health teaching early in October. The gains made by the children who were ten per cent or more underweight may be attributed in the main to the use of more milk at home. The results obtained in this school of 500 pupils are shown in the following table:

		Number	Per cent
September . .	Children 10% or more underweight	138	27.6
October . . .	" " " " "	106	21.2
November . .	" " " " "	86	17.2
December . .	" " " " "	71	14.2
January . .	" " " " "	55	11.0

In another city five nutrition classes of 20 children each were organized in as many schools. The children selected were all 10 per cent or more underweight. While they remained in the classes each child drank one pint of milk at school on five days of the week and was urged to drink milk at home, especially on the other two days. These children were selected regardless of their physical condition and it was found later that a number who failed to gain satisfactorily were suffering with bad tonsils, poor teeth, adenoids and other physical defects. But regardless of this the average of the gains made by all of the children was approximately normal when age and other factors are considered as compared with a rate much below normal before the nutrition classes were started. A number of the children dropped out before the classes were discontinued but a summary grouping the children by the number of weeks they were in the classes is as follows:

Period of feeding (weeks)	No. of children	Average gain per month (approximate) (pounds)
28	57	.50
24	6	.72
16	9	1.13
10	26	.55

There were 98 children in five nutrition classes. The number was originally 100, but two left a class one week after organization.

The low average gain for the children who remained in the classes for the entire 28 weeks may be attributed mainly to an average gain of only 2 pounds in one nutrition class, situated in a very poor neighborhood in which several of the children had bad physical defects.

In still another State in which a county milk campaign was conducted in November, 1922, the children were urged, as usual, to drink more milk and if they were in the habit of drinking coffee to substitute milk for it. In one city in this county the children in the schools were weighed just before the campaign was conducted and once during each of the first and third months following. It was found before the campaign started that 23.4 per cent of the children were 10 per cent or more underweight as compared with 14.2 per cent about six weeks later and 9.8 per cent three months after the campaign was conducted. The weights by grades for the children in the schools of this city are given in the following table:

Grade	November pre-campaign survey. Children 10 per cent or more underweight.	December 1st follow-up survey. Children 10 per cent or more underweight.	February 2d follow-up survey. Children 10 per cent or more underweight.
Per cent	Per cent	Per cent	Per cent
I	34.0	16.0	2.6
II	15.6	7.5	4.3
III	7.3	3.0	7.4
IV	31.0	20.0	9.3
V	15.0	8.0	6.6
VI	21.0	15.0	11.5
VII	24.0	11.0	17.1
VIII	39.22	33.0	20.0
Average	23.4	14.2	9.8

The increased gains in weight made by the underweight and normal children in these various localities, probably due to more milk being consumed, do not prove that milk is a miracle worker. But, on the other hand, they do indicate that milk has exceptionally valuable qualities as food for children and that it should have a regular place in the diets of all children.

School authorities in general are enthusiastic over educational milk work. They report that when the use of milk is increased the children are as a rule less restless, more attentive and show a marked improvement in health, conduct and scholarship. Conclusions as to the results of milk feeding, however, should be drawn cautiously, bearing in mind the importance of large numbers of observations extending throughout the year, the physical condition of the children at the outset, and many other factors which bear directly upon the problem.

"Use milk, it is economical, nutritious, easily digestible, and the best food for babies (mother's milk excepted); it should form the major portion of children's diet up to school age; the average school child should consume at least two glasses of milk at home and one at school daily: many adults would be benefited by substituting milk for meat; more milk used in cooking would add the cheapest nutrition to the food ration; proper nutrition conduces to efficiency and long life and milk is the most helpful contributing factor."

RICHMOND'S STANDARD DAIRY BARN

T. J. STRAUCH, *Chief Dairy Inspector,*
Bureau of Health, Richmond, Va.

It is significant that the history of the standard dairy barn which is now required by the Health Department for all dairymen selling milk in Richmond, Va., is the history of the improving of the milk supply in Richmond. Of course, I do not mean to imply that the Health Department considered a standard dairy barn for each producer the only important thing to be done in securing a pure milk supply for Richmond. There were other matters, such as the cleanliness of cows, milkers, and utensils, the prompt cooling of milk in properly conducted milk houses, and the necessity of keeping all milk down to a certain bacteria count and up to a certain butter-fat percentage, which were not neglected. But we did realize that properly constructed dairy barns would go a long way toward securing a clean milk supply for Richmond, and that to require these barns was one of the most important and first steps to be taken in improving our milk supply.

The first steps to improve the milk supply of Richmond were made in May, 1907, under the supervision of Dr. E. C. Levy, who, at that time, was health officer of the city and is now Director of Public Welfare. You can well imagine the difficulties, the antagonism, the prejudice we encountered when we advanced the rather new theory that barns where milk was produced should have the most perfect conditions of cleanliness. Even several years before 1907 the distributing plants in the cities had been modern, sanitary and up-to-date in every respect, so it seems rather ridiculous that our attempt to obtain these same conditions where the milk they handled was produced should have met with such strenuous opposition.

Antagonism was encountered on every hand, however, in spite of the fact that most people realized that milk is the most important food we have, and readily admitted that, once dirty, it could not be cleaned. The dairymen resented very strongly being told under what conditions the milk they were selling should be produced and handled. Some of them went so far as to have bills introduced in two sessions of the State Legislature, which had for their object the prohibiting of representatives from local health departments visiting farms located outside of the cities. As the rural sections of Virginia have a larger representation in the Legislature than the cities, it was only by a strenuous fight that these bills were defeated.

Thus the first step in the fight for a pure milk supply for Richmond was won, but there were even more difficult things ahead of us, before we achieved a really pure milk supply for the city. I can hardly draw the picture vividly enough for you of the unsanitary barns of the dairymen before 1907, when our crusade for pure milk began. They were uncomfortable, dirty, foul-smelling, poorly ventilated, and poorly constructed. It was more comfortable to hold one's nose while in them, as one dared not breathe without fear of contamination, while one stumbled around in their dirty interiors, over filth of all kinds. It was impossible for the cows, the milkers, the utensils, or the milk itself to be pure and clean in such unsanitary surroundings. And yet I suppose they were no worse than the majority of barns all over the country at that time.

There were fine, up-to-date distributing plants in the cities, with the most modern equipment obtainable, some of the plants finished on the inside with white enamel brick, to make them attractive. No expense was spared to make the distributing plants sanitary, but back of their white cleanliness were the numbers of unsanitary producing plants, or farms, where nothing was sanitary except through great good luck. Distributing plants threw their doors open to the public, begging it to visit their establishments, which they considered the last word in sanitation and efficiency. But these firms, as a rule, were not so anxious to have the public visit the farms and see the existing conditions under which the milk was being produced. We believed that it was just as important, or perhaps even more important, to have sanitary conditions at the farm than at the distributing plants. And so we launched our campaign for barns of modern construction, cleanly kept.

Our view was, and is, that a dairy barn is a factory in which the most delicate of foods, as well as one of the most valuable and most easily contaminated, is produced and handled. Since this is so, it should be a building so constructed as to be easily cleaned, well lighted and ventilated, also containing plenty of breathing space for the cattle. It should also be easy to disinfect in case of any contagious or infectious disease in the herd. We made some plans for such buildings at our office, always keeping in mind the fact that we wanted dairy barns that we would not be ashamed to have the public visit. Our plans showed the barn merely as a place for the stabling, feeding and milking of cows, and used for no other purpose.

The building was to be at least thirty-four feet wide, for a double row of cows, allowing a width of three and one-half feet per stall, with four square feet of light and two square feet of ventilation for each stall. We use the diffusion system of ventilation, which consists of a number of openings cut in each side of the barn, each opening one foot wide and two feet long, about two and one-half feet from the ground, all covered with muslin. Each stall has one of these openings in front of it. The plans called for at least 500 and not more than 800 cubic feet of air space per stall. The stalls, floor and mangers were to be of concrete, and the stanchions, stall divisions, and posts of iron. This type of barn would be our standard barn.

Having completed our plans our next job was to have our new barns constructed according to these plans, and our old barns, where possible, remodeled along the lines suggested by our plans. It was not so difficult to convince a new producer just starting in business of the advantages of building a barn of the type suggested by our plans, but it was difficult to convince a man who already had his unsanitary dairy barn of the excellence of these same plans. It was not until 1917 that we were able to get all of the dairy barns selling milk in Richmond built to conform with our plans. At the present time every drop of milk sold in Richmond is produced in barns constructed according to the plans adopted as our standard barn. The territory for many miles around Richmond is dotted with dairy barns, all built in uniform style.

When we started we tried to show the dairymen the advantages of the type of barn we recommended, which we now require. With the adoption of this barn by the larger dairymen we found that we not only made possible the production of Richmond's milk supply under the best conditions, but also made dairying more advantageous to the big dairymen, since it eliminated competition from men owning one, two or three cows, who carried on dairying as a side line. They could not afford to build to meet our requirements, and therefore dairymen who made dairying a business were protected from unfair competition.

At the present time Richmond is receiving its milk supply from seven thousand cows on two hundred dairy farms located in twenty-two counties of the State. We have no small producers, selling milk as a side line.

I do not want you to get the idea that we thought just this one thing, well-constructed dairy barns, would solve our milk problem. The important matters of cleanliness of cows, milkers and utensils, the prompt cooling of milk in properly constructed milk houses, were, as I said before, not neglected. When you also take into consideration the fact that every farm from which milk is shipped into Richmond is inspected at least once a month, sometimes oftener, and that samples for bacteriological examination are taken monthly, you can readily see that we did not place all our dependence for a good milk supply on well-constructed barns. We also have ninety-seven per cent of our milk supply pasteurized at the distributing plants, before it reaches the consumer, and this in addition to the sanitary conditions on the farms where milk is produced.

"All knowledge and all training are for use and for service. They may be for better health, better homes, finer citizenship."

WHAT CAN THE DAIRY AND MILK INSPECTOR ACCOMPLISH FOR HIS COMMUNITY?

CARL O. SEAMAN, *Milk Inspector,*
Manchester, N. H.

Getting the most out of milk inspection was the title I first proposed to write about, but after corresponding with Secretary Weld, and thinking it over, it occurred to me that someone might take the wrong meaning. Of course, an inspector should be recompensed according to his ability, but service to his commuunity should be his first aim.

Of primary importance in this service to the community is the necessity for keeping well-posted on the latest and most up-to-date methods of producing and distributing safe milk, so that efficient aid may be given to individuals or concerns planning new ventures.

About two years ago, the Health Officer and I discussed the milk situation, and reached the conclusion that in order to protect the health of the community the milk supply must be improved. To accomplish this, new regulations governing production and sale of milk and its products must be enacted. Urgent need of laws to prevent the sale of milk from herds infected with tuberculosis was paramount.

Situated as Manchester is, surrounded by the towns which produce from 60 to 80 per cent of the milk supply, it seemed possible and practicable to provide safe milk without requiring pasteurization of the same. Therefore we concluded to ask for regulations allowing milk to be sold from tuberculin-tested accredited herds or milk which has been properly pasteurized.

Almost everywhere we find people who are prejudiced against the use of pasteurized milk, and their objections are often well founded, particularly when the milk is for infant feeding. My city was no exception to this rule.

The following plans were formulated: first, to so improve the conduct of pasteurizing plants located in the city that the product supplied should be of such high quality that it could be recommended for use by physicians and others interested in a wholesome milk supply; second, to improve the quality of the raw milk sold. When this was accomplished, the health department was in a position to pass regulations governing production and sale of milk and to present the same to the board of mayor and aldermen for final approval, as provided by State law. These regulations provide for three grades of milk; first, raw milk, which must be drawn from tuberculin-tested and non-reacting cattle; second, pasteurized milk, which may or may not be produced by tuberculin-tested and non-reacting cattle, but pasteurized in plants approved by the health department; third, inspected milk, which may be sold subject to rules and regulations passed by the State board of health according to provisions of a State law.

We proceeded along these lines, with one pasteurizing plant at a time. Starting with the milk producers and sampling all milk as delivered at the plant, we took composite samples for bacteria counts and others for chemical analysis.

The efficiency of the pasteurizing outfit and the accuracy of the temperature recording device were tested, also the cleanliness of the cooler, bottle filler, filter and capping operation, special attention being given to machines and methods used in the cleansing and so-called sterilizing of cans and bottles. The care taken of cans and bottles after going through the sterilizing process was also noted.

By this system an inspector learns many things about the habits and slack methods practiced in some plants and is able to correct and advise regarding many little details which are sometimes overlooked in a general inspection.

We have 15 pasteurizing plants and 50 milk dealers who do not pasteurize their product. They are supplied by 800 or 900 milk producers whose dairies are from one to two hundred miles distant, covering probably 500 to 600 square miles.

After making careful bacteriological and chemical tests of samples taken in the pasteurizing plants at various stages of the process, and becoming satisfied that these plants were being conducted efficiently, it was possible to extend similar methods of inspection to some of the producing dairies.

Arriving at the plant just before the receipt of the daily supply, we secure samples of milk for bacteria count and other samples for chemical analysis from each producer as delivered to the plant. Then other samples from mixing tank, bottle filler and filled bottles are secured. We then test the cleaned and so-called sterilized cans and bottles to determine the number of bacteria contained therein.

After the chemical analysis and bacteria counts have been determined, a report with all these results, together with recommendations, is presented to the person owning or managing the dairy plant. The dairies inspected are scored on the official dairy score card and also on an inspection card devised by this office, which shows what equipment each place affords, the condition of the different pieces of apparatus, and the general sanitary aspect of each dairy.

Since this drive was begun, an immense amount of new apparatus has been added, new buildings have been constructed, and other activities have taken place.

When the rules and regulations requiring that all milk sold in Manchester must be either pasteurized or drawn from tuberculin-tested and non-reacting cattle were presented to the mayor and aldermen for approval, it was ascertained that the intensive work outlined above had brought the following results:

Six new pasteurizing plants have been put into operation. In 1922 about 76 per cent of our supply was safe milk. At the present time over 84 per cent is either pasteurized or drawn from tuberculin-tested accredited herds.

All of the dealers who have complied with these new rules and regulations, which, mind you, are not to be in full force until June 1, 1925, report a large increase in their business. Those dealers who have fought the department or in any way antagonized or refused to improve have lost customers and business. This is indicative that the consumer is keeping close watch, knows what he wants, and is ready to back up any honest attempt to improve the milk supply.

"It is necessary to try to surpass one's self always; this occupation ought to last a lifetime."

REPORT OF COMMITTEE ON REMADE MILK

C. S. LEETE, *Chairman*

The Committee on Remade Milk wishes at this time to report investigational work carried out by members of the committee. Its report will mainly take into consideration certain phases of the physical and chemical properties of remade milk.

There is also to be given at this meeting a paper dealing with "Dried Milk in Infant Feeding," by Dr. Taliaferro Clark, Surgeon, U. S. Public Health Service. Dr. Clark kindly consented to have incorporated in this committee report the material appearing in his paper. However, the committee believed that the investigator himself could present the subject to a greater advantage to all.

Experiments have been carried on by the Bureau of Chemistry with the idea of studying some of the physical and chemical aspects of remade milk. Investigations have shown that remade milk as made at the present time is not identical with natural milk. The conclusions here summarized are the results of analyses of approximately 100 samples of remade milk. Various combinations of raw material were used.

PHYSICAL PROPERTIES

Cream and fat globules. The appearance and amount of cream as well as the state of the fat globules as to graduation in size depends upon the methods of remaking the milk and upon the kind of powder used. In remade milk reconstituted from pressure spray whole milk powder and water, the fat does not rise to form a cream line and in this respect has the appearance of homogenized milk. A remade milk, made from a powder in the manufacture of which the fat globules have not been broken up by pressure, will have a cream line similar to that of natural milk. Remade milk made from skim-milk powder or condensed skim-milk and butter by means of emulsifying machines has a small cream layer which in most cases is very rich in butter-fat. Such a milk also has a larger number of very small fat globules than natural milk and this was shown by putting the milk through an ordinary cream separator and determining the per cent fat left in the skim-milk. The skim-milk obtained in this way from emulsified natural or remade milk was found to have a larger amount of fat than the skim-milk obtained in a similar manner from natural pasteurized milk.

Specific gravity. If the per cent fat and not-fatty solids fall within the range for natural milk, the specific gravity also tends to fall within this range.

Freezing point. Some samples of remade milk that have been examined in this respect were found to have freezing points outside the accepted limits for normal milk. Important factors involved here, however, are the proportions of milk powder and water used in making the remade milk and the composition of the original milk from which the powder was obtained.

Specific conductivity. The investigations made indicate that remade milk has practically the same specific conductivity as natural milk.

Viscosity. Remade milk in many cases tends to have a higher viscosity than natural milk, this being due mainly to the tendency of the heat used in the process of manufacture of the powder, to coagulate the albumin and lower the solubility.

Surface tension. Remade milk has the same surface tension as natural pasteurized milk.

CHEMICAL PROPERTIES

Hydrogen ion concentration. Slight differences have been found in some samples of remade milk as compared with natural milk.

Molecular concentration constant. This constant was found to be below normal in some samples of remade milk, which also had an abnormal freezing point.

Action toward rennet. The curd formed by the action of rennet tends to be less firm in remade milk than in natural pasteurized milk.

Enzyme activity. Many samples of remade milk show the same peroxidase activity as natural pasteurized milk.

Albumin. In most cases the per cent albumin in remade milk was found to be less than in natural pasteurized milk. Aside from the coagulation, a difference has also been detected between the albumin of natural milk and remade milk by means of a color test.

Casein. The electro-chemical properties of remade milk in respect to the rate of transference of the protein molecule were found to be little different from those of natural pasteurized milk. A change in the casein has been shown by means of a color test, the washed curd of remade milk made from milk powder giving a yellow color when treated with dilute sodium hydroxide. This serves as a practical test for remade milk as such, or when mixed with natural milk.

The solubility of milk powders was studied by one of the committee and a report of this work follows:

Solubility has been considered an important matter in judging the adaptability of milk powder for certain purposes. The term "solubility" as used herein refers to the ability of the respective constituents of desiccated milk to again, on re-mixing with the proper amount of water, form a solution, suspension or emulsion which will simulate the physical characteristics of natural milk. This basis for judging the quality of milk powder comes into prominence especially when the product is used under conditions where a visible comparison with the natural product is easily made. As yet there is no available evidence to support the supposition that a certain degree of insolubility alone adversely affects the nutritive value of product. Furthermore, experience has shown that even though milk powder made by different processes may possess slight variations in degree of solubility, such products compete with equal success in practically all of the major fields in which desiccated milk is now used. The physical characteristics which are imparted to the product remade from different dry milks are not closely scrutinized in the trades which now consume the greater bulk of the product, but even if such were the case it is doubtful if slight differences in such properties as solubility, creaming ability, viscosity and miscibility would serve to offset the already proven nutritive and economic merits of the product.

The solubility of strictly fresh powder, particularly as applied to the ability of the casein to assume its normal suspendability in water, varies with the process of manufacture, the acidity and mineral balance of the milk dried, and with its moisture content, either that retained in the powder or that subsequently taken up from the atmosphere. It is believed, however, that the combined effect of age and moisture is one of the most significant factors determining the solubility of the casein at the time it reaches the consumer. It has been shown that under adverse storage conditions, insolubility of the casein of milk powder increases progressively. This characteristic change can be classed as a type of deterioration which has been found to be applicable to all milk powders irrespective of the degree of solubility in the freshly made product.

Since it is considered that reduced solubility of the proteins of milk powder during storage is a distinct manifestation of deterioration, it seems pertinent to include general results from certain experimental work which shows the actual degree of deterioration taking place over given periods of time and under carefully controlled conditions. The plan of the work involved periodic determinations of the total protein and casein in the supernatant liquid of reconstituted milk powder after centrifuging under constant conditions. The storage conditions, moisture content and other essential manipulations were carefully controlled in order that results from the different objects of study might be comparable. The general results follow:

Air with a relative humidity between 70 and 80 circulated through a given quantity of milk powder at the rate of 1,600 cubic centimeters per minute or one hour per day, caused the moisture content to increase from 1.95 per cent to 11.14 per cent in 52 days. At the beginning of the observation period 85.9 per cent of the total casein of the sample remained normally suspended; after 25 days the moisture content had increased to 7.77 per cent and only 44.5 per cent of the casein remained suspended after centrifuging under the same conditions; and after 53 days the moisture content had increased to 11.14 per cent with none of the casein retaining its original suspendability. Parallel samples through which practically dry air was circulated at the same rate showed an increase in moisture content of less than 1 per cent after 174 days, and 83.5 per cent of the casein of the sample remained in suspension.

Since the foregoing results were obtained under artificial air and moisture environments they do not permit of direct interpretation in terms of time and moisture content which cause the development of a given degree of insolubility under commercial conditions. In order to obtain further data on this particular point fresh normal powder was subjected to conditions whereby the moisture content of experimental samples could be controlled at will throughout an indefinite storage period. Examinations were made at regular intervals for approximately one year or until there was an absence of suspended casein after reconstituting and centrifuging as already described. When the moisture content of the powder was held between 2.30 per cent and 3.50 per cent for a period of 329 days the solubility of the casein showed but slight change. At the beginning of the observation period 77.3 per cent of the casein in the total sample remained in suspension. After 329 days, during which time the moisture content was slowly increased to 3.45 per cent, the amount of casein remaining in suspension was 71.6 per cent. In another series of samples the moisture content was slightly raised from less than 2 per cent to over 5 per cent during a period of 358 days. At the beginning the amount of casein remaining in suspension was 77.3 per cent of the total. At the end of the storage period only 46.5 per cent retained its normal suspendability. In the third set of samples the moisture content was raised to approximately 5 per cent immediately after manufacture and maintained at this point for 273 days. At the start 77.3 per cent of the casein remained in suspension, whereas at the end of the observation period only 6.5 per cent remained in suspension.

The results obtained seem to show conclusively that the insolubility of the casein is due to excessive moisture. Probably comparatively little milk powder contains sufficiently high moisture at the time of manufacture to cause as rapid a development of insolubility as is indicated by the results obtained from circulating moist air. It is believed that a large proportion of the difficulty encountered with insoluble milk powders as found on the market is due to the absorption of moisture after packing. The elimination of much insoluble powder is, therefore, dependent upon the use of containers which will entirely exclude atmospheric moisture for long periods of time and under the most adverse conditions. It is also apparent that correct interpretation of the cause of insolubility in various samples of desiccated milk should take into consideration the moisture content at the time of examination, and if possible, the age of the product as well as the type of container in which it has been stored.

"Scientific observers reason that there is a close connection between milk drinking and progress in science and the mechanical arts."

REPORT OF COMMITTEE ON SERVING MILK IN SCHOOLS

PROF. W. P. B. LOCKWOOD, *Chairman*

The Committee on Serving Milk in Schools last year made specific recommendations as to the quality of the supply and methods of handling school milk. It was felt that this year it would be interesting to try to find out the extent of milk service in the schools. About forty questionnaires were sent out.

Answers from these questionnaires indicated that school boards in general are very favorable to this service, some of them being enthusiastic, while a very few are indifferent. The same may be said of the school teachers. Some are enthusiastic, others favorable, while still others do the work of serving the milk in the schools, but feel that they are loaded with enough work and should not have this put on them. As a general rule the milk service in the schools is much more effective when the school teachers are favorable or enthusiastic about it.

Many schools are serving milk only to children that are undernourished or underweight. These may or may not be in the open window or open air rooms. The school boards or departments of education of Chicago, Detroit, Buffalo, Richmond, and Schenectady have authority to use funds from school appropriations under proper budgets for undernourished or deficient children. Richmond, Virginia, furnishes milk for all open air rooms, of which they have twenty-two. Detroit furnishes milk for the undernourished children. In Chicago, the Municipal Tuberculosis Sanitarium supplies about 4,800 gallons of milk monthly for the use of undernourished children in the open air rooms as part of its municipal program.

On the other hand a larger number are compelled to get their funds for this work from outside contributions.

These have come from such sources as Women's Clubs, Visiting Nurses' Associations, the Elks, Kiwanis Clubs, Mothers' Clubs, the Red Cross, Parent-Teachers' Associations, City Chest Funds and any source that can be made available through the enthusiastic workers and friends of the undernourished child.

Another class of milk service, at both midmorning and other lunches, provides for the purchase of milk by the children. The reports indicate that the milk service in the schools is as follows:

Boston, Mass.	20,077 half pints,	lower grades.
Boston, Mass.	4,000 half pints,	upper grades and high school lunch rooms.
Brookline, Mass.	1,500 half pints,	
Greater Boston (Not counted above.)	24,500 half pints,	
Worcester, Mass.	4,000 half pints,	certified milk.
Winchester, Mass.	280 half pints,	
Schenectady, N. Y.	4,000 half pints,	
Buffalo, N. Y.	200 half pints,	exclusive of those served in kindergarten. No figures given for them.
Scranton, Pa.	200 half pints,	in a school. Number of schools not given.
Harrisburg, Pa.	2,560 half pints,	
Philadelphia, Pa.	11,000 half pints,	about 65 per cent of schools.
Pittsburgh, Pa.	7,000 half pints,	
Baltimore, Md.	15,000 half pints,	
Richmond, Va.	400 half pints,	open air schools. Others purchase at cafeteria.
Detroit, Mich.	700 half pints,	to undernourished. Several thousands purchased by children.
Chicago, Ill.	1,160 half pints,	to undernourished children.
Chicago, Ill.	60,000 half pints,	purchased by other children.
Kansas City, Mo.	All children in open air rooms. In other schools, all have a chance to purchase.	
Berkeley, Calif.	1,200 half pints,	
Eureka, Calif.	700 half pints,	
Hayward, Calif.	445 half pints,	
Riverside, Calif.	500 half pints,	
Santa Barbara, Calif.	4,500 half pints,	
San Francisco, Calif.	14,600 half pints,	
San Luis Obispo, Cal.	1,100 half pints,	
San Jose, Calif.	2,700 half pints,	
Los Angeles, Calif.	15,000 half pints,	
Oakland, Calif.	5,800 half pints.	

Several of the cities did not give the numbers as they were not able to get the records this summer.

No report was made where they were able to appropriate school funds for a full supply of milk for all children. As a matter of fact one or two of the men in answering the questionnaire said that they felt that they would like to see milk made available for all children in the schools rather than for a few who were able to pay for it.

The price varies in different localities from three cents per half pint to five cents per half pint. In many places crackers are served with the milk. In some instances one extra cent is charged to furnish milk for children who are not able to pay for it.

Very few reported milk served from cups. Those who did, reported the use of a sanitary cup for the purpose of reducing the cost and to make it possible for more children to get the milk. Boston reported the cost in cups from two to three cents per cup, varying with the size of the cup.

Relative to the control of the supply of milk given to the schools in Worcester, Massachusetts, the health authorities insist that nothing be used except certified milk. Several cities report control of the milk and special inspection, while others make no mention of special control. However, we know that these cities are fully awake and are making sure that the proper class of milk is going into the schools.

With one or two exceptions the reports indicated that the service of milk in the schools benefited the children's physical condition, as indicated by increased weight, more activity, etc. It was also indicated that with the increased weight and vitality of the children they did better school work and one report indicated that there was better self-control.

The report of City of Chicago Municipal Tuberculosis

Sanitarium, which furnishes the milk for the open air schools, says:

"Classes begin at nine o'clock. A pint and a half of milk is provided free by the sanitarium and this is given the children on their arrival at schools, with their dinner and before they leave for home in the afternoon."

The general curriculum is carried, with rest periods of complete relaxation instead of gymnasium work.

"An inspection of the results obtained during the year 1921-1922 shows that a total of 1,583 children registered in open air schools, with gains of weight and height in 1,468 and 1,162 cases, respectively, and a good physical improvement in 1,154 of the total number enrolled; 294 showed fair improvement, leaving only 139 who showed no obvious improvement."

For those of you who are interested in a more complete analysis of what can be done in this line, we recommend that you secure the report on nutrition as published by the Health Department of Detroit for the months of November and December, 1922, Vol. 5, Nos. 11 and 12. These give the results of an extensive study of physical defects, their correction, diet, etc., and are so comprehensive that we will not attempt to review them but will refer you to them.

As for the need of this type of work, we wish to call your attention to a survey report by one of the members of this committee from Harrisburg, Pa., as follows:

"In the special nutrition-health program carried out in Dauphin County, the number of persons attending community meetings was 7,422 and the number of children reached was:

Rural	3,865
Small towns	6,416
City (Harrisburg and Steelton)	14,170
Total	24,451

"Of these the percentages 10 per cent or more underweight are as follows:

Rural	23	per cent
Small towns	22	"
City—		
Grades	30	"
Junior High	35	"
High	33½	"
Girls in high	36	"
Boys in high	30	"

"While from this survey it is not possible to draw absolutely definite conclusions, yet there are some points especially worthy of note in that they will aid in planning future work.

"Dauphin County is quite representative, having definite agricultural and industrial sections, with the usual problems of the country, the small town and the large city."

"This survey would indicate:

"(1) That in country, town and city, there is need of a great deal of systematic educational work to bring to the people in an understandable form accurate scientific knowledge about foods and the other factors that enter into the problem of good health.

"(2) That health in children is not due to any one factor, but that all factors are important and have their place in the physical well-being of children.

"(3) That country children have some things that city children lack and vice versa; that a program of work needs to be adapted to the needs of each individual community, that consistent systematic training in correct food and living habits is fundamental and that such training is based upon a knowledge of what is correct in food and of what constitutes right living.

"This would indicate that a nutrition health program should be broad and comprehensive, as well as specific in its scope and should be planned to cover a period of years. An effort should constantly be made in carrying out the work to teach fundamentals and to maintain a balanced proportion in the various phases of the work."

Professor Roadhouse of Davis, California, writes:

"In September, 1922, when the Parent-Teachers' Association of the University Farm town of Davis started guaranteeing the payment for all milk that parents did not volunteer to pay for, 23 per cent of 160 children were more than 10 per cent under average weight. In December, after three and one-half months of milk feeding, together with supervised play and supervised eating of lunches, only 7 per cent of the children were more than 10 per cent underweight."

Miss Towne of the Bowdoin School, Boston, in a paper relative to their school health program and the milk service, which she read at the meeting of the Massachusetts Dairymen's Association in January, 1921, said:

"What are the results of the three years' work? First, this fall, it has been more difficult to recruit pupils for open air classes, because weights of younger pupils are steadily approaching the required standards. In a sixth grade, the insistence upon fresh air and milk each day is being carried out so magnificently that I give the gain in weight for this class the past two months:

4 girls gained 2 lbs.	2 girls gained 5 lbs.
5 girls gained 3 lbs.	3 girls gained 6 lbs.
7 girls gained 4 lbs.	1 girl gained 9 lbs.

while the rest of the class has normal weight. Such results along the line show why in seventh and eighth grades there are at present comparatively only a few pupils under the required weight, for their height. Surely, the value of such cooperative work cannot be questioned.

"Segregation of children in open air rooms—the mid-morning lunch are, however, only initial steps in securing perfect nutrition for the child. Care of the teeth, removal of adenoids and tonsils, correct home habits of sleep, etc., are just as vital."

One of the big problems is the reaching of the parents and the getting of proper home cooperation from them. In many cases the school nurse follows up the school work.

Several of the reports mentioned the cooperation of the various Dairy Councils in helping with the nutrition classes and organizing the school milk service.

There are many cities and towns serving milk in their schools that are not included in this report as we were unable to secure any information, or adequate information, on which to base a report.

"The foundation of every State is the education of its youth."

WHAT IS THE BEST TYPE OF MILK ORDINANCE?

LESLIE C. FRANK, *Associate Sanitary Engineer*,
United States Public Health Service, Mobile, Ala.

There is much disagreement concerning the answer to this question. Correspondence with a number of men who are giving the problem thoughtful attention discloses the fact that their views are widely divergent.

The divergence has to do with fundamentals. It includes such items as the following: (1) The value of grading, and the number of grades into which the ordinance should divide milk; (2) The bacterial count as an index of quality and safety; (3) The minimum temperature to be required for the pasteurization process; (4) The use of disinfectant in preparing the cows' udders and the milkers' hands for the milking process; (5) The steam sterilization of vessels as a requirement in the case of milk sold raw; (6) The tuberculin test as a public health measure; (7) The examination of employees of dairies and pasteurization plants.

In the case of the first item opinion varies all the way from disbelief in any kind of grading to belief in the equivalent of an infinite number of grades, namely, the publication of score percentages. The average opinion seems to favor about four grades.

In the case of the second item majority opinion seems to favor the bacterial count as an index of quality and safety, but several authorities oppose it strongly. Opinion is about equally divided as to whether the minimum pasteurization temperature should be 142° or 145° F. One authority favors 143° F. A small majority favors the use of disinfectant upon the cows' udders and the milkers' hands. Opinion is about equally divided upon the matter of steam sterilization of vessels in the case of milk sold raw. One authority is opposed to the use of the tuberculin test as a public health measure.

It is obviously futile, in view of this very general divergence of opinion, to expect a speedy agreement. It is obviously impossible, in view of this wide disagreement, for the state or federal health authorities to take any particular position with regard to model milk legislation without provoking serious criticism from more than one highly respected authority.

And yet it is vitally necessary that something be done, that some conclusion be reached. Cities are constantly asking state departments of health: "What type of milk ordinance shall we adopt?" State departments of health are beginning more and more to ask the United States Public Health Service: "What answer shall we give these cities? What is the best state-wide program for us to adopt?"

Perhaps it will be helpful to scrutinize the above discussed divergence of opinion from the standpoint of its causes. I think the principal cause of it lies in our failure in the past to give sufficient analytical attention to milk legislation as contrasted with milk sanitation. Our textbooks are replete with the discussion of milk sanitation and the discussion is usually supported by logical reasoning. In the case of milk legislation, however, there seems to be a lack of logical analysis. Milk ordinances are usually simply quoted as examples from practice.

What I mean is this: the wide differences of opinion above noted as to the principles of milk legislation are owing largely to the fact that we have made very little attempt in the past to discuss them as principles. There has been too much reference to practice and too little attempt at analysis. We have been somewhat too prone in the past to incorporate our theories of milk sanitation bodily into sections of milk legislation. We have been somewhat too prone to take for granted that all we needed to do was to find out how milk *should* be safeguarded, write a law saying it *must* be so safeguarded, and let that be the end of the matter.

Milk legislation may not be written in so carefree a manner. It may seem strange to the layman to say that merely to determine what needs to be done and then command it to be done is insufficient, but I will warrant that statement does not seem strange to the man who has to do with the enforcement of milk legislation.

Were this not so I think most of us would at once write a State law requiring that all milk except certified milk be pasteurized under the supervision of the health department. To go one step further, I personally would require that all milk must come up to certain specifications while raw and that all milk, *including certified,* must be pasteurized under the supervision of the health department. Then at last we who carry the responsibility of milk sanitation might sleep soundly without constant fear of milk-borne epidemics.

But, however much we may desire such an ideal solution, most of us know, in the sober reflection of our practical experience, that it is as yet impossible. Hence we must all recognize immediately that milk legislation should be considered not as a legal form of what we, the authorities, know *should* be done, but instead as a device for bringing about as soon as possible the nearest approximation of the ideal solution. Legislation must constantly press in the right direction but not harder than the citizenry will tolerate. The people will ultimately destroy or ignore any law which it does not understand, and the resultant lowered "law and order morale" is obviously destructive of the fundamental fibre of our social structure. We have all had the unhappy experience of witnessing the desperate attempts to enforce laws for which the people were not yet ready. Let those of us who have been given the responsibility of guiding the progress of milk legislation not make a similar error. Let us pass laws only as we have prepared the people for them.

Granted then that the divergence of opinion as to the best type of milk ordinance is great; that the divergence of opinion is owing largely to the failure to differentiate between legislation as a reflection of knowledge and legislation as a device for ultimately attaining an end; that nevertheless the importunities of municipal and State authorities make at least a tentative conclusion desirable; granted these facts, what is it advisable for us to do in order to promote the solution of the problem of optimum milk legislation?

It seems to me that the answer is wider discussion and big scale experimentation, and one of the objects of this paper is to make a plea for the necessity of these two things.

It is the further object of this paper to comply in part with its own plea and to attempt a brief presentation of the principles of milk legislation. I am thoroughly conscious of the fact that the subject is still developing and my attempt is intended merely as a point of departure.

With that understanding, I have tried to facilitate the analysis of the subject by propounding a series of questions. The first of these is:

(1) *What are the criteria by which any milk law should be judged?*

This question has been asked first because upon its answer the answer to most of the other questions relative to the nature of the ordinance may be based. The following criteria are suggested:

(A) It must bring about as quickly as possible the effective pasteurization of the maximum practicable percentage of the milk supply.

(B) It must promote improvement in the quality of the raw milk before pasteurization.

(C) It must safeguard as well as practicable that part of the raw milk supply which is not pasteurized.

(D) It must promote the consumption of more milk.

(E) It must be of such a nature that governing bodies can be induced to pass it.

(F) It must be easy to enforce.

It may be asked with regard to criterion (A), why should not the ordinance bring about the immediate pasteurization of all milk? There is no longer any real doubt, it may be urged, that any milk supply, however high in quality, is rendered still safer by proper pasteurization, or, stated still more strongly, that no raw milk supply, however carefully produced and handled, is safe enough to be trusted absolutely.

Why, then, should we not boldly require the full measure of what we know to be advisable? Simply because in most cities the education of the public as to the necessity for pasteurization has not yet proceeded to a point at which it will support such a law. In all cities of the United States there is some sentiment, and in many cities there is a majority sentiment against pasteurized milk. In many cases this sentiment has been inspired by the physicians themselves, partly because of a mistaken belief in the extent of vitamine destruction caused by pasteurization, and partly because of a conviction that most of the pasteurized milk obtainable in many of our cities has gone dangerously far along the road of bacterial action before being pasteurized, and is not a desirable infant food entirely apart from communicable disease reasons.

Further, there are always large numbers of citizens who have what might be termed a "traditional" dislike to the flavor of pasteurized milk, and who immediately resent any proposed legislation which would deprive them of raw milk.

Finally, whatever the underlying causes of the sentiment against pasteurization, the fact is that attempts to legislate universal pasteurization into being tend immediately to bring out the accusation that the legislation is inspired by existing or proposed pasteurization plants and is intended to give them a monopoly. Such an accusation naturally draws out the under-dog protective instinct among the population, including many people who prefer pasteurized milk but who hesitate to force it down anybody else's throat. Under these circumstances the legislation is almost certain to fail of passage.

It seems evident, therefore, that the model law should not require universal pasteurization. Practically no cities would pass it and while we would have advised cities what to do we would not have accomplished as much of our purpose as if we had adjusted our advice to the immediate possibilities. The larger end is not achieved by an ordinance which remains in the "proposed" stage.

(2) *Should the model law be based upon the grading principle?*

The answer to this question has been foreshadowed in what has immediately preceded. Once the decision is reached not to attempt universal pasteurization, but to permit *some* milk to be sold raw, even though it be but one grade, such as certified, we have tacitly admitted the grading principle and the ordinance should therefore embrace it frankly.

The reasonableness of the grading principle seems clear. If milk of different qualities is to be permitted upon a given market the differences in those qualities should be plainly indicated upon the label, and this is the essence of grading.

(3) *How many grades should be provided for?*

As a general principle there should be a sufficient number of grades to inspire competitive effort and yet not so many grades as to cause the intervals in quality between grades to be negligible. Within these limits I can see no cause for objection to the particular number of grades provided for.

I am at present of the opinion that two grades of raw milk should be provided for during the first year the ordinance is in force, unless the city in question has already made considerable progress in milk sanitation, in which case the milk permitted to be sold raw may be limited to one grade. In the former case the one year of "grace" is allowed in order to prevent any possible criticism of harshness and to give the dairy industry a reasonable opportunity to adjust itself to the new order.

The ordinance should provide permanently for at least two grades of pasteurized milk, as it is believed that such a provision will tend to improve the quality of the pasteurized milk which is placed upon the market. The limiting conditions of quality beyond which the sale of pasteurized milk will be prohibited should first be determined, and then the several grades arranged within these limits.

The question may be asked: "How will having two or more grades of pasteurized milk tend to improve the quality of pasteurized milk?" By placing quality upon a competitive basis. It is practically assured that the pasteurization plants supplying a given city will not all produce equally high quality milk and yet they may all be producing milk within the minimum limiting conditions required by legislation. If, then, the efforts of the better plants are rewarded by the award of a higher grade mark, improvement in the supply in general will be promoted. Quality will have been placed upon a sound business basis.

There exists another good reason for dividing pasteurized milk into two or more grades. It is believed that within a few years after such an ordinance goes into effect the great majority of pasteurization plants will be putting out Grade "A" milk, a higher standard than would have been originally required under a one standard system. At this time, when one of the plants violates one or more of the Grade "A" conditions demotion to Grade "B" will constitute a serious punishment and will usually result in the quick return of the offender to Grade "A" requirements. Grading constitutes a punishing device which the health officer may use without recourse to the courts.

It will be noted that nothing has been said about Certified Milk as a grade. This is deliberate. I am convinced that the fundamental idea of certified milk is wrong. Certified milk cannot ever serve more than a very small percentage of the people (at best in most cities the percentage is about one-half of one per cent) and it should not therefore be permitted to enter in an important way in the scheme for the solution of the major problem. Furthermore, the control of certified milk is illogical. The certified milk movement arose at a time when safe milk was generally impossible to procure and its control was placed under a jurisdiction outside the health department. Such a removal of jurisdiction constitutes a definite reflection upon the health department and in my opinion the need for this removal has now passed. The control of milk quality should not be vested in two separate authorities.

Furthermore, the very word "Certified" is objectionable. The word "Certified" to most consumers means "milk which is certified or guaranteed not to produce sickness." This in itself is enough to condemn the use of the word, as it cannot help but retard the progress of pasteurized milk.

It seems to me preferable to make the requirements for Grade "A" Raw Milk approximate the really vital requirements for Certified Milk, and then to be extremely careful as a health official never to lead consumers to believe that Grade "A" Raw Milk, or any grade of Raw Milk, is absolutely safe to drink.

(4) *Should the Bacterial Count be used as one limiting condition for grades?*

Decidedly so. There is no more sensitive measure of the cleanliness with which milk has been produced and handled and of the temperature at which it has been stored. Filthy milk or partly decomposed milk can never be good milk and the bacterial count is certainly a good indicator of these two conditions.

There has been a slight tendency recently to deprecate the use of the bacterial count, based upon the assertion that the count is not a measure of "safety," that is, of the likelihood of disease organisms being included in the general mass of organisms. However, the fact that occasional epidemics have occurred in milk supplies of low bacterial content does not seem to be a logical reason for assuming that the epidemics would not have been both more severe and more frequent had the supplies been of high bacterial content. What is needed to prove or disprove the above assertion is actual knowledge of the relative frequency and severity of milk-borne epidemics among low and high count supplies.

Has it not been demonstrated that the susceptibility of individuals is highly variable and that a weak infecting dose will infect a narrower range of susceptibles than will a strong infecting dose? If, then, we agree that typhoid and diphtheria bacilli and other milk-borne pathogens multiply rapidly in milk, will it not necessarily follow that the severity of a milk-borne epidemic from one of these diseases will be proportionate to the extent to which the original infection has been permitted to grow; in other words, that milk of habitually high bacterial count is more likely to produce epidemics because the infecting dose is more likely to have been permitted to grow to dangerous proportions, and for the same reason more likely to produce severe epidemics?

This seems to me, at least, to be the theoretical probability, and until the opposite has been definitely proved it seems to me logical to adhere to the bacterial count as a measure of safety as well as of quality.

Furthermore, the bacterial count is a decidedly wholesome check upon the thoroughness with which the process of pasteurization has been carried out. The wide-awake health officer soon learns to know what bacterial counts to expect when the pasteurization process is being properly carried out. He cannot depend solely upon time and temperature charts. These may be manipulated. But from actual experience in the operation of a pasteurization plant I am convinced that carelessness in operating will reflect itself sensitively in the post-pasteurization bacterial count.

To sum up, the bacterial count should be retained as one limiting condition for grades because it is a good measure of cleanliness, of the progress of the mllk towards decomposition, of the likelihood and probable severity of epidemics, and finally of the efficiency of pasteurization.

(5) *What should be the general nature of the other limiting conditions for grades?*

Inasmuch as the bacterial count is not an absolute measure of safety but merely an index of probability it should not be used as the *sole* criterion for grading.

The limiting conditions other than bacterial count should, in general, concern themselves with the nature and condition of the structures and equipment, with the methods of operation, and with the health of employees and cows.

Equipment should be stressed much less than it has been hitherto. Only such items of equipment as are vitally necessary in the interests of quality and safety, which are conducive to the use of proper methods, or which will clearly influence the morale of employees or customers, should be required. More than this will unnecessarily raise the price of milk and will conflict with criterion D.

Methods should be rigidly stressed. In general, they should include cleanliness of cows, barn, milk-house, milkers, utensils, and general equipment, the disinfection of udders and hands, the sterilization of utensils, and cooling.

The health of employees and the tuberculin testing of cows have been taken up as separate items.

(6) *Should the tuberculin test be regarded as a public health measure?*

It seems reasonable to regard the tuberculin test as a public health measure in the case of all raw milk, and in the case of both raw and pasteurized milk in those sections of the country where the percentage of tuberculosis among cattle is small. In the north and other sections of the country where a high tuberculosis rate exists tuberculin testing done by too high a pasteurization temperature is in direct ratio to the extent to which people have thereby refrained from drinking pasteurized milk and continued to drink raw milk.

In case there is any doubt as to the validity of the California experiments and of the recent Endicott experiments, the results of which have not yet been published, the experiments should be repeated again and again by competent authorities until a dependable and generally accepted conclusion is finally reached. In the meantime it seems to me that "not less than 142° F. for not less than 30 minutes" is a sensible standard.

The fact is emphasized here that the minimum pasteurizing temperature and holding time, above referred to, are not intended to apply to any and all types of pasteurizing machinery now on the market, but only to such types as are free of construction and operation defects, such as short-circuiting, dead ends, leaky pipes, excessive froth, splash, etc. It is further emphasized that the minimum temperature of 142° F., above referred to, means an actual minimum below which the holding temperature never drops, and that the pasteurizing apparatus must be set to operate *at such an average temperature above this point* as will insure the rigid observance of the minimum.

(8) *Should the examination of employees be required, and if so, to what extent?*

The objections which have been raised to the examination of employees are (a) that it is ineffective and (b) that milk.

it should be made unnecessary by the pasteurization of the

It seems to me that the examination of pasteurization plant employees and of employees of dairies whose milk is sold raw is readily defended.

The term "ineffective" is relative. If by "ineffective" we mean that not *all* disease is discovered and transmission prevented, this is obviously true. But if by "ineffective" is meant that the percentage of dangerous conditions discovered is negligible, then I think the statement needs proof. The actual occasional discovery of typhoid carriers and tuberculosis cases is direct evidence of the value of examinations. It is admittedly impossible to measure the precise value or the percentage effectiveness of examinations, but it seems to me that so long as any milk is sold raw the discovery of even one typhoid carrier in a year would justify all the examinations made that year.

The other objection, namely, that health examinations should be made unnecessary by the pasteurization of the milk supply seems to me to be begging the question, since so long as it is impossible in a given community to secure universal pasteurization the objection lacks validity.

(9) *Should a disinfectant be used in preparing the udders and hands for the milking process?*

The use of a hypochlorite solution in preparing the cows' udders and milkers' hands for the milking process has now been in vogue for several years in several sections of the country.

This practice is objected to by a minority of authorities on two grounds. First, it is feared that it is apt to irritate the udders and hands, thus lower the skin resistance to a point at which infection will be more likely, and hence defeat the very object of the practice.

In regard to this objection my experience has been thus far, in the very few cases in which irritation has been observed, that too strong a solution of hypochlorite has been used. I have not observed irritation where the recommended strength was used.

The second objection is to the effect that the practice is ineffective. Obviously, the use of disinfectant will not result in sterile udders and hands, but even if this is true it nevertheless remains that it is partially effective and to that extent, at least, protective. Investigations should be conducted as to its more exact effect, but in the meantime I see no weighty objection to the continuation of its use.

(10) *Should the steam sterilization of vessels, instead of sterilization by boiling water, be required in the case of milk sold raw?*

After detailed observations at many dairies it is my conviction that in the great majority of cases where boiling water is used or pretended to be used the sterilization is a mere farce. On the other hand, where a modern steam cabinet is used in connection with a sufficiently high powered boiler the results are not only obviously better in the majority of cases, but the operation is much more fool-proof and certain.

Therefore it seems logical to require steam sterilization in all cases where milk is sold raw and to encourage its use even in the case of milk which is to be pasteurized.

Obviously, the above questions are but a few of a total number of questions which could be included in a discussion of the best type of milk ordinance. The questions and answers which have been given, however, indicate the general nature of the ordinance which is at present believed to be the best type.

It remains, finally, to answer the question: Does the type of ordinance indicated satisfy the criteria suggested under question (1)?

It is believed that the ordinance will bring about as quickly as possible the effective pasteurization of the maximum practicable percentage of the milk supply (criterion "A") because within one year of the date of passage of the ordinance, if it is properly enforced, all milk will be pasteurized except one grade of raw milk and that grade will be the practical equivalent of certified milk.

It is believed that the ordinance indicated will promote improvement in the quality of the raw milk before pasteurization (criterion "B") because the grading of pasteurized milk and the resulting quality competition will exert constant pressure upon pasteurization plants to market only the highest grade of pasteurized milk, and this high grade will be required under the ordinance to be produced from high grade raw milk.

It is believed that the ordinance indicated will safeguard as well as practicable that part of the milk supply which is not pasteurized (criterion "C") inasmuch as within one year of the date of passage of the ordinance the only grade of raw milk permitted to be sold will be the practical equivalent of certified milk.

It is believed that the ordinance indicated will promote the consumption of more milk (criterion "D") because the two outstanding reasons for the small consumption of milk in many communities are "poor flavor" and "distrust of its safety"; hence, any ordinance which improves the quality of milk, as the indicated ordinance will do, will promote the consumption of more milk both because it will create public confidence in the safety of the labelled upper grade, and will improve the flavor.

It is believed that the indicated ordinance is of such a nature that governing bodies can be induced to pass it (criterion "E") because it is not a rigid "Thou Must" type of ordinance but one which rewards the production of quality by a grade label which has commercial value. Past experience has already shown that this characteristic at once appeals to governing bodies.

It is believed that the indicated ordinance will be easy to enforce (criterion "F"), that is, with the minimum number of court cases and with the maximum percentage of convictions, because the court cases which do arise will be limited largely to the question of misbranding, and it is usually easier to secure convictions upon this charge than upon the charge that a given milk supply will produce disease. It is much simpler to convince a judge or a jury that a given milk has been misbranded than that it will produce disease.

DISCUSSION

Dr. F. D. Holford, New York: Is it advisable to allow handling two grades of milk in one plant?

Dr. Frank: It would be inadvisable to say you may not handle more than one grade of milk, but as a matter of fact it usually works out that only one grade will be handled in a plant.

Dr. H. A. Harding, Detroit: Has not confidence in the bacteria count been shaken because of variations in media, for example?

Dr. Frank: That is not the fault of the principle of the bacteria count. If the medium had been properly standardized, these variations would not occur to any dangerous extent.

"The service which has been rendered the human race by the public health movement of the last half century is the noblest example afforded by history of successful, philanthropic, human activity."

THE CORRECT SAMPLING OF ICE CREAM

BENJAMIN VENER, *Chemist,* Tait Bros., Inc.,
Springfield, Mass.

Ice cream today is classified as a food instead of a luxury. It is thus regarded by the different States, which have set legal standards for its composition, purity and the sanitary conditions under which it is to be manufactured.

The importance of correct sampling of ice cream must be given careful consideration if we desire to secure a representative sample, a sample fair to the dealer, consumer and manufacturer.

We must consider the manufacture of ice cream to appreciate the difficulties and methods of procedure in the correct sampling of this product. Ice cream is a complex food, subject to various factors which change its physical composition as well as its chemical composition. The most important requisite in obtaining a true sample of ice cream is that the ice cream be in a solid or frozen condition. Other than in this state, the ice cream is subject to physical change which causes the component parts of the ice cream to separate rapidly and changes the true relation of each part to the original ice cream mixture. An analysis of a sample taken under these conditions would be incorrect, and with its consequent erroneous interpretation might cause unjustified complaints.

Ice cream making today by the large manufacturers allows the inspector to obtain without much trouble a perfect sample from any part of the can or packer, provided it is solidly frozen. And as a matter of fact the sample, so obtained, is usually representative of the day's output of the particular manufacturer from whom it is obtained.

At this point it may be advisable to point out that in the ice cream from the large manufacturers the butter-fat globules are broken up into minute globular particles, and for this reason the ice cream of the larger manufacturers can be sampled with greater uniformity than is usually the case with the ice creams of the smaller manufacturer. This process of manufacture is called by various trade names, such as homogenization, viscolization, etc., and produces an ice cream which will analyze the same from any part of the can. As an example, two five-gallon cans of ice cream made by this process were sampled. Three samples from the upper part of the can were taken, three from the middle of the can, and three from the bottom of the can, and every test was practically the same, no matter where taken or from which can. Both cans of ice cream, of course, were made from the same stock. Other processes that aim to produce similar results upon the fatty constituents are called emulsification, creaming, etc. These are processes which act upon the ice cream mixture, intimately combining other ingredients with the fatty constituents into a uniform mixture, but these processes do not completely prevent the fatty constituents from separating.

There is a great deal of ice cream manufactured, in the making of which neither of these processes is used. And it is this unprocessed type of ice cream that may produce wide variation in the analyses due to the separation, either in the raw or unfrozen state or even in the slow physical separation of the fatty constituents while in a frozen condition. Ice cream in which the fat is not thoroughly broken up will change its original distribution within the can even in a frozen condition. In a can of ice cream, the fat of which was not broken up, a variation of 10 per cent to 50 per cent was found. There are other factors which prevent an accurate sample being obtained, such as improperly mixed ingredients, separation of the fatty layer in a butter mix, buttering or churning of the fat, curdling, etc.

The fat content for ice cream usually is obtained from fresh products such as milk, cream and condensed milk, though butter or butter oil is sometimes used in summer or when cream is scarce. The fat constituent is well distributed throughout the stock when milk and cream is used and very little variation can be expected in this type of ice cream. When butter or butter oil is used, unless these products are properly processed a great variation in the analyses may be expected. In a vat handling a butter stock ice cream mix which was not thoroughly agitated a range of tests was obtained (in a theoretical mixture of 11 per cent butter-fat), running from 6 per cent to 24 per cent butter-fat. Suppose the 10 per cent State Inspector obtained the 6 per cent sample and the 7 per cent legal standard inspector obtained the 24 per cent ice cream sample and both sent their reports to the manufacturer. What a comedy of errors! Which is correct? Both correct, but the manufacturer thinks them both mistaken and pats himself on the back and does not imagine that it is himself who is wrong. This business comedy has actually taken place with its many rather peculiar complications.

Many small makers of ice cream figure their fat content from their milk and cream constituents, forgetting that their sugar, gelatine, flavor and fruits, and also the very small amount of water they add are likely to reduce their fat content below the legal standard. The wide awake inspector usually computes the fat content with this type of manufacturer when he has obtained a low test.

In order to obtain a proper sample of ice cream and for a just interpretation of the analysis, so that the inspector may be fair to the manufacturer, to the consumer and to the dealer from whom the sample was taken, the inspector should have a complete record; where the sample was taken, the name of the manufacturer, the kind of ice cream, the type of package or packer, the name on the packer, whether the sample was taken from a piece can, whether other ice cream was mixed in this can, whether the ice cream was repacked and whether the ice cream was in a soft condition. If "A's" ice cream is to be sampled it should be taken from "A's" packer and preferably from a full can. Soft ice cream should not be sampled and neither should icy ice cream be taken. Ice cream that is sour, curdled or buttery, or ice cream that does not melt down to a homogeneous liquid condition should be thoroughly shaken and treated so all the fat is thoroughly melted before an extraction for the fat content is obtained. Fruit or nut ice cream should have filtered from it all pieces of fruit or nuts so as to obtain a fair sample and due allowance should be made for the weight of such fruit or nuts in determining the final per cent fat in the total sample.

If three consecutive samples are below the legal standards, then and not till then should the inspector enforce the law against the maker, though after the first low test it would be advisable for the inspector to point out to the manufacturer where the sample was taken, kind of ice cream, name on the packer, the amount in the can, etc., so as to give the manufacturer this information which will enable him to trace back and correct any faults in the manufacture or perhaps in the way the dealer is handling the product. It is well known that many dealers make certain home-made grades of ice cream and they sell these with that of the large manufacturer; or they even handle the product of two ice cream makers. The dealer may also let the ice cream melt with the resultant separation or breaking down of the original physical perfect mixture of ice cream.

In sampling ice cream for bacterial content it is advisable to take a sample from the center of the can of hardest ice cream by means of a sterile spoon. This sample should be placed in a sterile pint Mason jar and kept in the refrigerator at a temperature not above 40° F. When the ice cream has melted, a one c.c. pipette is inserted through the foam or air cells while holding the finger over the mouth of the pipette, and then one c.c. is drawn into the pipette. This cubic centimeter when emptied at 40° F. is usually one gram in weight. In reporting results the same precautions should be taken as to the true identity of the ice cream as was taken for the chemical examination.

May the bacterial examination of ice cream be standardized, so that this choice food and delicacy may become as pure as the best of our market milks. This can be done, as most manufacturers of ice cream are thoroughly pasteurizing their stock and handling ice cream under the best of sanitary conditions.

"Books must follow sciences and sciences books."

REPORT OF COMMITTEE ON METHODS OF BACTERIAL ANALYSIS OF MILK AND MILK PRODUCTS

George E. Bolling, *Chairman*

Your committee has continued the same general line of investigation as for the several previous years, viz: to ascertain the relationship of the counts obtained by plating the same sample of milk with different media.

The media employed were as follows:

1. Present standard meat extract agar.
2. Previous standard meat infusion agar.
3. Dehydrated Bacto Agar, from the Digestive Ferments Co., Detroit.
4. Desiccated milk agar from the Dry Milk Co., Adams, N. Y.
5. Standard meat extract agar plus 1 per cent lactose.
6. One laboratory each employed certain other media, viz: Ayers' agar, a dehydrated Bacto peptonized agar and the standard agar and Bacto agar plus sodium chloride. Several laboratories ran the same samples of milk by the Frost Little Plate Method and several made direct microscopic counts by the present standard Breed method and the previous standard Slack method.

So many hundreds of samples were tested in the aggregate that any attempt to present individual counts is inadvisable, hence a summary has been prepared which serves to visualize the results by assuming the average of all counts obtained upon standard meat extract agar to be 100 per cent and giving the relationship the average counts upon other media have to the standard 100 per cent. This summary is given in the accompanying table.

Laboratory	Milk	PLATE COUNTS: Standard Extract Agar. Per cent	PLATE COUNTS: Meat Infusion Agar. Per cent	PLATE COUNTS: Dehydrated Bacto Agar. Per cent	PLATE COUNTS: Desiccated Milk Agar. Per cent	PLATE COUNTS: Milk Agar Ayers Process. Per cent	PLATE COUNTS: Meat Extract Agar +1% Lactose. Per cent.	PLATE COUNTS: Dehydrated Bacto Peptonized Agar. Per cent	PLATE COUNTS: Standard Agar +NaCl. Per cent	PLATE COUNTS: Dehydrated Bacto Agar. +NaCl. Per cent	FROST LITTLE PLATE METHOD: Standard Extract Agar. Per cent	FROST LITTLE PLATE METHOD: Standard Agar+1% Lactose.	FROST LITTLE PLATE METHOD: Dehydrated Bacto Agar. Per cent	FROST LITTLE PLATE METHOD: Desiccated Milk Agar. Per cent	DIRECT MICROSCOPIC COUNTS: Breed Method. Per cent	DIRECT MICROSCOPIC COUNTS: Slack Method. Per cent
A.	Raw	100		103	98		106								129	
	Past.	100		179	50		55				17	19	18	18		
	Cert.	100		120	94		98				260	220	229	212	740	
B.	General	100		97	217		161								376	
C.	Raw	100	109	97	107		164								164	123
	Past.	100	160	108	113		184									
D.	General	100		106	62	86	83									
E.	General	100		90	128		115		95	229	13	3.4	2.1	1.8	1742	.07
F.	General	100	136	113	127		130	128								12
	Averages	100	135	112	111	86	122	128	95	229	97	80.8	83	77.2	730	45

We believe it to have been again demonstrated that the more elaborately prepared media are apt to give more erratic results, and feel that the use of such media, while of undoubted value in research, has so far failed to demonstrate any necessity in their use for official plate counts. The general use of a dried powdered medium by all making official plate counts would tend to eliminate a prolific source of error and render data from different cities far more comparable than at present. We are ready to recommend the use of such a dried medium as is at present put on the market by the Digestive Ferments Company and a very similar product the manufacture of which is contemplated by the Research Laboratory of the Dry Milk Company of New York. The slight variations obtained to our minds appear to justify such a recommendation.

As each batch of such media is prepared by the factory a sample should be sent to some designated laboratory until it had been passed as acceptable, the expense, which should be nominal, to be borne by the company. This is much the same method as is employed by the Hygienic Laboratory of the U. S. Public Health Service in supervising the sale of various antitoxins, vaccines, sera and arsephenamin.

A suggestion to the Hygienic Laboratory that the testing of dehydrated culture media be added to their work brought the answer that the articles to be tested were closely defined in the Congressional Act granting the authority for their present work, and it could not be extended.

Intimation has been received that this Association itself should initiate such work and others would soon accept the plan, realizing that a long step toward unification and simplification had been taken.

The Committee believes that in the use of bacterial examinations of milk to ferret out faulty methods of production or marketing lies their greatest value. If the results are used in punitive procedures they should be so employed only after much effort on the part of the official has been made to have the delinquent correct any faulty practice.

If bacterial results are to be employed in particular cases as a basis for court procedure or to exclude any source of supply, it may be advisable for a time to have the laboratorian run duplicates on both standard meat extract agar and the dehydrated agars.

"He who goes too hastily along often stumbles on a fair road."

SOME OBSERVATIONS ON HIGH COUNTS IN MILK FRESHLY PASTEURIZED UNDER COMMERCIAL CONDITIONS[1]

W. D. Dotterrer, Bowman Dairy Company,
Chicago, Ill.

INTRODUCTION

During the past three or four years high bacterial counts have occasionally been found in milk from several pasteurizing plants operated by the Bowman Dairy Company which could not be accounted for by the most careful inspection and tests made at the plants. This was especially true at one plant which had the lowest average count for the year 1920, and in 1921 had a number of very high counts. Conditions at the plant were essentially the same, but the Frost little plate method was used quite generally for several months in the laboratory. It was the little plates which showed the high counts, while standard plates did not often do so. In these cases high counts were secured in samples taken direct from the holding machine when the temperature and holding time were carefully checked and known to be correct. On several occasions samples were taken at intervals throughout the run and counts varying from a few thousands to hundreds of thousands were secured.

The most striking illustration of this condition occurred during the summer of 1921 in the country pasteurizing plant mentioned above. In this instance the counts on

[1] The work reported in this paper was done in the laboratory of the Bowman Dairy Company. A good part of the experimental work was done by Mr. O. J. Schrenck, Miss Ray Cooley and Mr. M. M. Kloser. Acknowledgments are due them and Dr. Robert S. Breed of the New York Agricultural Experiment Station, and Dr. H. A. Harding of the Frederick C. Mathews Company, whose suggestions and criticisms of the manuscript were of great assistance.

samples taken from the holder were low during about one-half of the run, when there was a sudden increase to hundreds of thousands. On one day when a test was made the increase was from 16,000 per c.c. to over a million in an interval of ten minutes, which was the time between the taking of samples. Conditions as to temperature and time of holding were so nearly the same during the day's run that it was apparent that the variation in counts must be due to variations in the bacterial flora of the milk as it came to the plant. The experiments reported in this paper were undertaken for the purpose of determining the cause of such great fluctuations in count. The data are presented for what they are worth, with the realization that this report must be considered as more or less preliminary and in the hope that a more complete study may be made later. Since starting this work reports have been received from other cities where similar troubles have been encountered quite frequently.

CONDITIONS OBSERVED AND METHODS USED

It was noted in the beginning that there was usually a great difference between counts made by the standard agar plate method[1] and those made by the Frost little plate method[2], on samples which showed a high count as the milk came from the pasteurizing machine. Standard agar plates generally showed quite uniform counts all through the run, while counts made by the Frost method were high on part of the samples. Occasionally a high count was obtained by the standard method. When this occurred the colonies were very small, sometimes barely visible. Counts made on standard plates poured with Ayers' milk

[1] Standard Methods for the Bacterial Examination of Milk, 3d edition. A. P. H. A., 1921. 24 pp.

[2] Frost, W. D. Improved Technic for the Micro or Little Plate Method of Counting Bacteria in Milk. Journal of Infectious Diseases, Vol. 28, No. 2, Feb., 1921.

powder medium[1] gave counts quite comparable to those made by the Frost method. This behavior indicated that the organisms which were causing the high counts required a greater amount of milk nutrients than were present in the standard medium. No attempt is made here to identify the organisms or to give cultural characteristics except those mentioned above.

Owing to the fact that the organism or organisms did not grow well on plain agar plates, the Frost method was used for all pasteurized samples in these experiments. Counts were made on the raw milk in only part of the work. When raw milk counts are given they have been made by the Breed direct microscopic method.[2] There was so little relation between the raw milk counts and those made on pasteurized milk that it was felt that little could be gained from raw milk counts.

The object of these experiments was to find some way of preventing the high counts in freshly pasteurized milk. When the experiments were started there was no thought of publishing records, consequently not so much detail was included in the record as might be desirable.

DETAILED OBSERVATIONS

The first experiment consisted in taking samples from a number of patrons at Plant A and pasteurizing them in a water bath at 144° F. for 30 minutes. The tubes were loosely packed in baskets and agitated occasionally. They were cooled at once and plated with the Frost technic within a short time. In the first experiment the pasteurization of the samples in test tubes was carried out in the country

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[1] S. Henry Ayers and Courtland S. Mudge. Milk Powder Medium for the Determination of Bacteria in Milk. Journal of Bacteriology, Vol. 5, No. 6, Nov., 1920.

[2] Robert S. Breed and James D. Brew. Counting Bacteria by Means of the Microscope. Technical Bulletin No. 49, New York Agricultural Experiment Station. Feb., 1916.

plant and the plates made at once. The results are given in Table I.

TABLE I

SAMPLES OF MILK FROM INDIVIDUAL PATRONS, PASTEURIZED IN TEST TUBES AT 144° F. FOR 30 MINUTES

Patron's Number	Raw milk. Counts of groups by Breed method Per c.c.	Pasteurized milk. No. of colonies by Frost method Per c.c.	Percentage reductions
8	1,000,000	5,000	99.50
12	660,000	31,000	95.30
18	9,000,000	1,450,000	83.88
21	7,380,000	1,620,000	78.05
27	1,440,000	8,000	99.45
36	1,200,000	6,000	99.50
37	17,000,000	15,000	99.91
40	1,740,000	6,500	99.56
42	9,300,000	1,050,000	88.71
43	5,400,000	149,000	97.20
53	2,940,000	15,000	98.51
68	1,620,000	4,000	99.74
69	8,760,000	249,000	98.30
74	5,100,000	6,000	99.88
75	5,820,000	7,000	99.94
84	2,160,000	6,000	99.72
85	3,360,000	3,000	99.91
89	360,000	1,500	99.58
91	3,540,000	237,000	93.30
92	4,860,000	280,000	94.23
93	5,580,000	490,000	91.05
99	240,000	4,000	98.33
102	2,460,000	253,000	89.71
103	420,000	2,300	99.45

A study of Table I will show that the counts on the raw milk samples varied from 240,000 per c.c. to 17,000,000 per c.c. and on the pasteurized samples from 1,500 per c.c. to 1,620,000 per c.c., with variations in the percentage reduction from 78.05 to 99.94 per cent. All of these samples received the same treatment, that is, they were subjected to the same temperature for the same length of time. It is usually expected that better percentage reductions will be secured when high count milk is pasteurized than when milk having a low count is pasteurized, but in these tests such is not uniformly the case. Sample No. 37, for instance, shows 99.91 per cent of the bacteria killed, and Sample No. 89 shows 99.58 per cent killed. In both of these cases there is an excellent percentage reduction, although one sample contained millions of bacteria and the other a few hundred thousand per c.c. In Sample No. 12, with a count of 660,000 per c.c., there was a poor reduction in count. Samples Nos. 18, 21 and 42, containing millions of bacteria per c.c., also showed a very poor reduction. Such variations in the effectiveness of pasteurization as are shown in this table are hard to explain if the types of bacteria present in the samples were similar.

TABLE II

SAMPLES OF MILK FROM INDIVIDUAL PATRONS, PASTEURIZED IN TEST TUBES AT 145° F. FOR 30 MINUTES

Patron's Number	Raw milk. Counts of groups by Breed method	Pasteurized milk. No. of colonies by Frost method	Percentage reductions
	Per c.c.	Per c.c.	
8	1,980,000	......	....
12	1,380,000	1,500	99.89
18	8,760,000	105,000	98.80
21	12,060,000	680,000	94.36
27	2,580,000	3,500	99.76
36	32,700,000	5,000	99.95
37	3,360,000	53,000	98.20
40	840,000	500	99.92
42	7,680,000	464,000	93.95
43	14,700,000	340,000	97.76
53	6,240,000	770,000	87.76
68	4,020,000	13,000	99.67
69	10,740,000	492,000	96.16
74	12,060,000	184,000	98.47
75	9,960,000	38,000	99.61
84	19,740,000	11,000	99.94
85	9,180,000	3,500	99.95
89	600,000	500	99.91
91	2,760,000	48,000	98.26
92	6,420,000	260,000	95.95
93	3,000,000	505,000	83.16
99	720,000	1,500	98.46
102	8,820,000	45,000	99.48
103	1,860,000	15,000	98.70

In Table No. II counts are given on samples from the same dairies as those in Table No. I. These samples were taken several days after those in Table No. I and were sent to the laboratory where they were tested before and after pasteurization. The temperature of pasteurization was 145° F. and the time of holding 30 minutes. These samples received the same treatment as those in Table No. I except that the temperature of pasteurization was 145° F. instead of 144° F., and the work was done in the laboratory instead of the country plant.

The results given in Table No. II are very nearly the same as those in Table No. I. In the majority of cases the same patron's milk has a high count after pasteurization in both tables. The counts on the milk of the majority of the patrons are lower in Table No. II than in Table No. I. This is as would be expected, since the temperature of pasteurization is one degree higher.

In Table No. I there are 9 samples which show a count of more than 50,000 per c.c. after pasteurization, and in Table No. II there are 10 samples with counts above 50,000 per c.c. In both tables the counts above 50,000 per c.c. occur on samples from the same dairies except that Dairies Nos. 37, 53 and 74 are above that figure only in Table No. II and Dairies Nos. 91 and 102 are above only in Table No. I.

TABLE III

PLANT B. SAMPLES OF RAW MILK FROM THE CLARIFIER AND OF THE SAME MILK AS IT CAME FROM THE HOLDER

No. of sample	Raw milk. Counts of individuals by Breed method	Pasteurized milk. No. of colonies by Frost method
	Per c.c.	Per c.c.
1	1,038,000	19,000
2	894,000	81,000
3	6,600,000	43,000
4	2,040,000	16,000
5	5,520,000	30,000
6	10,560,000	11,000
7	5,040,000	45,000
8	5,700,000	42,000
9	3,720,000	28,000
10	2,340,000	29,000
11	7,440,000	21,000
12	6,030,000	13,000
13	14,340,000	16,000
14	11,040,000	15,000
15	8,340,000	14,000
16	9,300,000	16,000
17	15,000,000	1,264,000
18	14,760,000	2,976,000
19	10,560,000	1,550,000
20	7,860,000	2,112,000
21	....	1,488,000
22	.. ....	1,440,000

In Table No. III the results are given of a series of samples taken from the mixed raw and pasteurized milk at Plant B. These samples were taken at ten minute intervals as the milk was entering the clarifier, and samples of the same milk were taken as it left the holder. At the beginning of the run the temperature of heating was somewhat irregular but was soon uniform and remained so for the rest of the run.

Beginning with Sample No. 2 a sample was taken from each compartment during the first round of the Willman holder; so the first 8 samples were taken less than ten minutes apart. The counts are quite uniformly low as far as Sample No. 17, when there is an increase to over a million and then to nearly three million. The counts remained above a million during the rest of the run. There is no corresponding increase in the count on the raw milk. The raw milk counts are all higher than usual and represent the total number of individual bacteria seen by the Breed method.

Several other similar tests showed a similar increase in the count of the pasteurized milk in the second half of the run.

In Table No. IV the results are given of tests made on the milk as it entered the holder and at five-minute intervals until the end of the holding period. The temperature is also given at the time each sample was taken. The first series was held at the lowest temperature and also showed the lowest count. The second series was held at a little higher temperature and showed higher counts. The third series was heated to 148° F. and came out of the holder at a temperature of 146° F. and with a count of 134,000 per c.c. The fourth series shows a little reduction during the holding and the fifth series a greater reduction, but only in the first series is the reduction as great as it should be. This series of samples was started near the middle

TABLE IV

SAMPLES OF MILK AS THEY ENTERED THE HOLDER AND AT FIVE-MINUTE INTERVALS THROUGHOUT THE HOLDING PERIOD. ALL COUNTS ARE BY THE FROST METHOD

	Series I Held from 9.20–9.50		Series II Held from 9.50–10.20		Series III Held from 10.25–10.55		Series IV Held from 10.55–11.25		Series V Held from 11.00–11.30	
Milk	*Temp.*	*Count per c.c.*	*Temp.*	*Count per c.c.*	*Temp.*	*Count per c.c.*	*Temp.*	*Count per c.c.*	*Temp.*	*Count per c.c.*
Heated . . .	143°	43,000	143°	360,000	148°	126,000	142°	142,000	144°	185,000
Held 5 min...	143	20,000	143	299,000	148	194,000	143	97,000	144	101,000
Held 10 min...	143	.....	144	250,000	148	144,000	143	134,000	144	113,000
Held 15 min...	143	14,000	144	283,000	147	138,000	143	103,000	144	127,000
Held 20 min...	143	18,000	144	215,000	147	131,000	143	116,000	144	96,000
Held 25 min...	143	12,000	143	267,000	146	133,000	143	114,000	144	100,000
Held 30 min...	143	5,000	144	274,000	146	134,000	143	106,000	144	86,000

of the day's run so the increase in count occurs at approximately the same time as was noted in other tests.

CONCLUSIONS

All the counts given in the preceding tables and many more not recorded here indicate that there are marked differences in the bacterial flora of the milk as it is delivered at pasteurizing plants, and the presence of certain heat resisting types of bacteria in some of the milk is strongly suggested by the data.

A large number of samples were taken from the milk of individual farmers. The samples were pasteurized in test tubes at 145° F. for 30 minutes and counts made on Frost plates. A number of such samples from each plant gave high counts on the pasteurized milk. In tracing the cause of these high counts it was found that improperly handled utensils (including milking machines) were being used. In most of the cases the milking machines were at fault. At Plant B two farmers were found to be bringing in milk which still had a high count after the pasteurization of samples of milk from these farms. On both farms improperly handled milking machines were found. These conditions were corrected and the regular daily laboratory counts on milk from the plant dropped to a few thousand at once. A series of counts such as are reported in Table No. III showed low counts all through the run. A similar result was secured at Plant C, where two improperly handled milking machines and one dairy with milk pails and strainers poorly cared for were found to be the cause of the high counts.

At Plant A, where about fifty milking machines were in use among 103 dairies, 19 samples gave high counts after pasteurization. Of these, five were the same dairies which gave high counts as recorded in Table No. I. The other dairies showing the high counts as recorded in Table No. I are low in this series. The remainder of the 19 high counts were from dairies which were not tested when the records given in Table No. I were made. An attempt to get lower counts at Plant A by instructions regarding the care of the milking machines was not as successful as at Plants B and C, probably on account of the difficulty of reaching and influencing a larger number of dairymen.

The tests made during this investigation appear to indicate that milking machines and other utensils may be seeded with organisms which are not killed at ordinary pasteurization temperatures. It is also quite possible that poorly handled equipment in the milk plants may become seeded with organisms similar to those found in the farmers' utensils. Since these organisms grow poorly or not at all on standard plates it is quite probable that they are more generally distributed than appears at present. They may not be of much significance so far as their effect on the milk is concerned, but their elimination from a milk supply is certainly a desirable accomplishment. If further work shows more conclusively that they are the usual accompaniment of neglected utensils, it will be a simple matter to find the farmers who are not careful enough in handling their utensils. The Frost little plate method and Ayers' milk powder medium can both be used in combination with the standard plates to detect the presence of these heat resistant bacteria.

The great difference in counts secured by various agar plating methods naturally again raises the question of the accuracy of the counts as obtained by the present standard method. The standard method is not intended to give the total number of bacteria in milk, but rather to serve as an index of comparison for the guidance of those who use it. However, since the high counts secured by the Frost method and from Ayers' medium are mostly due to organisms which withstand pasteurization and which are probably harmless to health, it may be that for practical purposes the standard count is more useful. Certainly more work should be done before any changes are made in the present standard methods. If the Frost method or Ayers' medium is accepted as standard, the present work indicates that there should be a modification of present bacterial count standards for pasteurized milk at the same time.

Since this paper was written a greater number of high counts have been cropping out on the standard plates. The variations occur on media made from the same materials. It is possible that variations in the media which are beyond our control are responsible for the variation in counts. Follow up work on high counts found by the standard method shows the same source of trouble as noted when the Frost method was used, namely, utensils which are poorly cared for, of which the milking machine is the most common offender.

DISCUSSION

Mr. Geo. B. Taylor, Washington, D. C.: Have you differentiated between those small colonies which are least resistant and those which grow enormously at pasteurizing temperatures?

Mr. Dotterrer: No.

Mr. Taylor: We have experienced a type which grows enormously at pasteurizing temperatures. We do not detect these with standard agar.

"Progress is ahead of public record."

THE RELATIONSHIP BETWEEN DAIRY AND PATHOGENIC STREPTOCOCCI:

A FURTHER ARGUMENT FOR PASTEURIZATION

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When milk-borne streptococcus infections are discussed it is generally *Streptococcus hemolyticus* which is under consideration, the streptococcus which causes mastitis in cattle, and a variety of diseases in man (including epidemic sore throat, certain outbreaks of which have been definitely traced to milk as the disseminator).

In this discussion another kind of pathogenic streptococcus will be considered—the type commonly called *Streptococcus viridans,* the specific name *viridans* coming from the property of this organism of producing a greenish discoloration in any medium containing red blood cells. A better approved name is the "alpha type" of streptococcus but in this discussion it will be called by its convenient name *viridans.*

Streptococcus viridans infections are commonly chronic, often secondary, following some more acute infection. The organisms are found quite constantly in cases of measles and "German measles," and although they are generally believed to be secondary invaders they are considered by some investigators to be primarily responsible for those diseases. During the war *Streptococcus viridans* infections increased in number and severity; whether it was because abnormal living conditions lowered the general resistance of the populace to the infections or whether the bringing together of the people from out-of-the-way communities permitted an increase in the virulence of the organisms by rapid passage from one highly susceptible person to another, or whatever else may have been the cause we do not know; we know only the result, namely, that *Streptococcus viridans* was associated with serious epidemic infections during the war; particularly it was responsible for many of the cases of pneumonia following influenza.

This brief outline of the pathogenic properties of *Streptococcus viridans* suggests that it should not be ignored even though the more virulent pathogenicity of *Streptococcus hemolyticus* naturally directs attention to that species when disease-producing streptococci in dairy products are under consideration.

There is one fact regarding *Streptococcus viridans* which renders it an organism of peculiar biological interest. The pathogenic strains are so nearly like certain beneficial streptococci which are necessary for the production of desirable flavors in ripening dairy products that with the bacteriological methods which have been applied thus far no distinctions have been found which can differentiate the beneficial from the pathogenic strains.

When considered from the point of view of a dairy microorganism useful in the production of flavors in ripening cheese the most important characteristic of the streptococcus we are considering is its property of breaking down carbohydrates into simple compounds with a considerable percentage of volatile acids among the by-products. In this it differs from the familiar *Streptococcus lacticus* which produces the lactic acid so essential in the manufacture of dairy products. As you all know, the *Streptococcus lacticus* develops rapidly in milk and cream, breaking down the milk sugar into the lactic acid which is necessary in the manufacture of butter and cheese. During the first few days of storage the *Streptococcus lacticus* completes its chief work of acid production, and, having exhausted the supply of milk sugar, it gradually dies out. Simultaneously with the disappearance of *Streptococcus lacticus* those cheese ripening organisms which are responsible for the delicate flavors of well-ripened cheese increase in numbers. There are several species of these flavor-producing organisms, and one of them which is always present in every variety of cheese, so far as I know, is this streptococcus which is indistinguishable from the pathogenic *Streptococcus viridans*. The characteristic by-products of its metabolism are volatile acids, particularly acetic acid. The volatile acids unite with other substances in the cheese to form various kinds of alcohols and esters, compounds characterized by their pleasant flavors and odors. By these and other changes the cheese which had only a sour taste during the first few days of storage becomes a palatable food.

It matters not whether a strain of *Streptococcus viridans* is isolated from ripening cheese or from a pathological exudate, its physiological requirements for growth are the same. Strains from both sources consume the same kinds of food substances; their growth is suppressed by the same degree of accumulating acidity; they are equally independent of atmospheric oxygen; and, most important, the strains from pathogenic sources can multiply at low temperatures as well as the dairy streptococci. It was of great interest, and rather surprising also, to find, when experimental animals were injected with dairy streptococci, that immune bodies appeared in the blood serum similar in nature and similar in quantities to the immune bodies produced by treating animals with the pathogenic streptococci.

All the above facts lead to the practical query whether the pathogenic *Streptococcus viridans* may not multiply in dairy products. Rosenow of the Mayo Clinic has published some evidence that certain epidemics due to pathogenic *Streptococcus viridans* were spread by dairy products. The evidence is not as yet sufficient to justify conclusions. There is no definite proof that dairy products are responsible for the spread of this pathogenic streptococcus, but, so far as available information goes, no reason can be adduced why this disease-producing organism could not live and multiply under any conditions suitable for the multiplication of dairy streptococci.

The reasons why milk should be pasteurized are multiple and urgent, and the necessities for this precaution for the conservation of public health were long ago recognized. In comparison with established facts the somewhat theoretical added argument for pasteurization here presented, namely, the prevention of possible spread of *Streptococcus viridans* infections, cannot fall with great force on an audience already convinced of the benefits of pasteurization.

There are, however, steps forward which are yet to be taken. Pasteurization of milk for cheese making is still in the experimental stage, although there is no doubt about the economic saving that would result if the bacteria which cause spoilage of dairy products could be destroyed. The difficulty lies largely in our ignorance of what kind of bacteria should make up the "starters" to replace those organisms necessary for cheese ripening which are destroyed together with the deleterious forms. Very likely the practical difficulties will be solved, and pasteurization of milk for cheese making will come into general practice some time in the future.

Health authorities have not interested themselves very much in the pasteurization of milk which is to be used in the manufacture of dairy products, for the reason that most pathogenic bacteria are too delicate to withstand the conditions which obtain during the manufacture and storage. Attention has been directed mainly to the tubercle bacillus, which is the hardiest of the pathogenic organisms known to infect milk.

The facts presented in this paper indicate that the pasteurization of milk for the manufacture of dairy products may, on account of the *Streptococcus viridans,* be of interest to those concerned with the conservation of health, as well as to those who are working for industrial progress.

"Pasteurization has passed the pioneering stage. It is everywhere accepted as the practical and economical method for safeguarding, and at the same time conserving, milk supplies."

A COMPREHENSIVE SYSTEM OF DAIRY INSPECTION

DR. J. J. FREY, *Superintendent of Dairy Service,* State Department of Agriculture, Sacramento, Cal.

Dairy inspection, though long established, has been passing through a long period of evolution and, like many other human endeavors, there has been much lost motion in the upward struggle. It has been characterized by inconsistency, "hit and miss" methods, poorly directed endeavor and often guided by prejudicial opinion rather than well founded principles of science. In spite of this a real need has kept it in public favor, and much good has been accomplished.

If we profit by the errors of the past the efforts of our predecessors will not have been in vain. Dairy inspection is generally recognized and accepted as a fundamental necessity, not alone for the protection of public health, but also for the commercial success of the industry. Eventually funds will be available to more adequately conduct regulatory work and sufficient salaries be paid regular inspectors to justify preparation for this position as a life work.

The need for well directed dairy inspection arises from the fact that milk and its products constitute the most necessary and most perishable food of mankind. The spread of epidemics through the milk supply, the attacks of indigestion resulting from spoiled dairy products have often been discussed and are too well known to require further discussion. In fact, this feature has been stressed so much that in the minds of all too many people milk is associated with germs and bugs and filth of all kinds and dairies with manure piles. This attitude may be in part responsible for the undernourished condition of so large a percentage of children, which is generally admitted to be the cause of more ill health, susceptibility to infectious disease and premature loss of life and human inefficiency than all the milk-borne epidemics of which we have record. Our task now is to bring the milk supply to a state of perfect wholesomeness and to urge its more liberal use as a means of body nourishment and of strengthening the resistance of the body against attack by disease.

The appreciation of the public for dairy inspection which actually improves the quality of dairy products is manifest by increased per capita consumption and a greater demand for the several products.

Dr. M. E. McDonald, Market Milk Specialist in the Dairy Service of the California Department of Agriculture, says:

"There is a very definite relationship between the amount of milk consumed and the quality of the product. The public is being taught that milk is a perfect food but the fullest effect of milk publicity can only be felt when the highest quality of the product is maintained. There are twenty-three approved milk inspecting departments, ranging from single cities and groups of cities to an entire county, where milk is graded. Information obtained from the local health units over the State gives an average per capita consumption of one pint a day for graded milk in contrast to three-fourths of a pint a day for ungraded milk."

Commissaries in the Northwest lumber camps have found it economical to buy only the finest butter, since by its use enough more bread, which is the cheapest food, is eaten to more than offset the increased cost of the better butter, thereby lessening the total cost of feeding the men. In addition the men feel better fed, are more satisfied and are better workmen.

Reports from the dairy officials of ten states in the East, Middle West and West indicate that some kind of inspection of market milk is in effect in all of the larger cities: seven of the ten states afford some kind of inspection to all of the small cities and towns; three give some attention to some of them; all of the states give some inspection to all of the milk products plants of the state, but only two give inspection to all the dairies producing and sending products to these plants; five make some effort in this directon, but in most cases it is very incomplete, and three make no effort whatever at conducting such inspections.

Apparently a fairly complete, though disconnected, supervision of market milk dairies is in effect throughout the country, but very incomplete supervision of the production of milk and cream for manufacturing purposes exists, and in parts of the country almost none. This does not mean that inspection of market milk has been overemphasized, for it is the most perishable of dairy products; rather it means that the production of milk and cream for butter, ice cream, cheese making and for condensing has been underemphasized. The inspection of market milk needs to be strengthened and coordinated. The inspection of milk and cream for manufacturing needs to be greatly extended and all of it apparently needs to be systematized.

The requisites of an inspection system are, first, a good law; second, competent enforcing agencies; and third, sufficient funds.

A good law should include only essential, reasonable and justifiable requirements and must be as complete as necessity requires, yet flexible enough to meet changing conditions without an act by the legislature. Rules and regulations should be provided, not to establish precepts but to fill in details which cannot always be anticipated, and prescribe ways and means for the accomplishment of the purposes of the act. Just how far the courts will go in upholding the constitutionality of regulations is difficult to say and depends largely upon the merits and evidence in each individual case. Usually, however, a way of securing observance of just regulations may be found without recourse to the courts.

A good law should also be orderly and systematic. Each subject should be treated completely as a unit so that all requirements concerning a given point may be found at one place. It should be written clearly in simple language so it may be read and understood by those expected to obey it. The most effective weapon in the hands of an inspecting department is authority to suspend the sale of products from a dairy or plant and this authority should be included in the act.

An enforcing agency willing and capable of enforcing the law is more important than the character of the law. Poor, cumbersome ordinances, thought to be good, have been copied because the city where they were in force had the reputation of a good milk supply. The credit in these cases will usually be found to be due to the earnest, intelligent efforts of the inspection service.

The enforcing agency may be a unit of federal, state, county or municipal government. The greatest correlation of these units is desirable. The fewer policies in operation, the greater is the efficiency and satisfaction which will result. It would be well if all agencies were responsible directly, or indirectly, to a bureau of the United States Department of Agriculture, but under our form of government the state is sovereign and supreme in regulatory matters within its borders and federal regulation generally extends only to interstate movements.

The next best arrangement is, therefore, to have all inspection agencies within each state responsible to the state office, with cooperation between the state offices facilitated and correlated by advisory agents of the United States Department of Agriculture.

Funds sufficient to maintain a well trained corps of inspectors large enough to completely carry out the work must be provided and are a source of concern to every inspecting department. In some cases the amount is so meager it has been disheartening to those affected. At least three sources of funds are possible, *i. e.*, appropriations, license fees, and donations. Of the three, license fees are most dependable and generally provide for the work most liberally. If inspection is worth while, it should pay its own way. While there may be resistance to the establishment of license fees where appropriations have heretofore been made from the general funds, every person who feels the responsibility of properly financing an inspecting department would do well to work toward a fee basis for support. Sometimes special matters outside the regular routine require sums of money which are not available. Under these circumstances there are frequently those who are willing to donate a sufficient amount to carry on the work. Provision should be made in the law for acceptance of such funds for legitimate purposes and expenditure by the enforcing agency.

The scope of dairy inspection should not be limited to any product or class of products. An adequate system should comprehend the regulation of the composition and wholesomeness of milk and all of its products, their labeling, advertising and sale and the regulation and sale of their substitutes.

There are two general classes, based on the method of distribution, into which dairy products may be divided for convenience in inspection. The first includes market milk (that sold in its natural fluid state) and market cream, which in general are produced locally or within a limited radius and sold locally within a few days after production. Inspection of this class should be financed by local funds. The second class, comprising butter, cheese, evaporated milk, etc., which enter extensively into inter-city, intercounty, inter-state and international commerce, therefore comes under the direct supervision of a larger political unit.

The success of any organization depends upon its personnel; therefore too much care cannot be taken in the selection of the men who are to meet the dairyman, his lawyer, landlord and bankers; the health officers and public health nurses; the welfare organization leaders; the district attorneys and judges of the courts. Inspectors are not completely trained in schools, although such training is desirable; some may be born, but most have to be trained in the work, and like a colt or an automobile may be ruined in "breaking" them.

One inspector for a thousand dairies producing milk or cream for manufacturing is about all that can be expected. In this case the inspector must use his time judiciously and it will be found that after requirements are understood by the dairymen, most of the number need to be visited only at rare intervals and then only to keep up acquaintance and familiarize the dairyman with the progress and benefits of the work, in cultivating his friendship and enlisting his friendly and sympathetic cooperation. The most of the inspector's time may be advantageously spent on receiving platforms observing the condition of products as they arrive at the plant and visiting with necessary frequency those who need inspection most, as shown by examination of the products. The cooperation of plant managers in supplying confidential information relative to the source of poor products is most helpful.

A senior inspector whose ability is proven and who has the respect of the men is necessary to correlate the work in the field, visiting the men by turns in order to promote uniform and efficient work.

The foregoing, with any additional special employees for special work and a trained and capable corps of laboratory workers sufficient to carry on the work, constitutes the necessary organization for supervision of manufactured products and raw materials which enter into them.

A market milk specialist and such assistants as are necessary to organize and supervise local inspecting departments and approve them for some system of grading, when the work merits it, constitute a second unit of the organization. Official milk scoring at intervals of a few months is an excellent index to the class of work accomplished by local departments.

The method of organizing local departments is an important consideration. Those who go direct to city trustees with their proposal rarely ever succeed. They are usually told that it is a good thing but there are no funds to provide for it. The wise organizer will begin with the health officer, where such matters should properly begin. If his interest is aroused, with his assistance quietly enlist the interest and support of the welfare organizations, Parent-Teachers' Associations, Red Cross, Civic Leagues, Chambers of Commerce, lodges and women's clubs, as well as newspapers. Then go to the dairymen, the better ones first. Show them what inspection means to them; bigger volume, less overhead; better prices, more profits; less complaint and fair competition. Get them to wanting inspection so much that they will accept a license fee equivalent to one-half cent a quart or less. When you have some of the dairymen and the public demanding inspection, the other dairymen dare not oppose it. Then send a committee of two or three to informally interview each city councilman or trustee individually; select a special committee for each man, choosing a person in each case who is close enough to the official to assure a sympathetic hearing and one who is capable of expounding the real benefits and desirability of inspection. When a majority of the local legislative body have committed themselves to one or more responsible citizens the time is ripe to go before the board in public assemblage. Have your dairymen present to announce their willingness to accept the fee and the outcome is a foregone conclusion. Such a procedure is not idle speculation. It has operated effectively wherever it has been tried, but of necessity requires some time and effort.

A model ordinance, simple, brief and adaptable to local conditions, will nearly always be appreciated and acceptable to local authorities. Thus uniformity in city regulations is facilitated.

Sufficient clerical help to conduct the office work incident to the activities of a corps of inspectors and local inspecting departments and a general supervisor to plan and administer all of the work and maintain relations with the industry complete the personnel of a department or bureau formed for the effective administration of a comprehensive dairy law.

It is advisable for the personnel of those inspecting departments which are too small to render effective service to devote their energy to the enlargement of the staff, rather than to continue indefinitely with an inadequate program of enforcement which engenders contempt for law and loses the confidence and support of those who might otherwise be enthusiastic supporters of inspection service.

The general policy of any inspecting department should be to completely and rigidly enforce the law as it is written. The enforcement of an unjust law is the surest means of securing its repeal. It may be legitimate to postpone action on a manifestly unfair or unnecessary requirement of law which the legislative body has had opportunity to repeal, but in such a case it should be known to everyone affected by it. If the law is a good one it will state what is meant in definite terms. Those who obey it voluntarily pay a premium in doing so, if their competitors are not compelled to abide by its requirements. Lax enforcement has a tendency to force honest men out of the business or break their principles and encourage the unscrupulous. New requirements must be enforced gradually but equally on all parties concerned. This is as much for the protection of the inspecting department as for individuals, for seldom is a prosecution made that discrimination is not charged in defence. Such charges cannot stand if the inspectors have been impartial. Dairymen should be given ample warning in most instances regarding all requirements and courteous assistance extended to help them comply before taking action against them. Unusual insanitary conditions which constitute an immediate menace, or flagrant adulteration which anyone knows should not be practised, are exceptions which justify immediate and positive action by inspectors. Suspension of the sale of products is usually more effective than court action. It secures more prompt compliances, less bitterness, less unfavorable publicity and is more permanent and positive in its moral effect.

The project method of inspection in giving emphasis to a special phase of the work within a given time in order to take up laxness in some particular is good if it does not become spasmodic. Once slack has been taken up, it must not be allowed to become slack again, and work which cannot be kept up should not be undertaken.

The methodical visitation of dairies and routine scoring with a score card ill adapted to conditions and with an improper distribution of points may do more harm than good and certainly does little good. The best inspector must keep the idea of high quality products paramount in his mind and give particular attention to those things which have a direct and appreciable effect on quality.

The use of a score card in conducting the inspection of the dairy farms is an advantage in some respects, especially in the hands of inexperienced men. It calls attention to all details, serves as a permanent record of conditions, and on some dairymen who pride themselves on a high score its use may exert a beneficial effect. It must be used, however, with a definite purpose in mind, and this purpose, as for all inspection work, is to improve the quality of the product. The score card should therefore allow proper weights to the various points on the card according to their effect on the product. This may vary in different dairy sections and it is therefore possible that some variations in score cards is permissible. This, however, is getting away from the idea of uniformity, which is so desirable. Certainly our present score card is susceptible of very great improvement on the basis of the fundamental idea underlying all inspection work as outlined above and in the light of more generally understood scientific facts regarding the principal factors affecting quality in dairy products.

The publication of bacteria counts in milk, by inspection units, while it is designed to accomplish and does accomplish a useful purpose, is objectionable because the significance of the bacterial count is not understood by the general public.

All that is accomplished by the publication of bacteria counts may be accomplished by publication of ratings on dairies which may be based mainly on a series of bacterial counts, in each case, and at the same time give consideration to other factors which make milk a desirable food.

All of the things entitled to consideration in a discussion of any system of dairy inspection cannot be included within the scope of a single paper, therefore no attempt has been made beyond the brief mention of those things which are important and are also neglected or abused by present methods in many places.

Summarizing, the purpose of dairy inspection contemplates the protection of public health and the stabilization and promotion of the industry through the maintenance of uniform high standards of quality for all dairy products. The scope of dairy inspection, therefore, needs to be broadened to include more complete supervision of the manufactured products of milk and particularly the production of milk and cream for manufacture; and the present disunited and incoherent inspection practices need to be correlated into a definite system of supervision under the direction of the state government, since this is the largest political unit having regulatory powers with the several states. The work of state departments should be assisted and directed by federal officers to such extent as is permissible under the constitution. The requisites of such a system are (1) A good law, complete but flexible, simple, understandable, logical, systematic, and enforceable; (2) Enforcement by a capable enforcing agency with funds derived from appropriations, license fees or donations, sufficient in the aggregate to maintain an effective organization.

The organization should be adapted to the needs, with provision for supervision of the market milk by local units under the general supervision of a market milk specialist and his assistants—sufficient trained men to directly supervise the production and manufacture of those products which are the subject of inter-city traffic and adequate laboratory and clerical staff, with the whole organization under the direction of a general supervisor who keeps in contact with the needs of the industry and the consuming public by advisors representing organized bodies within each group. All requirements and methods must be fair, based on well established scientific facts and justified by the real needs of the industry and the public.

The success of such a system may be judged by the actual measurable improvement in the dairy products, the appreciation of the public as shown by increased per capita consumption, better prices and fewer complaints; and the enthusiastic support of the inspection service by the industry.

"The originality of a subject is in its treatment."

A CLEAN MILK SUPPLY FOR A SMALL TOWN

Miss Sarah H. Vance

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The problem of a clean milk supply for small towns is one which it is essential that the State health officials solve for the towns. I do not mean that the State inspection service should shoulder the responsibility in its entirety, but the small town is very often not awake to the fact of danger to the community. With the growing interest in child hygiene in the country and the establishment of this needed work in the rural communities, the time appears proper for the introduction in the small town of some form of local supervision of the milk supply.

In times past, towns have passed ordinances governing the milk sold in the town and then have forgotten about the supply and the ordinance. I have come across several of these ordinances, some of them passed in 1906 or thereabouts, and a few, more recently. Yet in the very towns having these ordinances, no attempt has been made to enforce them in any manner. Often no person or organization has been designated as responsible and again the enforcement is placed in the hands of the health officer who, a practicing physician, is paid the munificent salary of perhaps $100 a year to shoulder the responsibilities of the health of the community. Our vital statistics show that the towns of this type get no more health work or disease prevention than they pay for.

I am going to use as examples in milk control work the experiences of several of the small towns in Kentucky. The results and statistics are undoubtedly the same as those of other small towns of their size in other parts of the United States.

The surveys made in the towns mentioned were made by an inspector of the State Board of Health. The United States Department of Agriculture dairy score card was used in scoring the dairies.

In the surveys it was impossible to visit every single farm or home from which small quantities of milk were sold and only the dairies of fair size supplying the greater part of the milk in the town were inspected. In most cases, the production of milk in the dairies inspected was not the major work of the farm and it was only a side issue with the farmer. Samples of milk as sold to the consumer from each dairy or depot were collected and shipped in iced containers to the State Laboratories. Analyses in the cases of the surveys mentioned here were made within four to six hours after collection of the samples, which reached the Laboratory at 0°C. The total bacterial count was made in accordance with the official A.P.H.A. procedure and the B. coli count was made on each sample by means of the Endo plate method, official in the State of Kentucky.

The town of Newport, with a population of about 30,000, was first brought to the attention of the State bureau as a milk supply problem when in 1920 a very vigorous complaint on the quality of pasteurized milk sold in this town was made by the medical officer in charge of an army hospital just outside of the town. Newport is situated in the midst of a dairy section of the State, from which comes a large supply of the milk for a large city in another State. There had been no systematic dairy inspection in this section for about 8 years except what was done spasmodically by the dairy inspectors of the large city, and they were naturally only concerned with the dairies shipping milk into their city. The town of Newport had a full time health officer who did not concern himself with the milk supply. The county had a part time health officer who was vitally interested but totally unable to make the necessary inspections. There was no ordinance in operation covering the sale of milk.

A rather brief survey of the dairies was made and some analyses of the milk as supplied to the pasteurization plants, of which there were two at the time, were made at the government hospital by a State inspector. Besides the pasteurizing plants, there were a number of hill side, "barn fed" dairies which sold varying amounts of raw bottled milk in the town. The average total score of the dairies scored on the United States Department of Agriculture score card was 58, and of the dairies inspected, 8 were above this score. The average bacterial count of the milk as delivered to the plants was over 3,000,000. No counts were made on the raw milk sold but conditions at the farms indicated that the sanitary condition of the milk left much to be desired. The tuberculin testing of the herds of the county had just been begun by the State Veterinarian's Office and the Extension Division of the State University had established a man in the county for the formation of cow testing and feeding clubs. Such were the conditions surrounding the milk supply of Newport in 1920.

During the summer of that year, with a small appropriation from the State department and a donation from a milk dealers' association in the large city mentioned before, a dairy inspector was employed and proper laboratory equipment provided. The attitude of the dairymen was antagonistic, as they felt the association in the city was trying to boss them. Very little was accomplished in six months except to show the community the need of this inspection.

Beginning in 1921, the county, the town of Newport and the neighboring town of Fort Thomas made a joint appropriation of $3,000.00 for a year to pay the salary of the inspector, his automobile expenses and laboratory equipment.

The work progressed slowly in 1921, and in 1922, when a new inspector was employed, the results began to show. In the town of Newport an ordinance requiring pasteurization of all milk, except certified, and prohibiting the sale of any milk with B. coli or a bacterial count above 70,000 per c.c. was passed in the early part of 1922 and is being enforced as far as is possible today. The results of the surveys made by the State inspector during this time will give some idea of what was accomplished by an expenditure of $3,000.00 per year by the two towns and the county. The figures for the number of deaths from infantile diarrhea are particularly interesting, as they show the immediate effect of the strict supervision of the milk supply during 1922. The cause for a sudden rise in 1923 is the polluted public water supply which caused during January, February and March an epidemic of typhoid fever and is not, I believe, traceable entirely to the milk supply. The inspection of the milk supply of this county and the two towns is under the supervision of the milk commission of the county which is composed of the county health officer and the health officers of the two towns. The inspector makes his report direct to the commission, which meets each month and which has absolute control over the appropriation mentioned and the enforcement of the town ordinance and the State health laws. The arrangement is very satisfactory and the State bureau acts only in an advisory capacity in the case of trouble.

Though the milk is not perfect, the improvement in the physical conditions of the dairies is very marked. The dairymen are all very interested in the work of inspection and at the last meeting of the county fiscal court when the question of continuing the appropriation came up, it was the dairymen who urged the continuance of the inspection. It is a little too large a job for one man, but as has been demonstrated many times in dairy inspection work, the personality of the inspector is of equal or greater value than his actual technical training. Newport has solved her milk problem by adequate laws, laboratory and field inspection, and with a somewhat larger appropriation will be able to show even greater improvement.

The second town, Frankfort, of about 10,000 population, is on the edge of the blue grass section in the hills of the Kentucky River.

There had been no systematic inspection of the dairies supplying this town, though samples were collected at irregular intervals by the local inspector. No follow up work was done.

The first survey in June, 1922, showed the average bacterial count of the milk as sold to be over 400,000 per c.c. with 75 per cent contaminated with B. coli, and only one-third of the dairies showing a score of over 60. The town had an obsolete and useless ordinance, a part time health officer, and an underpaid untrained inspector. The greater part of the milk supply was raw milk bottled at the farm, though there were also two small pasteurizing plants. A rather vigorous campaign was started by the State bureau. A public meeting or a legal hearing of all the dairymen was held by the State Director of the inspection and the essentials of the production of clean milk was discussed with them. The bacteriological count was explained and each dairyman was given the opportunity of asking questions and requesting advice in regard to his own dairy. All the dairymen were interested and the second survey made in August, 1922, showed the remarkable improvement made in the physical condition of the dairies and in the average bacteriological count of the milk. Even the percentage of samples contaminated with B. coli showed a decrease.

The local inspector was instructed to take milk samples once a month, but due to insufficient funds, these samples were not taken during the period between the August, 1922, inspection and the June, 1923, inspection. No inspections were made of the dairies by the local inspector or health officer during this period so far as I have been able to learn. In September, 1922, an ordinance governing the sale of milk and milk products sold in the city of Frankfort was passed. This ordinance required permits for the sale of milk and a score of 60 for each dairy before a permit was granted. It did not provide a bacteriological standard nor the means for inspection of the dairies. The health officer was designated as the person responsible for the enforcement of the ordinance.

The third survey of June, 1923, still shows the effects of the former inspections in the percentage of samples contaminated with B. coli, but the average bacterial count is nearly equal to that of the first survey though the per cent of samples under 100,000 per c.c. is a little higher than that of the June, 1922, survey. No inspections of the dairies were made in June, 1923. The figures for the infantile diarrheal deaths for these years and the seven months of 1923 give a fairly accurate picture contrasting with the figures for Newport for the same years. The results in Newport are permanent so long as the inspection keeps up, while those of Frankfort are temporary, if any. Frankfort has not solved the problem of her milk supply by passing a model ordinance.

The third town, Winchester, of about 8,000 population, is in what is known as the center of the blue grass district. In May of 1922, the town, at the instigation of the local health board, passed an ordinance governing the milk supply. This ordinance provided for a permit system, a grading of milk by bacteriological standards, and prohibited the sale of milk containing over 1,000,000 bacteria per c.c. The ordinance further provided for an inspector and for the bacteriological examination of the milk. Funds were not, however, appropriated for the transportation of the inspector to the dairies. The inspector and laboratory technician was employed in July, 1922, and the first analyses of the milk sold in Winchester were made in August, 1923. The first survey by the State inspector was made in September, 1922, and showed that though the average bacterial count was low, 145,000 per c.c., 67 per cent of the samples were contaminated with B. coli. Over two-thirds of the dairies were scored over 60 on the official score card. A meeting was held as in the Frankfort survey, though not for nearly sixty days after the inspection. Letters and direct orders were sent to all the dairymen by the State department explaining the requirements as well as the changes necessary in their own dairies.

Very soon after the meeting, a second survey in December, 1922, was made by the State inspector. Of course, we can expect seasonal improvement in a milk supply but the improvement as indicated in this survey cannot be traced entirely to cold weather. No dairy inspections were made in December. During the period between December, 1922, and June, 1923, the city technician made monthly examinations of the milk and informed the individual dairyman of his count by letter. No inspections of dairies were made and no instruction was given the individual dairyman.

The third State survey of June, 1923, showed a marked increase in the average bacterial count due, however, to two samples, because 80 per cent of the samples were still under 100,000 bacteria per c.c. The per cent of contamination with B. coli increased over that of the December survey. The ordinance was not being rigidly enforced. No inspection of dairies was made in June, 1923. In July, 1923, a second meeting of the dairymen was called with the city Board of Health and the question of clean milk was discussed at length. The dairymen were interested but asked to be shown the proper methods on their own farms.

In August, a fourth inspection and survey was made. The average count is not very high, though only 64 per cent of the samples were below 100,000 bacteria per c.c. Very curiously the scoring of the dairies fell below that of the previous September and is due, I believe, to the fact that no inspections were made during the year.

Winchester apparently has not completely solved the problem of a clean milk supply, and will not do so until regular inspection of the dairies is provided.

The fourth town, Shelbyville, of about 4,000 population, is located very close to the headquarters of the State inspection bureau and when the State dairy inspection was revived in June, 1922, after nearly six years, this town's milk supply was the first one surveyed. The average bacterial count was nearly 1,000,000 per c.c. Not a single sample was under 100,000 per c.c. and all samples were contaminated with B. coli. No one of the ten dairies made a score of above 60. The town had no health officer and no inspection service of any kind, except from a part time county health officer. There was no ordinance covering the sale of milk.

In July, 1922, a meeting or legal hearing was held with the dairymen of this town and the matter of their responsibility to the community, as well as to the State law, was thoroughly discussed. The State department undertook the responsibility of making as many inspections as possible during the coming year and also of collecting samples of milk for bacteriological analysis. No attempt was made to pass any ordinance to control the sale of milk as it was impossible to hope for funds from the town to finance the enforcement.

Five surveys were made during the year from June, 1922, to July, 1923. The improvement in the physical condition of the dairies was remarkable. The bacterial count showed remarkable improvement also, and the percentage of samples showing contamination with B. coli has shown improvement but not to the extent one would desire. Shelbyville has had her milk problem solved for her partially as long as the State inspection can continue regular inspection.

From these surveys, I believe that we can draw some very definite conclusions, which are only reiterating conclusions which have been drawn many times before.

The requirements for a small town planning to provide a clean milk supply are:

First, a trained and interested inspector, or if you prefer, dairy instructor, provided with proper and adequate means of transportation, who can interest the dairymen as well as the public in the production of a clean milk.

Second, an interested and fairly intelligent type of dairyman, who is willing to shoulder his responsibility to the community in producing a clean milk.

Third, facilities in the town itself for bacteriological and chemical control of the milk supply, and

Fourth, of the least importance, an ordinance or other legal instrument providing a permit system and standards and specifications for the production and sale of milk.

"Each person is responsible for all the good within the scope of his ability."

RELATION OF ACIDITY TO BUTTER-FAT CONTENT IN MILK AND CREAM

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L. V. TOWT, Nestlé's Food Company, Gonzales, Cal.

The data collected on the relation of acidity to butter-fat content in milk and cream resulted from receiving a communication from a commercial dairy plant laboratory which submitted the following statement:

"This company has established .11 acidity as the maximum for 40 per cent cream. With that as a basis, the acidity of any per cent cream might be calculated from a relation of the serums of the creams. Is there a direct relationship between the acidity and butter-fat content of cream of varying richness?"

To the best of our knowledge, there is no formula given in the literature that is in actual use. With a view to answering this question, the data presented in this paper have been collected.

Three gallon cans of fresh whole milk were tested for acidity and fat. Part of this milk was immediately run through a cream separator in which the cream screw was adjusted to give a very thin cream. Another portion was run through with the cream screw set for a slightly richer cream. This was repeated until samples of cream were obtained from the original milk which varied in test from 10 per cent to 56 per cent. These samples were immediately put on ice and tested for acidity and fat.

Determinations were made by the Mann test and repeated until duplicate tests did not vary more than .005 of 1 per cent. In this way the acidity of samples with different fat contents were noted. The fat contents varied inversely as the serum content, and a numerical relation was determined between the acidity and butter-fat content.

TABLE I

THE RELATION BETWEEN ACIDITY AND BUTTER-FAT CONTENT IN MILK AND CREAM

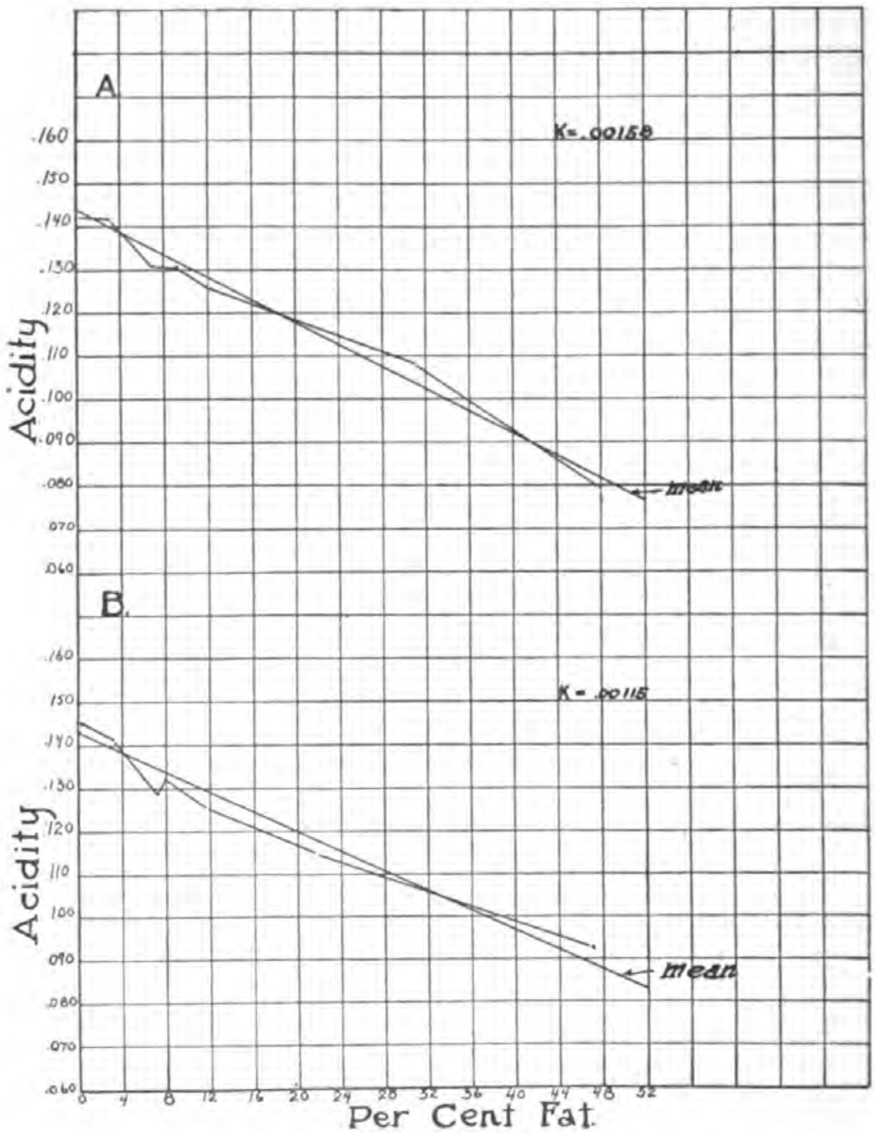
Experiment A

Sample No.	Per cent fat	c.c. sample	Sp. Gr.	Wt. sample	c.c. NaOh	Av. acidity
1	trace	9	1.036	9.32	1.5	.142
					1.5	
2	3.3	9	1.032	9.30	1.52	.1418
					1.50	
3	7.0	9	1.027	9.24	1.39	.1309
					1.38	
4	9.5	9	1.024	9.22	1.37	.1307
					1.39	
5	12.5	9	1.020	9.18	1.32	.1257
					1.32	
6	30.5	9	1.002	9.02	1.14	.1082
					1.10	
7	52	9	.9780	8.8	.80	.0793

Experiment B

Sample No.	Per cent fat	c.c. sample	Sp. Gr.	Wt. sample	c.c. NaOh	Av. acidity
1	trace	10	1.036	10.36	1.70	.1453
					1.75	
2	3.7	10	1.032	10.32	1.65	.1415
					1.70	
3	7.5	10	.1.028	10.28	1.51	.1289
					1.52	
4	8.0	10	1.028	10.28	1.55	.1323
					1.57	
5	12.0	10	1.021	10.21	1.49	.1254
					1.45	
6	22.0	10	1.011	10.11	1.32	.1148
					1.34	
7	47.0	10	.9832	9.83	1.00	.0924

The experiment as described was repeated several times and an example of the data gathered is shown on the following pages. In Figure I, the butter-fat as abscissa is



plotted against the acidity as ordinate. In experiments A and B, it will be seen that this graph approaches a straight line.

The preceding figure and tables show that there is not a direct proportion between the acidity and butter-fat content of milk and cream. In order to arrive at a definite ratio between acidity and the butter-fat content of milk and cream, the results shown in Table I were averaged, represented by the mean on the chart.

From this line, a constant "K" was calculated, which represented the decrease in acidity for each 1 per cent increase in butter-fat in the cream. The value of "K" derived in this way was found to be .00128. This constant may be applied by using the following formula:

$$x = a - [(c - m) \times .00128]$$

x = Acidity of cream desired
a = Acidity of milk
c = Per cent fat in cream
m = Per cent fat in milk

Assuming the average of the data gathered to be approximately correct and using the constant .00128, one is able to calculate the acidity of separated cream, when the acidity of the milk and percentage of fat in the whole milk and cream are known.

The accuracy of this constant was checked under commercial conditions and the following table shows how the calculated acidity of the cream checked with the actual acidity:

TABLE II

CALCULATED ACIDITY COMPARED WITH ACTUAL ACIDITY IN MILK AND CREAM

Trial No.	Per cent fat in milk	Acidity of milk	Per cent fat in cream	Calc. acid.	Act. acid.
1	3.9	.1451	33.0	.1080	.1003
2	4.0	.1499	36.0	.1090	.1101
3	4.0	.1391	57.0	.0713	.0857
4	3.5	.1334	55.0	.0675	.0738
5	3.6	.1350	55.0	.0690	.0738

BIBLIOGRAPHY:

Farrington, E. H.
19th Annual Report of the Agricultural Experiment Station, University of Wisconsin, 1902, page 133.

DISCUSSION

Dr. H. A. Harding, Detroit, Mich.: What is the explanation of the lack of direct relation between the acidity and butter-fat content of milk and cream?

Dr. Roadhouse: According to Farrington, it is due to the presence of neutral fats in the butter-fat.

"Where a man is in earnest and knows what he is about, his work is half done."

WHAT SHOULD AN INSPECTOR LOOK FOR AT THE FARM AS THE CAUSE OF HIGH COUNT RAW MILK?

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During the early period of farm inspection the accepted method was to consider the dairy farm as a unit. Using the score card as the measuring stick the dairies of a region were placed in their relative order of desirability. Later, the specific details leading to the low scores were paraded before the less progressive dairymen and moral suasion, together with other available influence, was used to improve the low scores.

When funds became insufficient for keeping up this general oversight, attention was restricted to the low scoring dairies in the effort to bring them up to or at least toward the score of the better ones.

A decade of this experience convinced many of us that we were employing unfruitful methods so far as the improvement of the milk was concerned. A careful study of score cards demonstrated that they did not measure anything in particular.

Meanwhile, there has been gradually developing a clearer notion of just what was expected of the milk inspector. His job is to assist the public in getting the kind of milk which it wants and this is a milk which is safe, rich, clean and sweet. To accomplish this result most efficiently he should know, before he visits a farm, the particular quality or qualities in which its product is deficient. When he reaches the farm he should have a definite idea of just where to look for the cause of the deficiency.

In short, the task of the farm inspector has changed from giving a farm a general inspection to that of looking for the cause of very specific difficulties. To phrase the matter in medical terms, his work has changed from that of a general practitioner to that of a specialist.

Fortunately for the inspector, dairy farm studies have already furnished much guidance as to where to look for the causes of poor milk and how to apply the remedies.

It has been demonstrated fairly completely that it is impracticable to produce a safe raw milk at a cost which is not prohibitive and that the safety of the milk supply is principally a matter of pasteurization. Supervision of this process is a city problem and outside the field of farm inspection.

Richness in milk is fundamentally a matter of the breed of dairy cattle on the farm and the choice of breeds is determined by factors which are likewise outside the province of the dairy farm inspector.

Cleanliness of the milk, at least in so far as it concerns the visible dirt getting into the milk, is largely a matter of the cleanliness of the coat of the cow at milking time. While the condition of the coat can be observed readily by the inspector, if present during the milking process, much valuable information may be obtained with little loss of time through the application of the sediment test as the milk is delivered at the receiving station.

The factors controlling the safety and richness of the milk are thus largely outside the province of the farm inspector and the cause of dirty milk is practically restricted to a single source. Accordingly, the real field for the exercise of his powers of observation is in detecting and remedying the causes of the raw milk of high bacterial content which is so abundant every summer.

Fortunately for the inspector, each of the successive steps in the production of milk has been studied by a number of observers working under different conditions. As a result there is available fairly definite information as to the range of additions to the germ content of the milk which may be expected as the milk passes from the udder of the cow to the can in which it is to be cooled and transported to the distributor.

It is evident to any one who is familiar with the changing conditions surrounding milk production that the number of bacteria contributed from any single source will vary between rather wide limits. In attempting to present these findings it seems best to point out what may be expected under two different and somewhat extreme sets of conditions, both of which are encountered during actual inspection. One of these will be found in the best of certified dairies. The other will be occasionally met in extremely undesirable conditions in ordinary milk production. Fortunately these extremely undesirable conditions rarely affect all of the factors in any one dairy simultaneously.

The results of the available studies are summarized in Table. I.

TABLE I

NUMBER OF BACTERIA NORMALLY ENTERING MILK AT THE FARM

Source	Under ideal conditions. *Per c.c.*	Under extremely bad conditions. *Per c.c.*
Udder	100	100,000
Coat of cow	50	20,000
Barn air	1	10
Hands of milker	1	100
Pails	1	10,000
Milking machines	1,000	1,000,000
Strainer	1	100,000
Cans	10	1,000,000

In considering this table attention should be directed toward the relative magnitude of the numbers rather than to the exact bacterial count. However, the numbers given will ordinarily be found to be fairly correct.

The column with the heading "Under ideal conditions" gives the germ count per cubic centimeter to be expected, from each of the sources enumerated, under the best of conditions. While the figures here given may seem extreme they are in fairly close accord with what is being accomplished in some commercial dairies. No attempt is made in this column to express values below 1 per cubic centimeter, though such items as barn air and hands of milker sometimes add less than that amount of germ life.

In selecting the figures for the column "Under extremely bad conditions" there is no such clear cut standard available as in the case of the certified dairies. Unfortunately, not all of the sources given have been studied under commercial conditions as fully as might be desired. This is especially true of the effect of the hands of the milker and of the strainer. However, the figures given are in accord with the available data. It is only fair to emphasize the point that in any single dairy only a few of these sources will be at their worst. Accordingly, the total amount of germ life entering the milk will be less than the total this would produce. Where the milking machines are used some of the other factors are eliminated.

The figure of 100,000 per cubic centimeter from the udder is based upon a single known case. The average from ordinary udders seems to be rather under than over 500 per cubic centimeter. Only about one cow in fifty has been found to furnish an excessively high count milk. Accordingly, the udder content does not come into question as the cause of high count raw milk except where the number of cows is limited or the attempt is being made to produce milk of an unusually low germ count. In such cases an otherwise unexplained high germ count would suggest an examination of the germ count of the milk as it comes from the individual cows.

The figure of 20,000 per cubic centimeter from the coat of the cow represents the extreme number to be expected from filth caked cows. Such conditions should not be tolerated because of the dirt added to the milk. Under anything like acceptable conditions of cleanliness of the coat of the cow the amount of germ life added to the milk from this source will amount to less than 5,000 per cubic centimeter. Accordingly the explanation for an unusually high count raw milk will rarely be found in a lack of cleanliness of the coat of the cow.

The barn air has been frequently charged with large additions to the germ count of the milk. However, careful measurements under a wide variety of conditions have made it plain that barn air is practically a negligible factor so far as the addition of bacteria to milk is concerned.

Much has likewise been said regarding the germs added to the milk from the hands of the milker. So far as it refers to the number of germs derived from this source this anxiety has been largely borrowed trouble. On the other hand this is a case where a few may be just as objectionable as many. It is indeed fortunate that the pasteurizing process is capable of taking care of such sources of danger to the safety of the milk, since it is practically impossible to protect raw milk effectively from this danger.

While it is inherently possible that under extreme conditions pails should be the source of more than 10,000 germs per cubic centimeter measurements of such conditions are not at hand. Apparently pails are so easy to wash and dry, particularly to dry, that they rarely add more than a couple of thousand germs per cubic centimeter.

It is practically universal experience that milking machines are a very fertile source of germ life. Even under the best of conditions these machines are among the largest contributors to the germ life of the milk. Where these machines are given only ordinary care they frequently add several hundred thousand germs per cubic centimeter.

There is really little satisfactory data regarding the additions to be expected from strainers, notwithstanding the fact that strainers have long been given credit for being an important source of germ life.

Where straining material, such as absorbent cotton, is being used but once there are no grounds for expecting measurable numbers of germs from this source. Freshly boiled cloth strainers or such strainers which have been dried give similar results. Additional quantitative data covering the effect of different degrees of carelessness in the handling of wire and cloth strainers would be helpful.

Cans are another source from which milk ordinarily receives large additions of germ life. This is true notwithstanding that the cans are usually well washed before leaving the milk plant. They are almost always moist at the time the covers are applied, with the result that the moist inner surface offers a fertile field for germ growth. Where the cans are really dried at the milk plant or are rinsed and dried after reaching the farm the influence of the can upon the germ content of the milk may be so slight as to be negligible. However, under ordinary conditions cans add 30,000 to 100,000 germs per cubic centimeter.

This analysis of the sources from which germs enter milk would be somewhat misleading if it did not also take account of another factor, that of growth of germ life in the milk. In the case of evening milk delivered the following morning with a high germ count, more than one-half of this germ life is usually to be accounted for as the result of growth. Accordingly, the inspector should give attention to the provisions for cooling and to the temperatures actually reached by the milk.

Where the milk is cooled to 50° F. within two hours from the cow and held at that temperature little or no growth will occur before delivery the following morning. On the other hand, when the milk is held at 70° F. growth will proceed almost as rapidly as at higher temperatures. Under ordinary conditions the limit of cooling is set by the temperature of the water supply. Unless this supply is abundant and flowing steadily the temperature of the milk will be some degrees above that of the water used for the cooling. Observations at the farm regarding facilities for cooling may well be checked by observations of the temperature of the milk as actually delivered.

The problem of the morning milk which is delivered within a short time after milking is quite another matter. Here growth will not have occurred regardless of the temperature and any germ count must be explained on the basis of added germ life.

The problem of the inspector may be summed up by saying that when he goes to the farm to locate the cause of a high germ count in milk it will be well to direct attention primarily to milking machines, cans, and cooling. In the vast majority of cases the explanation of the difficulty will be located in connection with one or more of these three items.

It may not be out of place to add that restricting his comments at the farm to these three factors will aid materially in getting results in the form of a product having a lower bacterial count.

DISCUSSION

Mr. Ernest Kelly, Washington, D. C.: I consider farm inspection necessary. It must still be used to check and record conditions at the farm. We should continue to teach the farmer what ideal conditions are for the production of milk, and the score card keeps those conditions constantly before him.

"Bad men excuse their faults, good men will leave them."

THE PIN POINT COLONIES OBSERVED IN THE BACTERIAL EXAMINATION OF MILK; THEIR RESISTANCE TO HEAT AND GROWTH IN DIFFERENT CULTURE MEDIA

J. W. YATES, *Director, Food and Dairy Division,* Hospital and Health Board, Kansas City, Mo., and DR. J. J. GLOVER, Hospital and Health Board, Kansas City, Mo.

The general adoption of American products, used in the preparation of media, was due to the difficulty of obtaining Witte Peptone and Leibig's extract of beef. Simultaneously with the adoption of these products, high counts in pasteurized milk were observed. These counts were uniformly due to small colonies, termed "pin points."

"Pin point" producing bacteria are demonstrated from buckets, cans, strainers, wash vats, various kinds of feeds and milking machines. Milk asceptically collected direct from the teat has always been found free from these contaminators on the most heavily seeded premises.

A peculiarity of these organisms is their elusiveness. They appear when least expected in the cleanest of dairies and may not be found in the dirtiest of dairies. Because of this, it was thought at one time that the use of hypochlorite solutions in too weak a solution as a disinfectant had a bearing on their appearance. This was studied superficially, using as a basis both the available chlorine exponent and percentage of solution, but no conclusions could be drawn from this study.

It has been satisfactorily demonstrated that the kind of materials used in the media has a general bearing on pin point propagation. In the fall of 1922 a series of samples was run in five different laboratories. Twenty-one samples were each divided equally between the laboratories. Each laboratory prepared a medium, titrated against phenolphthalein to plus 0.8, and was furnished with a medium by the Kansas City Food and Dairy Laboratory, which was Bacto-Nutrient Agar, having a pH of 6.54. In each laboratory the samples were plated on both media in 1:100, 1:1,000 and 1:10,000 dilutions. A total of 2,400 plates was made. A summary of this work showed that the pin point colonies appeared on both media in all dilutions, but had a much lower count on media prepared according to the old standards.

Further work was done, using pre-war Witte Peptone and Leibig's extract of beef titrated against phenolphthalein to plus 0.8 as a check on Bacto-Nutrient Agar, having a pH of 6.6, in a series of runs on pasteurization efficiency. Twenty runs, consisting of 118 samples, were made. The samples were raw composite milk collected from eight different pasteurizing plants. Each sample was divided into three parts. One part was pasteurized in a modified Sternberg bulb at 140° for 30 minutes, using a De Khotinsky constant temperature bath. The second part was pasteurized as above except at 145° F. The third was plated raw. Each part was plated on both media in dilutions of 1:100, 1:1,000 or 1:10,000 according to the quality of the milk being used.

A summary of this work shows that at 140° F. on Bacto medium an average efficiency of 82.7 per cent was obtained, and at 145° F. an average efficiency of 89.4 per cent was obtained. This was calculated from the total of all samples from all plates. The average count of milk pasteurized at 140° F. and plated on pre-war medium was 187,000. Pasteurized at 145° F., the average count was 93,000. It was not possible to calculate efficiency because lack of sufficient pre-war medium prevented making counts of raw samples on this medium.

In every run the pre-war medium gave a lower count, for the count was approximately three times higher on the Bacto medium.

To determine the cause of the difference in counts obtained on the standard Bacto medium and pre-war medium, standard and pre-war media were prepared and the hydrogen ion concentration of each corrected in series from pH 3.15 to pH 9.2. Six samples of composite raw milk were divided and pasteurized in modified Sternberg bulbs as in the case of the previous study. Each part was plated in 1:1,000 dilution on both media in each pH, making a total of 900 plates. Medium having a pH below 4.1 refused to harden in the plates. The results are presented in tables I, II, and III.

It will be observed in Table I that maximum count in Bacto medium was obtained at pH 8.1 in every instance in samples pasteurized at both temperatures. On the pre-war medium the maximum count was obtained in the pH range 7.0 to 8.6.

Comparing the check counts on both kinds of medium with raw milk and with milk pasteurized at 140° and 145° F., it will be seen that in most instances the count on Bacto Agar was very much higher than that on pre-war agar. In the three instances in question the counts were fairly close together, with the count on pre-war medium larger.

TABLE I

INFLUENCE OF VARYING HYDROGEN ION CONCENTRATIONS ON COUNT IN BACTO AGAR AND PRE-WAR AGAR

		Sample 8279				Sample 8280				Sample 8281			
		pH	Bacto	pH	Pre-war	pH	Bacto	pH	Pre-war	pH	Bacto	pH	Pre-war
Raw	Check	6.6	1,580,000	*	1,280,000	6.6	5,400,000	*	1,865,000	6.6	1,900,000	*	170,000
140°	"	6.6	19,500	*	5,000	6.6	108,000	*	20,000	6.6	12,000	*	21,000
	140°	4.1	2,000	4.4	5,000	4.1	2,500	4.4	0	4.1	500	4.4	1,000
	"	4.9	2,500	4.9	1,500	4.9	0	4.9	1,500	4.9	2,000	4.9	5,000
	"	5.3	19,500	5.3	9,500	5.3	10,500	5.3	4.500	5.3	9,500	5.3	6,500
	"	5.9	14,500	5.8	4,000	5.9	2,500	5.8	4,000	5.9	3,000	5.8	8,000
	"	6.2	23,000	6.3	17,000	6.2	14,000	6.3	5,500	6.2	8,500	6.3	8,500
	"	6.6	18,000	6.6	7,000	6.6	9,500	6.6	4,000	6.6	24,500	6.6	2,000
	"	6.9	18,000	7.0	14,000	6.9	11,000	7.0	9,000	6.9	5,000	7.0	14,500
	"	7.3	16,000	7.3	22,500	7.3	14,000	7.3	5,500	7.3	4,000	7.3	3,500
	"	7.8	18,000	7.9	6,000	7.8	13,000	7.9	3,500	7.8	9,000	7.9	4,000
	"	8.1	31,000	8.6	14,000	8.1	28,000	8.6	15,000	8.1	24,500	8.6	2,000
	"	9.2	8,000	9.5	11,000	9.2	13,500	9.5	2,500	9.2	6,000	9.5	500
145	Check	6.6	6,500	*	7,000	*	10,000	*	5,500	*	5,500	*	4,000
	145°	4.1	3,000	4.4	1,000	4.1	3,000	4.4	2,000	4.1	1,000	4.4	4,000
	"	4.9	6,500	4.9	5,000	4.9	1,500	4.9	500	4.9	2,000	4.9	1,000
	"	5.3	3,000	5.3	2,200	5.3	3,000	5.3	5,000	5.3	3,500	5.3	5,000
	"	5.9	3,500	5.8	3,500	5.9	2,500	5.8	2,000	5.9	7,500	5.8	3,500
	"	6.2	3,500	6.3	6,500	6.2	10,000	6.3	6,500	6.2	3,500	6.3	7,500
	"	6.6	13,500	6.6	6,500	6.6	12.500	6.6	6,500	6.6	8,000	6.6	3,000
	"	6.9	3,500	7.0	14,000	6.9	5,500	7.0	22,500	6.9	4,500	7.0	14,500
	"	7.3	2,000	7.3	5,000	7.3	2.000	7.3	8,500	7.3	2,500	7.3	4,000
	"	7.8	19,500	7.9	4,500	7.8	9,000	7.9	3,500	7.8	16,000	7.9	4,000
	"	8.1	22,500	8.6	500	8.1	23,000	8.6	1,500	8.1	31,500	8.6	1,000
	"	9.2	8,000	9.5	500	9.2	7,000	9.5	2,000	9.2	7,000	9.5	0

* Pre-war check medium titrated against phenolphthalein to plus 0.8.

TABLE II

INFLUENCE OF HYDROGEN ION CONCENTRATION ON COUNT IN PRE-WAR MEDIUM

		Sample No. 8290	Sample No. 8291	Sample No. 8292
* Raw	Check	14,260,000	13,400,000	14,700,000
pH	4.32	......	......	......
"	4.77	......	......	......
"	5.29	6,260,000	5,480,000	6,400,000
"	6.02	8,460,000	7,390,000	6,800,000
"	6.54	9,460,000	9,280,000	8,720,000
"	7.02	14,640,000	10,280,000	12,960,000
"	7.52	12,080,000	11,920,000	11,280,000
"	7.96	11,960,000	10,640,000	11,900,000
"	8.20	10,280,000	10,960,000	9,480,000
"	8.82	8,280,000	8,490,000	9,960,000
* 140°	Check	1,050,000	1,010,000	365,000
pH	4.32	35,000	......	......
"	4.77	......	......	......
"	5.29	70,000	35,000	100,000
"	6.02	300,000	150,000	50,000
"	6.54	200,000	560,000	470,000
"	7.02	40,000	14,500	40,000
"	7.52	70,000	25,000	40,000
"	7.96	30,000	20,000	90,000
"	8.20	65,000	390,000	75,000
"	8.82	35,000	190,000	......
* 145	Check	165,000	70,000	110,000
pH	4.32	......	......	......
"	4.77	......	......	......
"	5.29	45,000	45,000	30,000
"	6.02	55,000	45,000	30,000
"	6.54	60,000	40,000	75,000
"	7.02	95,000	65,000	80,000
"	7.52	37,500	20,000	20,000
"	7.96	40,000	25,000	75,000
"	8.20	85,000	75,000	40,000
"	8.82	15,000	10,000	......

From Table II it will be observed that the maximum count obtained from the three samples lay in the pH range 7.02 to 8.82. In the case of the pasteurized milk the maximum growth occurred between 6.02 and 7.02.

* Pre-war check medium titrated against phenolphthalein to plus 0.8.

TABLE III

INFLUENCE OF HYDROGEN ION CONCENTRATION ON COUNT ON BACTO AGAR

	pH	Sample No. 8290	Sample No. 8291	Sample No. 8292
Raw Check	6.6	18,620,000	16,760,000	15,550,000
	5.17	6,800,000	7,050,000	4,320,000
	5.50	5,760,000	8,000,000	6,740,000
	6.02	9,040,000	9,820,000	10,230,000
	6.44	......	......	......
	6.84	12,820,000	11,960,000	12,090,000
	7.27	12,920,000	13,700,000	13,010,000
	7.69	12,780,000	12,920,000	13,600,000
	7.94	13,800,000	8,260,000	12,900,000
	8.41	12,260,000	12,400,000	11,820,000
	8.72	9,730,000	9,980,000	10,020,000
	9.02	8,900,000	9,820,000	10,900,000
140° Check	6.6	1,460,000	1,020,000	1,470,000
	5.17	6,000	4,000	45,000
	5.50	160,000	235,000	110,000
	6.02	600,000	540,000	690,000
	6.44	......	......	......
	6.84	640,000	1,380,000	620,000
	7.27	700,000	440,000	520,000
	7.69	800,000	200,000	720,000
	7.94	900,000	320,000	520,000
	8.41	720,000	340,000	660,000
	8.72	75,000	380,000	390,000
	9.02	175,000	335,000	70,000
145° Check	6.6	185,000	75,000	90,000
	5.17	3,500	1,500	20,000
	5.50	34,000	50,000	50,000
	6.02	85,000	150,000	130,000
	6.44	......	......	......
	6.84	70,000	85,000	80,000
	7.27	50,000	120,000	90,000
	7.69	9,000	85,000	135,000
	7.94	145,000	110,000	175,000
	8.41	100,000	240,000	40,000
	8.72	70,000	110,000	20,000
	9.02	40,000	80,000	60,000

From Table III it will be observed that with raw milk the maximum count was obtained in the pH range 7.27 to 7.94. In the pasteurized milk the range in which maximum count was obtained in the three samples varied from 6.84 to 8.41.

For some time it has been noticed in checking through a certain plant that toward the last of pasteurization the count begins to rise, and if for any cause the plant has to shut down, the milk that is held for 45 minutes or an hour shows a decided jump in count, at times higher than the raw milk.

The pasteurization is continuous flow system, preheated at 145° F., holding 30 minutes. Samples are collected every 30 minutes, raw before preheater, after heater, after filter, after holders and finished product at bottler.

A plant check of a typical run is represented in Table IV.

TABLE IV

Time taken	Raw	After pre-heater	After filter	After holder	Finished product
8:20 A.M.	200,000	125,000	125,000	32,000	10,000
8:50 A.M.	200,000	125,000	94,000	10,000	26,000
9:20 A.M.	200,000	80,000	80,000	13,000	34,000
9:50 A.M.	140,000	83,000	39,000	16,000	53,000
10:20 A.M.	125,000	93,000	33,000	35,000	69,000
10:50 A.M.	100,000	45,000	30,000	6,000	50,000
11:20 A.M.	110,000	20,000	37,000	32,000	300,000
11:50 A.M.	100,000	30,000	44,000	32,000	200,000
12:20 P.M.	100,000	44,000	37,000	35,000	250,000

From this run, it will be noted that although a better quality of raw milk was entering the preheater, toward the last of the run corresponding higher counts in the finished product were being obtained, due to pin points in the pasteurized milk.

Further work to study the heat resisting characteristics of pin point colony producing organisms was done. Three samples of raw milk were used, two in the Kansas City Food and Dairy Laboratory and one in a cooperating milk plant laboratory. Each sample was divided into eight parts. In the Food and Dairy Laboratory each part was placed in an hermetically sealed Sternberg bulb. In the cooperating laboratory each part was placed in a test tube for heating. Samples were heated to 145° F. as in previous studies and each of seven parts held for 30, 60, 90, 120, 150, 180 and 210 minutes respectively. Cooled at 43° F. and plated in 1:1,000 dilution on Bacto-Nutrient Agar having a pH of 6.6. Incubated 48 hours at 37.5° C. The results are presented in Table V.

TABLE V

INFLUENCE OF TIME OF HOLDING ON MILK HEATED TO 145° F.

	Time of Holding		Sample No. 9165	Sample No. 9166	Sample No. 7167
Raw	....		1,500,000	260,000	1,200,000
Raw	....		1,300,000	260,000	440,000
145°	30	minutes	220,000	11,000	8,000
"	30	"	200,000	15,000	7,000
"	60	"	250,000	9,000	9,000
"	60	"	400,000	7,000	11,000
"	90	"	500,000	12,000	180,000
"	90	"	200,000	9,000	160,000
"	120	"	250,000	2,000	240,000
"	120	"	500,000	3,000	450,000
	150	"	750,000	920,000	1,750,000
'	150	"	1,000,000	1,200,000	2,940,000
"	180	"	2,000,000	3,000,000	2,880,000
"	180	"	2,000,000	5,000,000	4,560,000
"	210	"	2,000,000	5,000,000	7,820,000
"	210	"	2,000,000	5,000,000	6,140,000

From Table V it will be observed that in heating to 145° F. and holding for 30 minutes, we get an average efficiency of 99 per cent. Efficiency gradually decreases with length of holding period, and in holding 150 minutes the count equals the raw milk count. At 210 minutes the count is tripled over the raw count.

It has been observed that the smaller pasteurizing plants which run a small volume of milk and are able to complete their runs in a short time are less inclined to the increase in counts after pasteurization.

The evidence in Table V of the tremendous increase in counts where milk is held over three hours at 145° F., and in Table IV, in which a plant test was made with the milk flowing continuously at 145° F. for more than three hours, indicates that the equipment may become heavily seeded, consequently affecting the finished product.

According to the theory outlined, in addition to the normal destruction of germ life during the pasteurizing process there also occurs a steady increase of the germ life which thrives at 145° F.

In the case of a continuous flow pasteurizer the growth of this germ life on the walls of the hot chamber should increase with the length of the daily run.

This theory has been put to a practical test in a continuous flow pasteurizer where the normal day's run was approximately six hours. This plant has been seriously troubled by the presence of pin point colonies in the pasteurized product, as shown in Table IV.

Extreme care has been taken with the preparation of the utensils, without favorable reduction in the germ count of the pasteurized milk.

In the test of the validity of this theory of the growth of germ life in the pasteurizer, the pasteurizing process was interrupted at two-hour intervals. The material accumulating on the walls of the pasteurizer was examined bacteriologically and the pasteurizer carefully cleaned and disinfected. The bacteriological examination showed the presence of large numbers of the heat resistant germs in the material on the walls of the pasteurizer. The removal of this material at two-hour periods changed what had previously been a high count product to one giving a satisfactorily low bacterial count.

The laboratory and the plant tests agree in indicating that at least one of the factors producing the present confusion in bacterial counts of pasteurized milk is the presence in milk of germs which grow steadily at pasteurizing temperatures.

In addition to the more extensive work on composition and reaction of media we have made a few observations of a general nature regarding the organisms responsible for high counts.

It is found that these organisms incubate better at 95° F. Isolation of the bacteria is difficult and subculturing from one medium to another is almost impossible unless the organisms are first passed through the milk, and difficult then.

Pin point colony producing organisms are heat resisting up to 158° F. for thirty minutes and 185° F. for 15 minutes and resist 145° F. for three and one-half hours, as we have demonstrated, and probably very much longer. Media containing milk, whey or casein are very favorable for pin point propagation. Morphologically they appear often as single small rods but can have a coccus-like appearance and are also observed in short chains. A study of the biology of these organisms has not been completed and no report can be made at this time.

CONCLUSIONS

1. Tests with pre-war medium prepared in accordance with former standard methods, compared with Bacto Agar medium prepared in conformity to present standard methods, show that higher counts are obtained on the latter.

2. A series of efficiency tests has proved that ordinances that are based upon the theory of obtaining 98 per cent efficiency in the pasteurization of milk are impossible to enforce.

3. In comparing the pre-war and present standard media, in every case the pre-war medium with pH corresponding to standard medium showed the lower count, which leads us to believe that the hydrogen ion concentration does not have much bearing on pin point propagation.

4. We believe that the kind of materials used in preparing media has a bearing on the high count problem.

5. Pin point producing organisms are heat resisting at pasteurization temperatures for periods out of reason for commercial pasteurization efficiency.

6. No conclusions can be drawn as to the definite cause of these pin point colonies.

"Isolated facts may in time prove to be the keystone of the arch of knowledge."

FUNDAMENTALS OF A PRAÇTICAL MILK ORDINANCE

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It is now generally recognized that no matter what legislation is passed, progress is bound to be retarded unless an intelligent public interest is created.

In order to gain public sentiment for the support of any law that may be enacted it is essential that the measure be necessary, beneficial and practical. It is not possible to arouse public sentiment or enthusiasm in support of legislation, particularly trade legislation, unless more and better talking points are available than can be advanced against it.

Because requirements governing milk have been enacted which are unnecessary and impractical, milk control in some cities has failed utterly to accomplish the benefits to either the consumer or the producer which are attained in other cities where milk legislation is based on modern knowledge and research.

Fortunately, the advantages of a modern milk ordinance far outweigh any objections that may be brought against it by those unfamiliar with the true purpose in view. Provided a modern ordinance is adopted, little difficulty should be experienced in gaining public approval and the cooperation of the producer, for both are rewarded, while danger to the public health from milk and its products is greatly lessened. In view of the fact that milk is the most largely used of all articles of diet, with the exception of bread, and because milk in the past has been the cause of more disease than all other foodstuffs combined, the necessity of thorough milk control cannot be overestimated.

An industry to be successful must be organized, and by means of a modern milk ordinance enforced by outside and impartial authorities the milk producer protects himself in the simplest way possible from unscrupulous and unfair competition. The interests of the producer are too often lost sight of in the preparation of regulations governing public health milk control. After all, the interests of the producer, the consumer and the public health official coincide very closely. The producer strives to secure and maintain a good market for his product, and in order to accomplish this it is essential to obtain the confidence of the public in the wholesomeness of the milk supply and the value of milk as a food. On the other hand the consumer desires to obtain a supply of milk that is pure and of good quality, which can be procured only if the milk business is on a profitable basis and if the market of the legitimate dairyman is adequately protected against inferior grades of milk at cut prices. Similarly, the public health of a community is safeguarded by the same regulations that work to the advantage of the producer and the consumer of milk. In order to boost the consumption of milk, which is now recognized to be one of the most important steps for the promotion of public health and efficiency, it is necessary to have a supply that can be conscientiously recommended in a milk-for-health campaign.

The necessity of a milk code that is clearly defined, free from impractical requirements and unhampered by politics, red tape and incompetent officials, should be obvious to all concerned. It is indeed one of the primary duties of all cities to see that a milk code is enacted and enforced in a manner that will not only secure a wholesome supply of milk, but will also foster the interest of the dairy industry, without which no community can hope to progress.

It is beyond the scope of this paper to go into the numerous points that comprise a modern milk code. Practically every city is a law unto itself, and it is considered impossible to enumerate the various regulations that would be required by peculiar local conditions that exist throughout this country.

There are, however, certain factors that constitute the foundation of a modern milk ordinance, and these may be quoted:

1. A code which is concise, clearly defined and easily interpreted.

2. A code which assigns definite duties to those whose business it is to enforce its requirements.

3. A code which requires sanitary production and handling of milk, in keeping with modern knowledge and the ordinary laws of common decency.

4. A code which provides for the thorough grading of milk, and which provides bacterial and chemical standards which are practical.

5. A code which contains clear definitions of milk and its products and clearly interprets acts which are considered illegal.

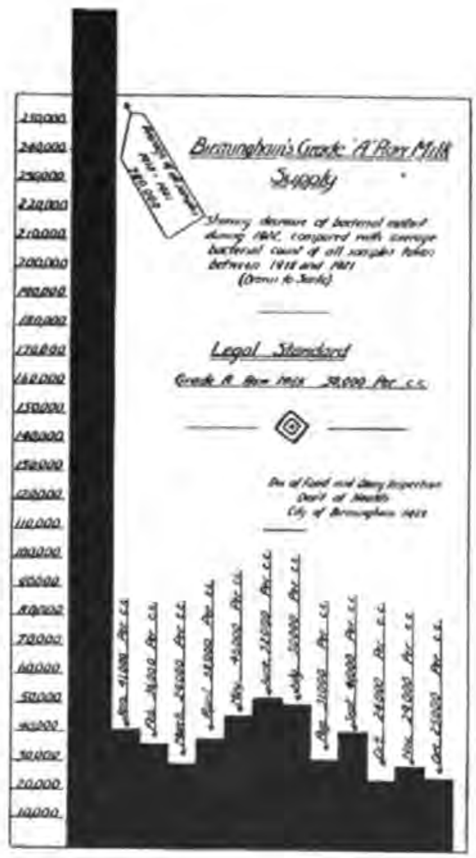
6. A code which sets forth specific requirements governing pasteurization and facilitates the modern movement to compel pasteurization of all but the highest grade of raw milk.

7. A code which provides well defined penalties for infringements of its requirements. These should be in keeping with the seriousness of the offense.

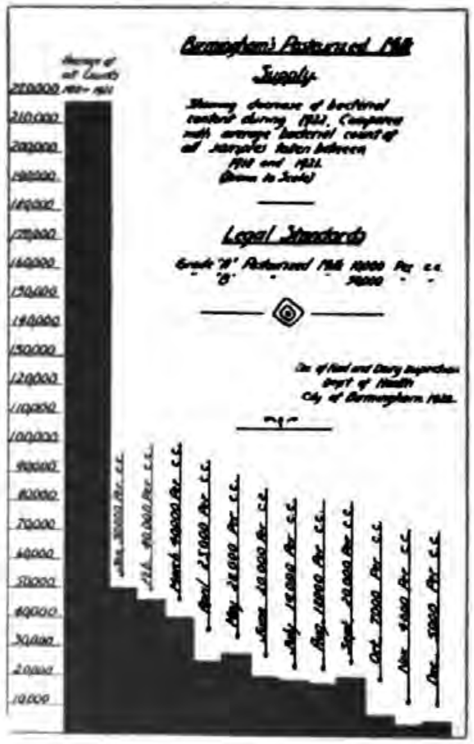
8. A code which is protected as far as possible against political interference.

Altogether, a milk code should be outlined in such a manner that its requirements may not easily be misconstrued, while regulations should be embodied that will safeguard the health of the community, enhance the quality of the product, increase public confidence in the supply and thereby raise consumption of milk. Similarly, the producer's welfare should be considered. The legitimate producer and distributer, in order to fulfill their obligations and requirements, must be afforded a fair field and be protected against the unscrupulous competitors and also the competition of the one and two cow dairies which are so prevalent in some cities.

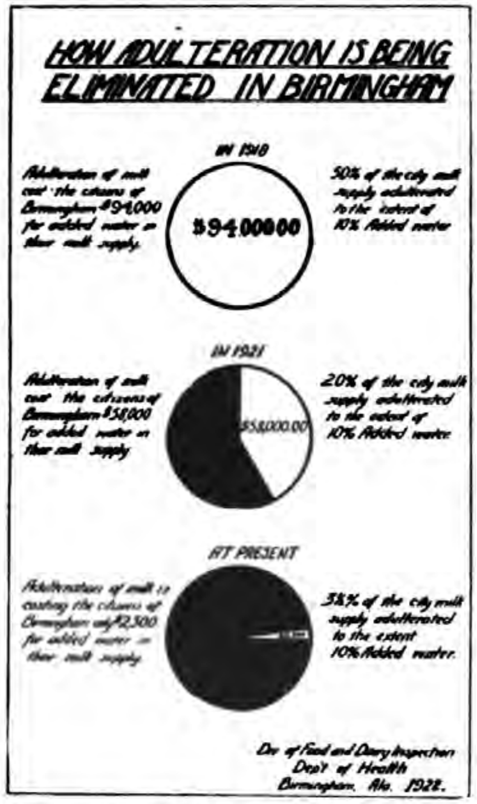
The possibilities of a modern milk ordinance are almost unbounded, as illustrated by the accomplishments of organized milk control in Birmingham, Alabama, during the past few years.



Less than three years ago Birmingham, a city of almost 200,000 people, had probably one of the worst milk supplies to be found in America. At that time approximately 90 per cent of its milk supply was derived from about 200 dairy farms, all of which distributed raw milk in the city. The average market milk in those days not only contained visible manurial sediment and was retailed in many instances without cooling and at almost an optimum temperature for bacterial growth, but analyses of the samples examined revealed the fact that a large percentage of the supply contained from one half million to two or three million bacteria per c.c., while the average bacterial count of all samples collected from 1918 to 1921, inclusive, was 780,000 per c.c. Furthermore, the average bacterial content of the small portion of pasteurized milk distributed over the same period

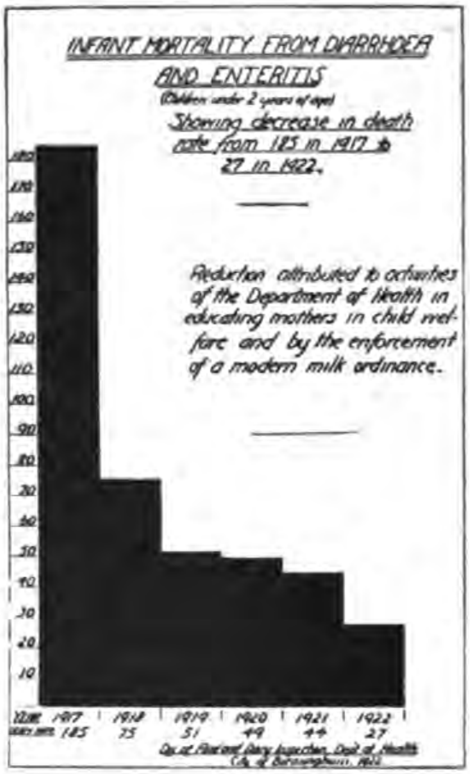


was 212,000 per c.c. Pasteurized milk because of its abnormal characteristics and poor keeping quality was then an article in ill repute, owing to lack of official control, inadequate and slipshod processing and the inferior grades of raw milk used by the plants. Although Birmingham has today a supply of pasteurized milk that will rank with the best of this country, the prejudice aroused against the product in the old days is still present and is a factor that the Department of Health in its campaign of milk control finds most difficult to eradicate from the public mind.



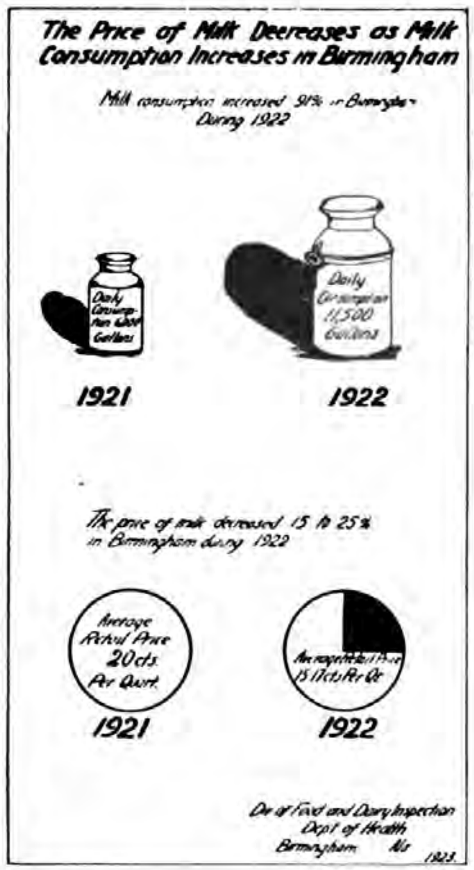
With such facts available concerning the old status of the Birmingham milk supply, it is not surprising that up to two years ago, when organized control was inaugurated, the milk question constituted one of the most acute health problems that confronted the Board of Health. Up to that period the dairy industry supplying the Birmingham market was disorganized. The average consumption of milk was one-fifth pint per capita, while many even of the better types of dairymen found it necessary to resort to adulteration in order to meet the competition of those less scrupulous.

The health of the city was repeatedly jeopardized by milk-borne epidemics; colitis was rampant among infants and mortality brought about by diseases commonly transmitted by milk was high. Because of these facts the general public were wholesomely afraid to use milk for anything but cooking purposes.



The milk situation in Birmingham during the past few years has been practically revolutionized. It is difficult to diagnose the factors that influence the dairy interests in opposing a measure that will bring about systematic control of the industry and encourage the public to have greater faith in milk as a food. However, it is the case in most cities when modern milk regulations are proposed and inaugurated that the ordinance at first is bitterly opposed, chiefly by dairymen and others who claim that laws requiring observance of sanitary and decent methods of production and handling, and maintenance of standards that experience has demonstrated as practical and just, will ruin the milk industry and put the majority of producers out of business.

The fallacy of such statements has been exposed in Birmingham. After one of the most serious milk fights between producers and health authorities on record in this country, the present health officer of Birmingham, Dr. J. D. Dowling, succeeded in having a modern milk code adopted and has for the past two years used aproximately $30,000 per year of available public health appropriations for the



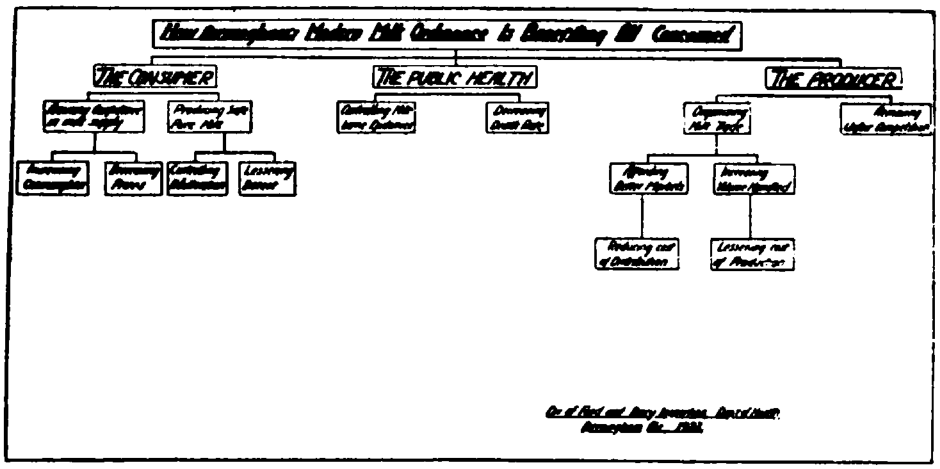
enforcement of its requirements. The dairymen spent thousands of dollars in fighting the measure through the courts and gained an injunction that prevented the enforcement of the act for over twelve months, while the lower element associated with the milk business carried on a strenuous campaign to intimidate officials by threatening the life of the health officer and frequently defying inspectors and collectors of milk samples at the point of a pistol.

It is gratifying, however, that in spite of the many obstacles that confronted the campaign for better milk control in Birmingham, the program was eventually put over. The milk market improved so rapidly and the consumption of milk increased so quickly that even the most obstinate opponents soon realized that the advantages of modern control and grading of milk afforded benefits and compensation far in excess of the initial outlay required to comply with sanitary requirements.

The change in attitude of the dairy interests is most clearly manifested by the fact that not a single court proceeding has been instituted against a producer or distributer since 1921. In fact, approximately 100 per cent of the milk producers and distributers in the course of the past three years have been won over to the cause of organized milk control. This victory has been brought about, apart from the efforts of the Department of Health, by the enforcement of practical regulations requiring systematic grading of both raw and pasteurized milk.

In addition to this radical change in the attitude of producers toward milk control, statistics in Birmingham show an increase in the consumption of milk of 91 per cent during 1922, a decrease in the price of milk of from 15 to 25 per cent, a decrease in the average bacterial content of raw milk from 780,000 per c.c. to a figure well below 50,000 per c.c., a reduction in the bacterial content of pasteurized milk from 212,000 per c.c. to approximately 10,000 per c.c., and an increase in the consumption of pasteurized milk from 10 per cent to approximately 85 per cent of the total supply. It is important to note from a public health standpoint that the death rate from colitis among infants under 2 years of age dropped during 1922 from 44 to 27, while there was a remarkable reduction of the death rate due to typhoid and other diseases frequently transmitted by milk.

Bearing in mind the relation of a prosperous dairy industry to the welfare of a community, the importance of increasing the use of milk and its products from the standpoint of public health, and also the grave menace to health presented by an inferior and unregulated milk supply, there appears no problem that is deserving of more attention than that of procuring a well controlled, safe and unadulterated supply of milk for every community in this country.



"Citizens are learning that an efficient health service is the best kind of investment, and the best advertisement for any city."

DRIED MILK POWDER IN INFANT FEEDING

DR. TALIAFERRO CLARK, *Surgeon,* U. S. Public Health Service, Washington, D. C.

Over large areas of our country, cow's milk is not produced in sufficient quantity to supply the local needs. Prohibitive cost naturally follows this condition in these localities, while in other sections milk is produced in such quantities that much of it goes to waste. The process of drying milk is one of the best means of conserving the supply where it is abundant, and of bringing this important food to localities where it is not available in its fresh state. The wide field of possible usefulness of this product, as a food for infants, made a study of its nutritive value of paramount importance.

In this country, except in institutional cases, no study of any magnitude had been undertaken to establish the usefulness of dried milk as an exclusive food for infants until that undertaken by the United States Public Health Service in the city of Boston, in cooperation with the Boston Baby Hygiene Association, the Boston Health Department, and several other agencies. The study covered a period of a full year, from August, 1919, to October, 1920. While the Public Health Service had already made some study of the vitamin content and growth-promoting values of dried milk powder, the study in Boston was designed to determine the safety, usefulness, and comparative value of dried milk powder in infant feeding on a practical community-wide basis.

A total of 241 infants were under observation for a sufficient length of time to furnish reliable data for use in tabulation of weight. These infants were divided into three groups: Group I (63 infants), fed on Grade "A" pasteurized milk; Group II (138 infants), fed on whole milk powder which was reconstituted in their homes; and Group III (40 infants), fed on milk which had been reconstructed from unsalted butter and skimmed milk powder. In each instance the milk was modified to meet the age and condition of individual babies.

These children were recruited from all sorts and conditions of homes, were entirely artificially fed, and with few exceptions, were not more than six months of age when included in the study.

In addition to careful directions for the preparation of milk, the following data were recorded on the history cards for each baby:

1. The weight of the baby at the beginning of the special feeding and at intervals of approximately two weeks thereafter.

2. The strength and amount of feeding, hours of feeding, amount taken in 24 hours, and changes made.

3. The nature and extent of any illness and treatment.

4. General condition of the baby with special reference to character and changes in stools, general development, activity, teething, and disposition.

5. Environment of baby, with special reference to mother's intelligence and cooperation.

A preliminary report for the first three months of the investigation indicated that dried milk powder, of the brand employed, was safe and useful for infant feeding, and that the babies made satisfactory gains. The continuation of the study in nutrition was accompanied by laboratory studies comprising examinations of milk prepared in homes of different degrees of cleanliness, classification of the intestinal flora of a selected number of babies from each group, and careful physical examination of babies of all groups with special reference to the incidence of rickets and scurvy. In addition, studies in the basal metabolism of a number of these babies were made by Dr. Fritz B. Talbot, of the Research Laboratory of the Massachusetts General Hospital.

The study in nutrition resulted in findings distinctly favorable to the use of whole milk powder in infant feeding. In all age classes the infants fed on a modification of cow's milk (Group I) made distinctly less progress, as measured by gain in weight, than those fed on a modification made from whole milk powder. This difference was especially marked in the younger group (1 to 3 months). Since the weight curves for Group I were consistently below those for Group II in all age classes, it seems safe to conclude that the infants on whole milk powder gained in weight more rapidly than did those fed on cow's milk.

The infants fed on a modification reconstructed from unsalted butter and skimmed milk powder (Group III) increased less rapidly in weight in the older age group (4 to 6 months) and in the total group (all ages); but in the younger age group (1 to 3 months), the gain in weight closely approximated that of infants on whole milk powder for about 11 weeks, but after the twelfth week on this diet the rate decreased and the curve approached that of the children fed on a modification of cow's milk. However, owing to unforeseen difficulties, the number of infants in Group III was too small, and the variations in the weight curve were too inconsistent to permit the drawing of any definite conclusions.

A bacteriological investigation was made of the intestinal flora of 110 specimens of infant's stools, obtained from 24 babies through a period of ten weeks. The number of specimens from each baby ranged from 2 to 7 with an average of 4.6 specimens per baby. Specimens from two breast-fed babies were used as controls.

A study of the total count of the microorganisms in the stools shows the lowest count for the breast fed babies, with Group II (receiving whole-milk powder) second. From the bacteriological standpoint it would seem that powdered milk, and especially the whole milk powder, can be safely used for feeding infants where breast milk or a good grade of fresh cow's milk cannot be obtained.

THE RELATION OF DRIED MILK TO SCURVY

The relation of dried milk to scurvy is dependent upon the anti-scorbutic vitamin content of the particular dried milk in question. The observations of Hopkins, Chick, Hume, Skelton, and Barnes ([1, 2, 3]) led to the conclusion that the amount of the anti-scorbutic vitamin even in fresh milk is not large and varies with the diet of the cow ([4, 5, 6]). Summer milk from pasture-fed cows has the higher value. It has been very generally believed that the process of drying milk reduces or destroys its anti-scorbutic value, and it is probably safer, in infant feeding, to proceed on this assumption and adhere closely to the policy of including an additional anti-scorbutic in the dietary. Hess, however, states that drying does not necessarily destroy the anti-scorbutic factor ([7, 8]) and Rosenau has more recently expressed the same opinion ([9]). To obtain a dried milk of highest anti-scorbutic value, it is necessary that the milk to be used should be fresh and of high anti-scorbutic value, exposed to a high temperature for not longer than one minute, protected from light, air and alkalization, and used within a few months of the time of manufacture. The mothers of the infants included in this study were instructed to give their babies orange juice, but 13 of the babies failed, for various reasons, to receive this anti-scorbutic. Two of them developed symptoms of scurvy—one infant on grade "A" milk (Group I), and one on reconstructed milk (Group III). These cases were recognized early in their development, and both of them responded promptly to appropriate treatment.

THE RELATION OF DRIED MILK TO RICKETS

The relation of diet to the development of rickets is less simple and clear-cut than its relation to scurvy. Neither dried nor fresh milk can be considered a determining factor in the prevention of rickets. Its value in this disease may be looked upon as due to its general value as food stuff. The latest investigations into the etiology of rickets go to show that there is an interdependence between light and an organic factor in the diet found abundantly in cod liver oil, both of which influence the metabolism of calcium and phosphorous salts in the baby. McCollum and his co-workers consider this organic factor to be distinct from fat-soluble vitamin A, although having the same distribution.(12)

A complete physical examination was made of 200 infants enrolled in this study and particular attention was paid to the incidence of rickets. One of the important points brought out by these examinations is the frequency and the similar distribution of this disorder in the different feeding groups. However, a number of these infants undoubtedly presented a slight degree of rickets at the time of enrollment; but owing to the relatively short period of observation in individual cases it is impossible to state with positiveness the effect of dried milk feeding on the course of the disorder.

BASAL METABOLISM

The metabolism studies in this series of cases show a tendency for the boys to fall within, or very close to, the standard variations, the greatest deviation being in the calories per kilogram of body weight. In girls, on the other hand, the metabolism ran higher, falling, with few exceptions, more than 10 per cent above the average, but not outside the extreme normal variation. This Talbot found to be in accord with previous observations of Benedict and Talbot. (11)

In the series of babies fed on dry milk powder, the author finds that the basal metabolism tends to be slightly higher than that of average normal infants, but is within normal limits. He thinks this may have been due to the relatively high protein content of the food, but that the deviations from the average are too small to allow any striking conclusions to be drawn.

REFERENCES

(1) Chick, H., Hume, E. M., and Skelton, R. F.: The anti-scorbutic value of cow's milk. Biochem. Jour., 1918, 12, 131–153.

(2) Hopkins, F. G., and Chick, H.: Accessory Factors in Food. The Lancet, 1919, II, 28–29.

(3) Barnes, R. E., and Hume, E. M.: Comparison between the Anti-scorbutic Properties of Fresh, Heated, and Dried Cow's Milk. The Lancet, 1919, II, 323–324.

(4) Dutcher, R. A., Eckles, C. H., Dahle, C. D., Mead, S. W., Schaefer, O. G.: Vitamin studies VI. The influence of the diet of the cow upon the nutritive and anti-scorbutic properties of cow's milk. Jour. Biol. Chem., 1920, 45, 119–132.

(5) Hess, A. F., Unger, L. J., and Supplee, G. C.: Relation of fodder to the anti-scorbutic potency and salt content of milk. Jour. Biol. Chem., 1920, 45, 229–235.

(6) Hart, E. B., Steenbock, H., and Ellis, N. R.: Influence of diet on the anti-scorbutic potency of milk. Jour. Biol. Chem., 1920, 42, 383.

(7) Hess, A. F., and Unger, L. J.: Scurvy of Guinea pigs III. Effect of Age, Heat, and Reaction on Anti-scorbutic Food. Jour. Biol. Chem., 1919, 38, 293.

(8) Hess, A. F.: Newer Aspects of some Nutritional Disorders. Jour. Amer. Med. Assoc., 1921, 76, 693–700.

(9) Rosenau, M. J. Vitamines in Milk. Boston Med. and Surg. Jour., 1921, 184, 455.

(10) Talbot, F. B., and Moriarty, M. E.: The basal metabolism of infants fed on dry milk powder. Public Health Reports, Vol. 37, No. 3, Jan. 20, 1922, 116–123.

(11) Benedict and Talbot. Carnegie Ins. Washington, Pub. No. 302.

(12) McCollum, Simmonds, Becker, and Shipley: Studies in Exp. Rickets. XXI Jour. Biol. Chem., 1922, 53, 293.

"Milk is the ideal food for growing children and it must have a greater place in the diet. The instructive talks to our school children by trained specialists have already been fruitful."

OBSERVATIONS ON THE WASHING AND STERILIZING OF MILK BOTTLES

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The daily washing and sterilization of empty milk bottles returned to small city dealers or to a large city milk plant constitutes a big problem. Bottles are usually received in varying conditions of cleanliness, sometimes in a condition bordering on filth, from the many and varied sources of collection. It therefore becomes somewhat of an accomplishment to make each of them clean, practically sterile and suitable as a container for milk.

Many cities have health regulations providing a penalty for returning unclean milk bottles, but in the general run of business it is not possible for health department inspectors to be constantly present. Some milk dealers instruct their drivers to refuse unclean bottles from individuals, restaurants and grocery stores, and in that way the recipients of the bottles get the habit of at least rinsing them soon after they are empty.

SORTING

When milk bottles are returned to the milk plant for washing the most important procedure is to examine them and separate those which are in the following condition:

Bottles that are cracked or badly chipped.
Bottles having sour and dried milk stuck to the inside.
Bottles having dirt or ashes inside.
Bottles having moulds or green or yellowish growths within.
Bottles having molasses, syrup or other sticky substance in them.

Bottles having kerosene, benzine or gasoline odors.
Bottles having musty, fecal or stale odors.

As a general rule, all such bottles should be placed in a sink or vat where they can be soaked thoroughly before any attempt is made to wash them. After a period of soaking, varying with their condition, they should be washed in a hot caustic solution to cut the grease which may be adhering to the glass. A rotary brush will facilitate this process.

It must be emphasized that special treatment of very unclean bottles is necessary before they can be expected to come through the present day mechanical bottle washers in a satisfactory condition.

Bottles that fail to respond to the soaking treatment are sometimes placed in a special cleaning solution, such as is used for laboratory glassware. Such a solution is made up of 60 grams of potassium bichromate and 1,000 c.c of water with 1 quart of sulphuric acid added to each 60 c.c. of water solution. This method of cleaning, however, is too expensive to be practical and instead new bottles are usually purchased.

WASHING AND STERILIZING

During studies of bottle washing and sterilizing, different methods were observed. These included hand and rotary brush washing with and without a single case steaming hood, steaming box or cabinet; the highly developed types of mechanical bottle washers and steamers; and chemical sterilization.

Three general types of mechanical bottle washers were observed and their treatment of empty bottles varied as follows:

One type immersed the inverted bottles in cases, for a short period, into successive solutions varying from water to caustic soda solution, each of which solutions had a different temperature.

One type passed the inverted bottles in cases or individually, intermittently, through compartments where sprays varying from water to caustic solution and steam were forced up into each bottle. The temperature of each solution varied.

One type provided for the placing of bottles in individual pockets in an endless chain device which carried them through successive soaking solutions, varying in temperature, thence into an inverted position. Here rotary brushes and a rinsing spray were inserted into the bottle by a mechanical device. In this type of machine the bottles were delivered upright on an endless conveyor for immediate filling. If milk is not ready when the bottles are ready, it becomes necessary to place the bottles again in cases or store them until they can be filled. It is, therefore, best to operate the bottle washers simultaneously with the filling process.

Another type was similar to the type just described but lacked the rotary brushes.

The ultimate object of each machine was to deliver bottles in as near a clean and sterile condition as possible. Each type of machine no doubt has its own mechanical features, but from a bacteriological standpoint, the object each seeks to accomplish is the same.

The question is often asked, "What bacteria count in bottles is necessary to class them as sterile?" Strictly speaking, a sterile bottle would have no germ of life in it. Under commercial conditions, however, we are concerned chiefly with what is practically sterile, or, in other words, an endeavor is made to reach as near a sterile condition as possible.

The bacteriological standard for drinking water in many places assumes that water is safe if it has less than 100 bacteria per cubic centimeter, and no B. coli present in more than one out of five 10-cubic-centimeter portions.

If the bacterial condition of the empty milk bottle, in relation to milk, comes within the bacterial standard for drinking water, the bottle should undoubtedly be considered as practically sterile. It is, therefore, not the object of this paper to discuss the relative merits or demerits of the mechanical or operating features of different types of mechanical bottle washers. All of them seem to be quite efficient when they are in good working condition and when the temperatures of the solutions for washing and sterilizing are proper.

It may be interesting to compare bacteriological results secured when two methods of bottle washing were used. In one method, the ordinary sink and rotary brush method was used and in the other method, the mechanical bottle washers were used. The results are shown in terms of bacteria per cubic centimeter in rinse water when standard methods are used for determining bacteria.

The bacteria which would be present to inoculate the milk and be counted in it later by themselves or their multiples are determined in terms of bacteria per cubic centimeter rather than total bacteria per bottle. This other method is sometimes used, because of the larger figures usually involved. It would seem, however, that reporting the inoculation per cubic centimeter of milk is the most uniform and desirable method, as the dealer desires to know just how much the bacteria count of his milk is to be influenced by the condition of the milk bottle.

A comparison of the efficiency of bottle washing was made at 17 dairies and 37 pasteurizing plants. At 18 of these plants mechanical bottle washers were used exclusively and at 17 plants the method consisted of a two-compartment wooden or metal sink with rotary brush and foot lever hot water spray.

The following tables show the results of the bacteriological examination of bottles washed in different ways:

HOT WATER AND ROTARY BRUSH METHOD OF WASHING BOTTLES AT DIFFERENT DAIRIES. NO STEAMER USED

Number (Bottles)	Average inoculation per cubic centimeter of milk (Bacteria)	Range of inoculation per cubic centimeter of milk (Bacteria)
5	10.5	6–20
5	10.8	1–20
5	13.6	1–52
5	60.8	15–139
5	92.2	32–183
5	162.0	11–676
5	172.2	133–219
5	355.4	143–608
5	360.4	51–783
5	426.6	26–1014
5	[1] 459.8	4–1154
5	[1] 714.0	482–1369
5	1100.2	211–3911
5	1168.0	16–2575
5	1568.4	190–5708
5	2621.2	507–6173
5	5141.8	95–13531
85	Average 849.3	Range 1–13531

HOT WATER AND ROTARY BRUSH METHOD OF WASHING BOTTLES AT DIFFERENT MILK PASTEURIZING PLANTS. NO STEAMER USED.

Number (Bottles)	Average inoculation per cubic centimeter of milk (Bacteria)	Range of inoculation per cubic centimeter of milk (Bacteria)
10	[2] 22.8	0–169
10	[2] 29.1	8–51
10	[2] 32.7	4–207
10	[2] 34.7	4–207
10	[2] 44.9	2–171
10	52.9	1–152
10	[2] 80.9	8–558
8	[2] 100.0	19–507
10	[2] 182.1	1–634
8	[2] 421.2	211–761
10	492.7	3–2114
10	486.0	84–1691
10	848.9	422–1564
10	977.2	171–3882
8	1086.1	116–3285
10	2197.5	1057–3297
10	[2] 2242.6	51–5496
10	2293.7	651–5288
10	11336.0	1118–44397
184	Average 1156.0	Range 0–44397

[1] Disinfectant used in addition to rotary brush, hot water and cleansing powder.

[2] Washing powder used.

MECHANICAL BOTTLE WASHER AND STEAMER WITH HOT CAUSTIC SODA SOLUTION, HOT WATER AND STEAM

Number (Bottles)	Average inoculation per cubic centimeter of milk (Bacteria)
20	Less than 1.
15	" " 1.
10	" " 1.
10	2.7
10	4.8
10	8.4
10	10.9
10	17.3
45	72.3
24	92.9
10	115.0
10	137.0
8	149.0
10	193.4
12	238.0
214	Average 66.8

The results shown greatly favor the mechanical washer and steamer in which the bottles are given a thorough washing with caustic soda solution and hot water, in addition to the application of live steam in a few instances.

CHEMICAL STERILIZATION

When hot caustic soda solution is used in bottle washing machines, the conditions correspond somewhat to the method of bottle sterilization approved by the Chicago Health Department after a recent thorough investigation.[1] A committee appointed to investigate how efficient cleansing and chemical sterilization of milk bottles might be accomplished by use of caustic soda reported as follows:

An approved method of bottle sterilization should conform with the following conditions:

1. Machine alkali.
   (a) Minimum proportion of caustic alkali to soda ash 2–1.

[1] American Journal Public Health, Vol. XIII, No. 7, July, 1923.

(b) Use minimum charge (1.5 pounds per cubic foot water).

(c) Make solution twelve hours before use to allow mixing.

(d) Minimum alkali reckoned as NaOH (sodium hydrate) always equal or exceed 1 per cent (10 grams per litre).

(c) Clean machine out thoroughly at least once a week.

2. Wash and rinse water.

(a) Water supply must be safe.

(b) Water must have sufficient pressure to effect complete rinsing, no alkali left in bottles.

(c) Spiral rinsing stream suggested as more effective than direct stream.

3. Machine.

(a) Minimum temperature of caustic solution always to be at least 120 degrees F.; automatic thermo regulator suggested.

(b) Maximum speed to expose bottles within the solution at least 10 minutes.[1]

(c) Examine each brush daily; keep brushes overnight or when not in use, in moderately strong soda solution.

(d) Be certain that the caustic solution is not diluted by leakage or seepage.

A machine for soaking and washing bottles should be provided as hot caustic soda solution is necessary for the proper disinfection of empty bottles, and this solution would be too hot and injurious to the hands of the attendant should he attempt to clean by hand. In other words, a cleaning solution which would allow the hands to be placed therein would not be an efficient cleaning solution for empty bottles.

[1] Later changed to 5 minutes.

COMMERCIAL STERILIZING SOLUTIONS

In some milk plants the process of washing bottles includes also the final rinsing in water containing chlorin as a disinfecting agent.

There seems to be an increasing tendency to displace steam sterilization with such disinfectants in the last rinse water. This method is sometimes called chemical sterilization and wherever it has been tried, satisfactory results have been reported during test periods only, when the strength of the disinfecting solution is known to be proper.

One ambitious manufacturer of a disinfecting solution has advertised that his solution will take the place of hot water and steam for sterilizing when "a couple of tablespoonfuls to a pail of water" is the dilution used. Such unqualified statements seem to be unwarranted when it is known that results with liquid chlorin disinfectants are secured only when all other conditions are proper and that for general purposes of sterilization no disinfecting solution can take the place of live steam.

It should be understood that disinfecting solutions have their limitations and that they are best used by those who realize the limitations and know how to make tests for the disinfecting strength of the dilutions.

Directions given by different companies for use of their disinfectants, for churns, floors, vats, separators, clarifiers, pipes, pumps, bottles, refrigerators, etc., called for varying dilutions.

It has been shown[1] that solutions of chlorinated lime containing available chlorin of a strength 1–5000 will sterilize milk utensils in a few moments when these are submerged

[1] The Use of Chlorinated Lime in the Sterilization of Milk Utensils. George B. Taylor. International Association of Dairy and Milk Inspectors' Annual Report. 1919. pages 193–205.

in the solution. To obtain this effect, however, it is necessary that all vessels be thoroughly washed and rinsed before soaking.

Commercial solutions containing chlorin which were examined and which, when diluted according to directions, were of sufficient strength to sterilize milk bottles properly, varied in wholesale price from .87 to 6.6 cents a gallon. Others advertised to sterilize but which were too weak for that purpose varied from .6 to 2.5 cents per gallon. Besides the chlorin, which is the active disinfecting agent, commercial solutions sometimes contain varying amounts of sodium chloride (common salt), sodium hydrate or sodium carbonate, but these have no active disinfecting value. As such solutions usually consist of about 90 per cent water it is evident that considerable profit can be realized from their wide advertisement and sale.

Sometimes a discrepancy occurs between the advertised and the actual cost of the solution. For instance, one manufacturer estimated the cost of a gallon of dilution, ready for use, to be about one-eighth of one cent. Calculation, however, showed the cost to be 1.4 to 1.5 cents per gallon. Later, advertisements appeared setting the cost at about one cent a gallon, but as the price of the solution had been increased, the price of the diluted solution likewise was increased.

The following table shows the wholesale price and chlorin content of 9 commercial solutions advertised and sold as sterilizing agents for dairy utensils and milk bottles. The dilution recommended by the manufacturer for making an efficient sterilizing solution for milk bottles, the price, chlorin content and approximate strength, are given. It must be borne in mind that price calculations are made when using the wholesale price, and therefore the cost to the user would be higher when the retail price is considered.

Number	Quantity	Wholesale price (dollars)	Available chlorin[1] (per cent)	Dilution directed for sterilizing bottles. Solution to water	Estimated available chlorin in dilution (per cent)	Estimated strength of dilution (1 part to water)	Estimated cost of 1 gallon of dilution (cents)
1	15 ounces	0.13	5.0	1 ounce to 1 gallon	1.5	1–2,560	.87
2	4 ounces	0.20	3.0	1 teaspoonful to 1 pint	.15	1–3,200	6.6
3	10 ounces	0.66	3.5	2 tablespoonfuls to 1 gallon	1.12	1–3,428	6.6
4	16 ounces	0.50	3.5	1–128	1.12	1–3,428	3.1
5	10 ounces	0.50	2.2	1 teaspoonful to 1 quart	.11	1–8,760	3.3
6	1 gallon	3.00	2.24	1 tablespoonful to 1 gal.	3.6	1–10,667	1.2
7	1 quart	0.70	1.89	3 ounces to 1 gallon	0.18	1–21,330	6.6
8	1 gallon	0.50	.17	1–30	0.05	1–75,300	1.7
9	1 gallon	2.50	.04	1 tablespoonful to 1 gal.	0.005	1–768,000	0.98
10	300 c.c. (12 ounces chlorinated lime)	0.15	4.39	1 pint to 8 gallons	2.5	1–12,244	.23

Specific attention is directed to the cost and chlorin content of commercial chloride of lime as compared with the other disinfectants. It is a very cheap and convenient source of available chlorin and can be prepared in the milk plant laboratory.

[2]For making a chlorin solution from commercial chlorinated lime a 12-ounce can should be dissolved in 2 gallons of water. This should be strained into a crock or glass jar, discarding all sediment. This should be covered and kept in a cool, dark place and used as a stock solution. One pint of the stock solution added to 8 gallons of water makes an efficient rinsing solution, but this dilution should be made fresh as often as necessary to insure its available chlorin content. Presence of slime, dirt, milk, etc., in the solution will destroy its effectiveness.

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[1] Analysis of solutions by courtesy of U. S. Bureau of Chemistry.
[2] U. S. Department of Agriculture Health Officer Letter, No. 37, May, 1920.

When using commercial liquid disinfectants which have chlorin as their active disinfecting agent the strength of the solution is of utmost importance. Ingenious devices have been observed for the constant automatic dipping of a new supply of concentrated chlorin solution into water used for rinsing milk bottles. These devices, however, disregard the exact strength of the rinse water, which may be less than required for efficient work. It is known that the presence of organic matter in the rinse water affects the action of chlorin and as this may vary from time to time no automatic addition of the disinfectant will insure results unless the strength of rinse water remains constant and free from organic matter. Chlorin also has a corroding action on certain metals used in the construction of milking pails, milking machine parts, milk vats and coolers and for this reason is not used by some.

A test[1] for the detection of hypochlorites and chloramines in milk and cream shows that one part of chlorin in 50,000 parts of milk or cream can be detected. It is, therefore, necessary to exercise care in the use of disinfecting solutions containing chlorin in order to forestall danger of prosecution for adulteration.

COOLING EMPTY BOTTLES

Cooling bottles prior to filling them with milk is now being practiced in some milk plants. Under ordinary conditions it has been frequently observed that a rise in temperature of milk of from 2 to 6 degrees usually occurs when milk is placed in warm glass bottles. It seems folly to allow the temperature of milk to rise after it has once been cooled. By averting such rises in temperature the milk plant owner will no doubt save expense and at the same time insure the condition of the milk. Some milk plants use a chilled room for bottle storage and at some plants, when the bottles are

[1] U. S. Department of Agriculture, Bulletin 1114. The Detection of Hypochlorites and Chloramines in Milk and Cream.

to be used at once, a spray of cold water is used for cooling the bottles just prior to filling. The advantage gained is that there will be little or no rise in temperature of the milk due to the temperature of the bottle. The disadvantages are that a wet bottle has to be handled at the filling machine; the bottles are slippery and for this reason breakage may be larger; and there is a possible chance for contaminating the bottle if the water used for cooling is not pure.

It became possible to make a comparison of the bacteriological condition of empty bottles which had been stored in an upright position and those which were cooled with a spray of cool water just previous to being filled with milk.

A bottle rinsing apparatus at one milk plant was installed to wash out any dust particles which might have collected during the upright storage period and also to cool the bottles just prior to filling them with milk. During warm weather the plan was to rinse the bottles with city water which was cooled by passing it through a coil pipe submerged in a cooling medium.

With the city water at 48° F. the temperature in the pint bottles was changed from an average of 62° F. to 58° F. by passing them through the rinsing machine.

Another case of warm bottles having an average temperature of 83° F. was changed to an average temperature of 79° F. when rinsed with water having a temperature of 62° F.

A case of empty bottles was passed through the cooling and rinsing machine having the city water at 48° F. A bacteriological examination was made of five bottles prior to rinsing and five others in the same case after rinsing. These bottles had been previously washed and stored in the same manner.

The following table shows the results secured:

Before rinsing. Total bottle count	Average initial inoculation per cubic centimeter milk	After rinsing. Total bottle count	Average initial inoculation per cubic centimeter milk
120,000	240.0	16,000	3.2
3,840	7.5	5,200	6.4
15,200	31.0	2,000	4.0
31,200	62.4	4,800	9.6
44,400	88.0	6,600	13.6
Average 42,928	85.8	3,720	7.4

Difference due to rinsing, 91.4 per cent.

While a bacteria reduction of 91.4 per cent was secured by the rinsing and a slight cooling of the bottle resulted, the operation may be called impractical in that it constitutes an added expense of water and of equipment and handling, as a substitute for correct storage by inverting bottles in a cool room.

When no attempt is made to cool bottles it sometimes means that milk coming off the cooler at 50° F. will have a temperature of 52° F. or 56° F. in a few minutes after it is bottled. If the temperature of the milk off the cooler happens to be 55° F., the warm bottle would raise it to 57° F. or 61° F. and undoubtedly storage at such a temperature would mean losses.

Milk dealers, therefore, are faced with the problem of cooling the milk bottles by outside means prior to filling or allow the milk itself to rise in temperature a few degrees. No practical solution of this problem which would insure practically sterile bottles has been observed and no doubt individual plants will adopt the method best suited to their conditions.

BOTTLE STORAGE

Bottle storage in an inverted position is generally practiced but occasionally a milk plant can be found where little or no attention is given to this detail. Typical bacteriological changes that occur in bottles which are not inverted during the storage period before filling are compared in the following tables with freshly washed bottles which were likewise not inverted:

Freshly washed bottles—not inverted in storage.

Bottles	Average inoculation per cubic centimeter (Bacteria)	Range of count per cubic centimeter (Bacteria)
10	4.8	.5– 18.8
8	9.8	1.0– 44.0
12	24.0	.5–108.4
30	Average 13.8	Range .5–108.4

Bottles stored for several hours—not inverted in storage.

Bottles	Average inoculation per cubic centimeter (Bacteria)	Range in count per cubic centimeter (Bacteria)
8	149.	25–345
12	151.	40–460
10	137.	1.6–4084
30	Average 140.5	Range 1.6–4084

In these tests the faulty storage resulted in a bacterial count over 10 times greater than the count in the freshly washed bottles.

At one milk plant where bottles were stored in an upright position, the quantity of drain water found in 22 bottles taken at random varied from 1 c.c. to 6.2 c.c., or an average of 2.8 c.c. per bottle.

As milk plants increase their business they sometimes become crowded for proper bottle storage space and for this reason many have installed types of bottle washing machines which are operated simultaneously with the bottle filling process, thus doing away with storage of empty clean bottles. It is important, of course, that such machines be serviceable, as breakdowns or delays in the bottle washing process will consequently hold up the milk handling process, possibly to the detriment of the milk.

Such a continuous system in which storage of bottles is eliminated seems to result in a saving of time and sometimes also a saving in number of bottles used from day to day. However, it is sometimes necessary to consider the temperature of the freshly washed bottle; the fact that it is wet; the possibility of its being contaminated with improper rinse water or disinfecting solution; and the advisability of having on hand auxiliary bottle cleaning equipment in case of breakdowns.

SUMMARY

The problem of bottle washing and sterilization confronts every milk distributor. Education of the consuming public to return cleanable empty bottles, health department regulations, and penalties are used to provide better conditions.

Sorting of returned empties is necessary in order that very unclean bottles may receive special treatment.

A comparison of different methods of bottle washing shows that better bacteriological results are secured with mechanical bottle washers in which hot water and hot caustic soda solutions are present.

Chemical sterilization as approved by some includes brushing; a minimum of 5 minutes immersion of milk bottles in hot (at least 120° F.) caustic soda solution (1.5 pounds caustic soda to a cubic foot of water); and thorough rinsing with water that is safe. Results can be secured only when it is certain that the caustic solution is not diluted by leakage or seepage.

Commercial sterilizing solutions containing chlorin are widely advertised for sterilizing milk bottles; before they are used, their cost and disinfecting strength, when diluted, should be known. The strength of disinfecting solutions is of utmost importance. The presence of organic matter affects the action of chlorin. Chlorin has a corroding effect on certain metals used in milk utensils and apparatus. One part of chlorin can be detected in 50,000 parts of milk or cream.

The temperature of milk is sometimes raised by a warm glass bottle. Different methods of cooling the bottles just previous to filling with milk have been tried but no practical method which would insure practically sterile bottles has been observed.

During the storage period between washing and filling, milk bottles should be inverted; when bottle washing is carried on simultaneously with filling there is no storage period for the washed bottles. The number of bottles to be used from day to day may be lessened and considerable time and space may be saved. The temperature of the freshly washed bottle; the fact that it is wet; the possibility of contamination if an improper cooling medium is used; and the possibility of breakdowns necessitating auxiliary bottle washing equipment, are points also to be considered in a continuous process of bottle washing and filling.

"There is no work of genius that has not been the delight of mankind."

THE GLASS CONTAINER

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Glass was one of the greatest mysteries of the ages. The transformation of an ugly mixture of sand, soda and limestone, into a pure, transparent crystal was viewed with wonder. Glass articles were placed in the tombs of the early Pharaohs. The Roman Empire segregated the workers of glass and established a special social order for them. The Indians of this country bartered their wealth for a few glass beads. The earliest glass was purely ornamental, but the scientist and the inventor have developed the utilitarian phase of the glass industry to such an extent that the period is fast approaching when we can rightfully speak of the age of glass.

History proves the glass industry one of the most ancient. In 4750 B.C., during the first Egyptian dynasty, glass beads were used and it is supposed that the art was taught to the Egyptians by some peoples of an even earlier date. Later, in 4000 B.C., at the time of the fourth Egyptian dynasty, the wine bottle was introduced.

The primitive methods and the limited supply restricted the glass container to the nobility or the wealthier class. The Romans possessed a tear bottle. It was the custom at the death of a person for the mourners to weep in such a manner that their tears would fall into a bottle. Each mourner collected his own tears and the one with the greatest amount in his bottle was assumed to have had the greatest affection for the departed.

The art of glass making became well established in the city of Alexandria under the Egyptian control. Later it was entirely withdrawn from that city and moved to Rome when the Roman Empire reached the height of its power. At the fall of the Roman Empire the art fell into decay, but it was finally revived by the Venetians who continued the development of ornamental glassware until it reached a stage which has never been surpassed.

The primitive workers surrounded their raw materials by clay, forming a small ball which they heated in a furnace. After the material had cooled the clay was chipped away, leaving the glass bead. Later workers molded the plastic glass which was melted in a small furnace. They also drew fine threads which were twisted into the desired shapes. Finally the art of blowing was introduced and for several thousand years no other developments of any significance were discovered. Then appeared the automatic blowing machine and the glass industry was revolutionized. Production was enormously increased. The field of the glass article increased to such an extent that today we can hardly name a place where glass is not considered a necessity.

Glass is made of sand, soda ash, and limestone. These materials are finely ground and carefully mixed in the proper proportions. To this mixture or "batch" is added a certain amount of broken glass or "cullet." This batch is fed into a glass furnace where a temperature of about 2400 degrees F. is maintained. The powdered materials melt and form a liquid at the temperature of the furnace.

The glass is melted in a large square "tank" built of burnt clay blocks. These blocks are supported on brick piers so that the air can circulate around the outside of the tank. Above the tank proper is built a furnace. Long gas flames play across the upper surface of the molten glass in the tank. At regular intervals the direction of these flames is reversed. In order to prevent the molten glass from flowing out through the cracks between the tank blocks air is being continually blown against the blocks to keep them cool and thus chill the outer portions of the glass.

At the further end of the tank from where the batch is fed in, the molten glass is drawn off for the blowing operations. Various methods of removing the glass are used, depending upon the type of machine. This is the feeding operation and upon it depends the size of the bottle. It is necessary for the feeding device to remove from the furnace exactly the same amount of molten glass each time. To handle molten glass at the high temperature and with the precision of quantity is not an easy task, but this difficult work is accomplished with remarkable acccuracy and speed. The slight variations in the weight of bottles is concrete evidence of the efficiency of these feeding machines.

After the molten glass is delivered to the machine it must be blown into the desired shape. Cast iron molds are placed around the molten gob of glass and then air is blown into the glass itself, forcing it to take the shape of the mold. The mold has to be at the proper temperature to allow the glass to flow evenly over the mold. Any difference in temperature in one side of the mold is likely to cause uneven distribution.

The temperature range through which the glass is workable is small and in order to accomplish the blowing in one operation no time can be lost. This means a very close coordination of the speed of the machine, the temperature changes, and the initial temperature of the molten glass.

When glass cools, strains are set up which, if the glass is quickly cooled, are sufficient to cause it to fly to pieces when touched. In order to offset this condition the glass must be very carefully and slowly cooled. This process removes the strain and leaves the glass in a stable condition capable of receiving blows and shocks of considerable force without breaking.

This rather brief description may furnish only a brief outline of the process of manufacturing a bottle, but it is hoped that you will appreciate the difficulties experienced by the glass manufacturer and the remarkable manner in which he transforms a mixture of sand, soda, and lime into a perfect bottle of crystal clear glass.

PROPERTIES OF GLASS

Glass differs greatly from the other materials of commerce. No other material possesses so many properties which contribute to the progress of science and to the comfort and welfare of the world. The optical properties of glass have made it possible to enormously increase our knowledge of the universe. The scientist has explored by means of microscopes the world of minute organisms, the knowledge of which has secured greater freedom from disease. The resistance to the action of various chemicals has enabled the chemist to utilize transparent vessels in his experiments and follow very closely the progress of his reactions. Medical science owes a good share of its progress to the ease with which glassware can be completely sterilized without the slightest damage.

These three properties of glass, its transparency, its resistance to the action of chemicals, and its ability to withstand sterilizing at high temperatures, are responsible for the acceptance of glass as the universal container. These same properties have insured the glass bottle as the proper container for fluid milk. The fact that glass can be perfectly sterilized means a clean sterile bottle to receive the milk. The resistance to the action of chemicals absolutely eliminates any reactions between the milk and the glass which might cause spoilage. Yet perhaps the most important feature is the crystal clearness of the glass which enables the dairy to detect any dirt or such materials in the milk and which enables the housewife to assure herself that she is receiving a full bottle of rich milk free from impurities.

MILK BOTTLE INVESTIGATION

There appears to be some uncertainty concerning the ability of the glass bottle to withstand the treatment received as a milk bottle. The number of trips which might serve as a measure of its durability as stated by various men connected with the milk industry vary from 16 to 40. This, however, is no measure of the durability of the bottle because the bottles not returned are not considered as a separate item. Some dairies have conducted investigations of their own along these lines but principally for the purpose of checking up their losses. There seems to be no data available covering the entire dairy field which might serve as a means of definitely fixing conditions of service for the milk bottle. As the Glass Container Association was interested in determining all the facts concerning the behavior of the milk bottle in service, an investigation of this field of the glass container was commenced.

The purpose of this investigation was to determine the actual service requirements of the milk bottle in order to develop tests, the application of which to a new bottle would establish its fitness for service. Such a test would benefit both the manufacturer and the dairyman. It furnishes the manufacturer with a means of maintaining the highest standard. The fact that he is seeking such a test is evidence of the good faith and sincerity with which he is attempting to carry on his industry.

Such an investigation necessitated the collecting of various facts during actual operation in order to insure any reliability. The obtaining of concordant results demanded the compilation of sufficient data to offset the effects of the many variable factors involved. The obvious method was to watch the various operations in the milk plant for a sufficient period to insure representative observations. In order to obtain quantitative results, it was necessary to record actual figures for the number of bottles handled and the rate of handling.

The method selected for the purpose of carrying out a quantitative study was to locate the points in the dairy where bottles were broken and determine the exact number while a given number of bottles passed the point. With a series of values covering the entire operation of the dairy, the total breakage was obtained and from a knowledge of the total number of bottles handled the life of an individual bottle determined. At the same time a detailed study of the various processes in the light of the breakage brought out unusual conditions and faulty operating methods which were responsible for the high breakage.

The location of the different stations of observations correspond very closely among the various plants. The first point for observation was the unloading platform for the returned milk bottles. The manner of unloading varied according to the type of wagon, and to the design of the receiving device. There are three methods which are representative and these will be discussed to bring out a few points of interest in the proper handling of returned bottles.

The first method is employed by a plant which bottles about 50,000 quarts of milk daily. The outside platform is about the height of a case below the floor level of the small wagons, and about two cases below the level of the large wagons handling the wholesale trade. The driver stacks his cases four or five cases high. Two men on the platform lift the stack from the wagon and lower it to the platform. Another workman using a hook drags the stack of cases into the bottle washing room. There is no tossing of the cases, no confusion, no jamming of cases on the conveyor.

The second method is used by a plant handling about 25,000 quarts daily. A long automatic conveyor extends to the unloading platform where the driver can put his cases directly on the conveyor. The conveyor discharges the cases at some point above the washing room and the cases continue along the conveyor by gravity to the washing machine. The bottles are inspected and inverted as the cases slide along the conveyor. But the cases are received faster than the machine can handle them so they are stacked at convenient points.

The third method is used by a large number of dairies It consists in tossing the cases from the wagons to a horizontal conveyor which projects through an opening in the wall of the building. The cases continue along the conveyor under the motion given them by the first toss until they strike another case or are taken in charge by the men in the bottle washing room. This conveyor is frequently so short, due to the limited space or the location of the washing machine, that it is necessary to remove the cases and stack them. This calls for considerable handling and unless carefully watched the men will take the easiest method, which is to swing the case from the conveyor with a long free swing and allow the case to slide along the floor. This is unnecessarily rough treatment and it is directly responsible for considerable broken bottles.

The second position from which observations were taken was at the front end of the washing machine. From this point in the smaller plants both the inverting of the bottles and the feeding of the machine could be studied. There are two methods of inverting and feeding which will be considered.

The first method of inverting is to remove the bottles from the cases used on the wagon and place them inverted into empty cases which are brought up on another conveyor. This calls for excessive handling. The easiest method is to allow the bottles to strike the other bottles in the case and thus be directed into the proper place. This results in many chipped tops. In order to accomplish the many movements necessary the men work at excessive speed and this is a further disadvantage.

The second method, which is integral with the conveying of the cases to the washing room or to the washing machine, greatly diminishes the breakage and chipping. The men are stationed along the conveyor at certain intervals. Each man takes care of a separate row of bottles. The speed of the conveyor is determined by the number of cases which can be handled by the washing machine in a given time. But the number of operators and the amount of work each must do is regulated so that each man can efficiently accomplish his part of the operation.

In order to further demonstrate the differences between the various methods mentioned let us consider the actual figures obtained during the investigation. The figures given are an average of several plants:

Unloading platform		
Method 1	.05– .10	per cent broken
Method 2	.10– .25	" "
Method 3	.50–1.20	" "
Inverting of bottles		
Method 1	.30–1.10	" "
Method 2	.05– .30	" "

The feeding of the washing machine may result in excessive breakage unless the operators observe certain precautions. With the large machines where the bottles are fed in by hand from the cases very little breakage is experienced. The handling of a few bottles at a time is a comparatively easy task and the bottles can be properly placed in position without undue haste. The handling of heavy cases of bottles in order to feed certain types of machines is not an easy task. If the operator is required to lift the cases from a stack or the floor he will invariably toss the case. The sudden blow experienced by the bottles when the case strikes the conveyor of the machine develops cracks which later result in broken bottles.

The following figures offer further proof of the difference between the methods:

Feeding of washing machines.		
Machines taking loose bottles	.0–.30	per cent broken
Machines taking cases	.0–.45	" "

The low figures are obtained in the following manner. Either the operator is especially careful or there are special precautions taken in designing the conveyors to the washing machine. Suppose the men have to take the cases from the stack. The natural tendency is to toss the case on the conveyor. If, however, the conveyor is placed at an angle so that the men by dragging the stack close to the sloping conveyor can lift the cases to the conveyor at the same level, less energy is expended by the men and there is no jarring of the cases. Such a type of conveyor in one dairy has accomplished remarkable results. The cases are allowed to slide to the bottom of a belt which carries them at a definite speed to the washing machine, where they are guided into the machine. There is obtained by this scheme an even motion of the cases at all times.

The next point of observation was beyond the washing and sterilizing machine. The variations in the amount of breakage observed depend upon a large number of factors and could hardly be discussed properly in this paper. Under the current operating conditions the figures are small, varying from .01 per cent to .75 per cent. The operator of the machine plays the most important part in the maintenance of low breakage. The design of the machine and the type of cases have considerable bearing on the question.

There appears to be present in the minds of some of the members of the milk industry the idea that glass milk bottles are affected by the high temperatures of sterilization and that this is responsible for the breakage in the washing and sterilizing machines. This is not the case. The glass bottle will endure for a considerable period the action of steam at high pressures. The durability of a glass milk bottle is such that it would require from 300 to 1,000 trips through the ordinary sterilizing process before any visible effects could be observed.

There is, however, a limit to the temperature changes to which glass can be subjected. This is the cause of the excessive breakage in washing machines. The limit is by no means narrow, but it does exist and cannot be ignored. There are certain types of machines in use which cool the warm bottles so that they can be filled with cool milk as they leave the machine. This machine accomplishes the heating and cooling of the glass milk bottle with very slight breakage. The temperatures of the water baths are accurately controlled. But when the machine operator judges the temperature of the baths by his hand or the number of broken bottles coming out of the machine it is hardly possible to obtain efficient machine operation.

In a similar manner, the other operations were studied. This further study brought out the differences which exist between plants which use conveyors and similar devices to eliminate manual handling and those plants depending upon hand operations. The values are small in every case, varying according to the amount of systematic control of the operations present and the speed at which the men are required to work. The most vital factor is the spirit of the operators and the care exercised.

Summing up the foregoing statements concerning the handling of milk bottles in the dairy, we can best present them by the following outline:

Life of a milk bottle dependent upon
- (a) The percentage of bottles returned.
- (b) The methods of handling in the dairy.
- (c) The durability of the bottle.

Investigation of dairy practice influencing life of bottles.
- (a) Study of unloading of returned bottles.
  - Methods differing in amount of manual handling.
    1. Automatic conveyors.
    2. Hand unloading.
  - Differences in amount of breakage due to
    - Lack of system.
    - Excessive speed required in handling.
    - Carelessness of operators.
    - Utilization of automatic conveyors.
- (b) Study of operation of inverting.
  - Methods differing in amount of handling and speed of operation.

1. Transfer platform where operators transfer from one case to another.
2. Operators stationed along conveyor, each handling one section of case.

Differences in amount of breakage due to
Excessive speed required in handling.
Rough treatment given cases.

(c) Study of washing and sterilizing machines.
Differences in breakage on machine due to
Carelessness of the operator.
Improper design of cases.
Insufficient control of temperatures of the water baths.

The investigation is being continued along the lines given in this paper in order to obtain sufficient data to cover all operating methods. The results obtained to date have demonstrated the ability of the glass container to stand up under the most vigorous treatment received in the dairy. Careless methods cause the largest amount of breakage. By the use of automatic conveyors with movable belts to accomplish both the raising and lowering of the cases a considerable decrease in breakage can be accomplished. The elimination of all lifts possible in handling or the use of mechanical devices to accomplish the same prove especially effective in decreasing bottle losses. With machine operation the temperature control is an important factor. By ordinary attention to the details of bottle handling the bottle losses can be decreased from 2.5 per cent, which is an average value for the ordinary dairy, to .75 to .50 per cent, which is realized by many dairies.

"The man who can give inspiration to the men he meets is a success."

OF THE REGULATION FOR THE CONTROL OF THE TRADE IN COW'S MILK

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The matters of public health relative to cow's milk are being put under the control of the Sanitary Bureau of the Department of Home Affairs, and its regulation is enforced through the hands of the police department of each local government. The regulation consists of two ordinances, one being issued by the Department of Home Affairs, and the other by the local government. The former is the regulation for the control of the trade in cow's milk and is adapted to the whole land of Japan except her colonies such as Chosen, Formosa, Saghalien, while the latter is the rules for operation dealing with matters with regard to the production and sale of the milk. The range of its adaptation covers two kinds of milk, whole milk and skim milk, and three kinds of dairy products, condensed milk, condensed skim milk, and powdered milk.

Such rules treat in detail the matters regarding the health of cows, sanitary condition of dairies, materials and quantity indication of vessels, and health of milkmen. They also give a certain chemical standard to city milk as regards its constituents.

The present regulation, which is given elsewhere in these pages, was enacted in 1899, and leaves much to be desired. The amendment is being put in hand so as to make it suit the present social progress.

SECTION V. MILK

1. REGULATIONS FOR THE CONTROL OF THE TRADE IN COW'S MILK

(Home Department Ordinance No. 15, 1900; amended by Home Department Ordinances No. 7, 1906, 17, 1910, and 17, 1917.)

Article I. By the term cow's milk in these Regulations are understood whole milk and skim milk intended for sale, and by the term articles made from milk are understood condensed milk, condensed skim milk, and powdered milk intended for sale.

By the term trader in milk is understood a person who makes it his trade to extract, manufacture, or sell wholesale or by retail cow's milk or articles made therefrom.

Article II. The specific gravity of cow's milk shall be at 15° C. from 1.028 to 1.034 for whole milk and from 1.032 to 1.038 for skim milk.

The quantity of fat in whole milk shall be not less than 3 per cent.

The amount of solids in skim milk shall be not less than 8.5 per cent.

Article III. The amount of fat in condensed milk shall be not less than 8.0 per cent.

The amount of cane-sugar to be contained in condensed milk or condensed skim milk shall not, with milk sugar included, exceed 5.50 per cent.

Article IV. A person who proposes to engage in milking cows or making articles from milk must obtain therefor the permission of the local governor.

The local governor shall, when he gives the permission mentioned in the present article, cause a sanitary expert to examine the structure and accommodations of the place where milk or articles made therefrom are to be handled.

Article V. Traders in milk shall not draw milk from cows of the following descriptions:

1. Cows suffering from cattle plague, anthrax, contagious pleuro-pneumonia, foot-and-mouth disease, hydrophobia, tuberculosis, cowpox, jaundice, actinomycosis, symptomatic anthrax, dysentery, udder diseases, pyaemia, uraemia, septicaemia, poisoning, aphthae, septimetritis, and other febrile diseases;
2. Cows being treated with a poisonous or powerful medicine which is likely to enter into milk;
3. Cows within seven days after parturition.

Article VI. Traders in milk shall not use for holding or measuring milk or articles made therefrom vessels made of zinc, copper, or brass, earthenware badly enamelled and covered with injurious glaze, or vessels covered with enamel containing lead.

Article VII. Traders in milk shall not be permitted to sell, or transport or store with a view to sale milk of the following descriptions:

1. Putrefied;
2. Viscous or of bitter taste, or presenting a blue, red, or any other abnormal color;
3. Containing foreign matter;
4. Drawn from a cow to which any of the descriptions in Article V applies;
5. Not conforming to the provisions of Article II.

Article VIII. Traders in milk shall not be permitted to use the milk described in any of the first four items of the preceding article as material for making articles from milk.

Article IX. Traders in milk shall not be permitted to sell, or transport or store with a view to sale the following descriptions of articles made from milk:

1. Putrefied;
2. Mixed with foreign matter;
3. Held in any of the vessels mentioned in Article VI;
4. Made from the milk mentioned in the first four items of Article VII;

5. Condensed milk or condensed skim milk which does not conform to the provisions of Article III.

Article X. Traders in milk shall clearly state on the vessels for distributing milk whether they contain whole or skim milk, and on the vessels with condensed milk or condensed skim milk whether they contain condensed milk or condensed skim milk.

Traders in milk shall not be permitted to put skim milk into a vessel marked whole milk or to put condensed skimmed milk into a vessel marked condensed milk.

Article XI. Traders in milk shall always keep clean the places where vessels for holding and measuring milk and articles made from milk, and milk and articles made therefrom are handled.

Article XII. Traders in milk shall not allow persons suffering from tuberculosis, leprosy, syphilis, or any other infectious or contagious disease to handle milk, articles made therefrom, or vessels for holding or measuring them, nor admit them into places where they are handled. The same rule shall correspondingly apply when the traders themselves are infected with such diseases.

Article XIII. Traders in milk shall isolate cows afflicted with infectious or contagious diseases.

Article XIV. The local governor may cause a competent officer or sanitary expert to examine cows kept by a trader in milk and, if there is a cow among them afflicted with certain diseases, to brand a number or mark on its horn or to hang on its earlobe a ring bearing the number or mark.

The number, mark, and earring mentioned in the preceding clause shall not be erased or removed without the permission of the government officer.

Article XV. The local governor may take the measures prescribed in Article I of Law No. 15, 1900 (Law for the Control of Foods, Beverages, and other Articles), with respect to cows mentioned in Article V of the present Regulations, milk and articles made therefrom for which the vessels mentioned in Article VI are used, milk mentioned in any of the items in Article VII, and articles made from milk mentioned in any of the items in Article IX. The same rule applies also with respect to traders who contravene the present Regulations.

Article XVI. For the execution of the present Regulations the local governor may exercise the authority prescribed in Article II of Law No. 15, 1900 (Law for the Control of Foods, Beverages, and other Articles).

Article XVII. Any person who infringes the provision of the second clause of Article XIV shall be liable to a fine not exceeding one hundred yen or subject to detention.

Article XVIII. Any person to whom either of the following clauses applies shall be liable to a fine not exceeding one hundred yen:

1. Any person who engages without permission in the trade mentioned in Article IV;
2. Any person who infringes any of the provisions of Articles V–IX.

Article XIX. Any person who infringes any of the provisions of Articles X–XIII shall be liable to a fine not exceeding fifty yen.

Article XX. If a trader in milk is a minor or a person adjudged incompetent, the penal provisions applicable to him in the present Regulations shall apply to his legal representative; this rule, however, does not hold in the case of a minor who possesses the same capacity as an adult in regard to his business.

In the event of an agent of a trader in milk, the head of his house, a member of his family, an inmate of his house, or a person employed by him or otherwise taking part in his business, infringing the provisions of the present Regulations in regard to the said business, such trader shall not escape penalty on the ground that the infringement did not take place by his direction.

In the event of the representative of a juridical person or a person employed or otherwise taking part in its business, infringing the provisions of the present Regulations in regard to the said business, the penal provisions prescribed in these Regulations shall apply to the said juridical person.

In case of punishment of a juridical person the representative thereof shall be the accused.

Article XXI. The present Regulations shall come into effect on the 1st July, 1900.

Article XXII. The local governor shall determine the structure, accommodations, and supervision of cow-sheds and places to be used for milking and making articles from milk.

Article XXIII. In Tokyo Prefecture the duties of the local governor shall be discharged by the Inspector-General of the Metropolitan Police.

"Money spent for the public health is an investment, not an expenditure."

WHAT THE UNITED STATES DEPARTMENT OF AGRICULTURE IS DOING TO SECURE UNIFORMITY IN DAIRY AND MILK INSPECTION METHODS

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The title of this paper is perhaps somewhat broader than the contents will warrant. To attempt to enumerate all of the activities of the Department of Agriculture which contribute to the uniformity of dairy inspection methods is not exactly the purpose of this paper. In the first place the members of this Association, from long and intimate contact with the Dairy Division of the Bureau of Animal Industry of this Department, are already well acquainted with the past accomplishments and present activities of this unit.

It is my purpose to present to you what is being attempted through another branch of the Department, namely, the Bureau of Chemistry, and through the Office of Cooperation of which I happen to be in charge at the present time. As many of you are aware, this office had its inception about ten years ago at the request of many of the representative state officials who desired a closer harmony in action and better exchange of information between State and city officials on the one hand, and the Federal Government through the Bureau of Chemistry on the other. This office has been maintained throughout the past ten years with an infinite degree of satisfaction to the Federal officials, and we sincerely trust that it has afforded proportionate if not equal benefit to the State and city officials who are charged with enforcement of regulatory dairy, food and drug laws. I shall not attempt to enumerate the several functions ascribed to this office or the plans for the execution of these activities except to say that it is the accepted policy to cooperate in every manner with State and municipal health, food and drug officials. Aside from the Office of Cooperation at Washington, we maintain seventeen branch laboratories in different parts of the United States, the personnel of which come in frequent if not almost daily contact with the State and city officials in their respective sections. Through these contacts we have established a type of cooperation which we believe to be most fortunate for the accomplishment of the ends sought in the various legislative enactments relating to food and drugs.

In order to explain more intelligently the present attempt at uniformity, it is perhaps essential to say something of the organizations of regulatory officials which may possibly be unknown to some of the members present. The Association of American Dairy, Food and Drug Officials is probably fairly well known, since it has been in existence for twenty-seven years. Membership in this Association is confined to Federal, State and municipal officials who are charged with enforcement of regulatory dairy, food and drug laws, holding annual sessions for the presentation of papers dealing largely with administrative phases of the work and to which are invited so-called trade representatives, that is, those persons who are interested in that the products of their manufacture and distribution come within the jurisdiction of the several Acts. In addition to this main Association or parent body, there have been formed so-called sectional associations, seven in all, consisting of five to eight states each, which have been organized with identical purposes but with the idea in mind that their similar geographical location presents more or less specialized topics for consideration, more appropriate for deliberation in these so-called group meetings than at a national convention. The formation of these sectional associations was also expected to stimulate a cooperative interest between many of the city officials with the State authorities in each group and to anticipate attendance on the part of chemists and inspectors who in many instances are denied the privilege of attending a national convention. These associations, it should be said, include every State in the Union having a dairy or food law, which means that 47 states have allied themselves with these sectional organizations.

It is interesting to note that at the time these various groups were organized, in nearly every one of them provision was made for a standing committee to promote uniformity in inspection methods. How much has actually been accomplished through the deliberations of these committees which were appointed is somewhat difficult to say, but the important fact to consider is that the seed of uniformity was sown and that the tree still continues to grow. The problem has recently perhaps been considered from a somewhat different angle. It is realized that in order to secure uniform inspection methods, it is first necessary to secure uniformity in administrative procedure and such administrative procedure, in turn, is largely dependent on uniform rules and regulations. The question of uniformity in laws, rules and regulations has for many years been a subject of discussion at the annual meetings of the National Association of Dairy and Food Officials, and apparently without definite accomplishment. The suggestion was made that in order to secure such uniformity or at least to make a start toward it, it would be advisable to undertake this problem through the sectional associations above referred to. The fact that the geographical grouping of these sections would naturally make a similarity in products produced, manufactured and distributed, would largely tend toward uniformity in legislation, and it would be logical to attempt to secure similar rules and regulations among the member officials.

With this view in mind, a start was made in December, 1922, in one of the organizations known as the North Central States' Association of Dairy, Food, Drug and Feed Officials, which comprises a membership of seven states in the Missouri Valley section. A committee was appointed representative of the various states in the Association, who met for the greater part of a week, devoting three sessions a day to the preparation of a set of uniform rules and regulations. These were completed and adopted at an annual meeting of this Association following the committee meeting. These regulations, it should be stated, follow largely the rules and regulations which relate to the Federal Food and Drugs Act and cover merely general regulations on which are to be based from time to time specific regulations applying to various dairy and food products. Since that date, similar committees have been appointed in five out of the seven group associations and it is expected that the two remaining associations will very shortly announce the appointment of similar committees. The rules and regulations which were adopted by the North Central group of states have been tentatively adopted by one other group association and are being considered for adoption by two other associations at the present time.

I think it is pertinent here to call attention to the chief difficulty which was experienced in the first attempt to formulate these uniform rules and regulations. As you all know, there are many food officials generally well informed and perhaps somewhat more progressive than the average, who have evolved a code of rules and regulations for the conduct of their departments which they consider nearly letter perfect and of paramount importance for the proper conduct of that department. There is no disposition to question the good intentions or the ability of this type of official, but I have had no hesitancy in so far as my connection with this work is concerned, in suggesting to such officials that they sacrifice, perhaps, for the time being, certain of their particular requirements in order to bring such rules and regulations into conformity with the judgment of the majority of the members. If we are going to have a coordinate plan, there must be a sacrifice in some instances and I fully believe that it is warranted, if thereby we may proceed as a unit and on a common basis. I think it is not irrelevant to point out in this connection the analogy between uniform administrative procedure and standard methods of analysis. We have agreed upon standard methods of analysis, both chemical and bacteriological, for food, drug and dairy products, and while independent investigators may and frequently do offer improvements on the existing methods, for the great body of official analysts to follow each modification or accept, if you will, various changes in analytical methods would soon lead to a most unfortunate state of affairs, since we would fail to receive the benefit which should accrue from standardization of methods, and that is concordant results. It is just as desirable for administrative officials to adopt a uniform mode of procedure as it is for the official analyst.

The conclusion may have been formed in your minds that this is in a sense somewhat remote from uniformity in dairy and milk inspection methods, and the conclusion is justified when one considers the vast amount of work which is done by the city authorities in the control of market milk, particularly those cities which have laws or ordinances designed particularly to meet the needs of the municipality and many times not in harmony on all points with the statutes of the State in which the city is located. Nevertheless, this is an attempt on the part of officials, a sincere effort to get together and formulate working plans which shall be uniform and shall act as a guide in their respective jurisdictions. If it should eventually be possible, therefore, to secure complete uniformity of administrative procedure, at least so far as State officials are concerned, may we not hope that it can be continued until our regulations are uniform for states and cities alike. Conflicting rules and regulations are not satisfactory from the official's point of view and certainly do not contribute to the hearty and unimpeded growth of a vital industry such as dairying. While this represents only in a limited sense what the Department of Agriculture is doing, I trust you are in full sympathy with the attempts which are being made by this one unit and will pardon me if my paper appears to be somewhat misbranded within the meaning of the Act.

"In any great movement, such as that in which we are engaged, nothing is more necessary than sanity, than the refusal to be led into extremes by the advocates of the ultra course on either side."

REPORT OF COMMITTEE ON COMMUNICABLE DISEASES AFFECTING MAN—THEIR RELATION TO THE MILK SUPPLY AND TO THE PUBLIC HEALTH

DR. G. K. COOKE, *Chairman*

In considering the subject to be reported on at this meeting, it has seemed to some of the Committee that it would be an advisable preliminary to future activities to again survey the general situation throughout the United States with particular regard to the incidence of definite milk-borne infection. With this point in view, a survey relative to the above conditions was attempted, covering the milk supply and public health records of every city in the United States having a population of 50,000 or over, aggregating 113 cities, with a total population of 33,927,924.

Responses were obtained from sixty-eight cities comprising a population of 17,774,776. However, these results are informative inasmuch as the replies were well distributed over the present public health area of the United States. Among the sixty-eight cities heard from, only three reported epidemics or cases definitely traced to milk-borne infection of human origin or otherwise. Two were of typhoid fever and the third, an epidemic of septic sore throat.

Considered individually, we will first review the epidemic of septic sore throat. This outbreak occurred in a city with a population of approximately 270,000. Before control could be instituted, in fact during a period of five days, there occurred 487 cases with 22 deaths. These cases occurred for the most part among those people consuming the milk produced by a single raw milk dairy which had been rated as one of the best in the city. Within twenty-four hours after the health bureau had ordered the heating of the milk at this dairy, the incidence of new cases declined to such an extent that the few which appeared could be ascribed to contact infection. The causative organism was a hemolytic streptococcus obtained in almost pure culture from the inflamed udder of a milking cow, a milker's throat and the throats of numerous septic sore throat patients and contacts. As the strains were all shown to be of human type, it is very probable that the milker in question infected the cow's udder and that upon her milk being mixed with that of the herd, the resulting massed infection gave rise to the epidemic. This outbreak is of particular interest because of the fact that in spite of comparatively early control and also in spite of the fact that this dairy was one which had been producing a very high grade product, a large number of cases of disease of serious nature, with a mortality rate of over four per cent, developed before the situation could be controlled.

An epidemic of typhoid fever occurred in a city of 432,000. In this outbreak thirty-five cases of typhoid fever, with three deaths, were traced to a known typhoid carrier employed as a dairyman on a farm supplying this city with milk. Although the report does not so state, we conclude that this milk was delivered to the consumer in the raw state.

A second epidemic of typhoid fever was reported from a city of approximately 170,000 as follows: There were thirty cases of typhoid fever in one district. Eight of these had no definite data including milk and one was a non-resident. Of the remaining twenty-one cases, twelve were on the same milk route and seven occurred previous to investigation. Investigation gave evidence of insufficient sterilization of bottles at the dairy plant with absence of demonstrable carriers among the dairy force and farm producers. Following this, there were no more cases for a period of two months, when six cases occurred, five of which were reported as consuming this milk. High bacterial milk counts were reported during this period. Seventy-five per cent of the total cases were under the age of sixteen years.

This investigation apparently did not definitely fix the responsibility for, or locate, the original cause of this infection according to the report received; however, it threw suspicion on this particular part of the milk supply, and was considered by the local health department as a milk-borne outbreak.

An interesting feature of all these outbreaks is the fact that apparently in each case, the infection was spread by a raw milk supply. The absence of any reports of epidemic disease traced to pasteurized milk speaks very highly for the present day efficiency of commercial pasteurization as a public health safeguard.

In regard to the specific outbreaks reported, the systematic medical inspection of all milk handlers might probably have eliminated the typhoid outbreaks, but it is very doubtful that such routine examination would have prevented the presence of the epidemic of septic sore throat. Apparently, it is true that a raw milk supply carries a certain potential danger and as long as part of our milk supply is delivered to the public in a raw state, our greatest safeguard lies, not alone in thorough supervision, but in building up the morale of milk producers and handlers to such a point that not only the quality, but the safety of their product, from a public health standpoint, are regarded as indispensable factors in the ultimate success of their business.

At the time this survey was made, it was thought that it might be interesting to attempt to determine the relation possibly existing between infant mortality, particularly those deaths occurring from dysentery and enteritis, and the non-specific bacterial count of the milk delivered to the general public as determined by the standard agar plate method.

The latest complete records available were those of the calendar year 1922. With this data as a basis, a number of charts and graphs were prepared, the basic graph showing a curve based upon the yearly average bacterial count of milk delivered in the various cities; the second curve was based upon the death rate in infants under one year, and the third graph showed the infantile death from dysentery and enteritis under two years. A comparison of these graphs showed no constant relation between the before-mentioned items with the exception of the fact that the median curve showed the rate in infant mortality under one year to gradually increase with the average bacterial count of the milk, in spite of numerous individual exceptions to the rule.

The median death rate in infants under one year for those cities having a milk supply averaging 15,000 bacteria per cubic centimeter or under was about sixty, while that of cities with a milk supply averaging over 100,000 was approximately eighty-five.

While the committee fully realizes that there are a number of important factors relating to infant mortality during the first year of life, we believe that the character of the diet exerts a profound influence in this regard, which opinion is borne out by the foregoing survey.

"Men approach most nearly to the gods in their effort to protect public health."

THE DANGERS FROM BUTTER AS A CARRIER OF DISEASE

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About fifteen years ago, in an article on the occurrence, vitality and significance of tubercle bacilli in butter, I published a statement, virtually as follows: Among the articles of food commonly eaten in a raw state nothing has a wider distribution than butter, and next to milk nothing is of greater importance. It appears on most tables at every meal and is eaten two or three times daily by most persons who can afford to buy it. It may be kept long periods of time and transported long distances without becoming unpalatable, and those who eat it are seldom able to inform themselves about its mode of preparation and other facts that bear on its possible contamination with disease germs. Hence, butter must be regarded as a vehicle in which disease germs may be carried long distances from their sources directly into human mouths and stomachs in a way against which the individual has no sufficient means to protect himself.

If this statement requires revision because of the knowledge gained since it was published, it should be made stronger and not weaker, as we have learned during recent years that butter is a more valuable food than we formerly realized, and that the length of time pathogenic bacteria may remain alive and retain their virulence in it is greater than the tests made by earlier investigators proved.

We know today that butter is a food of which the abundant use cannot be too much encouraged, and for which, because of the fat-soluble, food-accessory factor it contains, imitation butters, though they may be wholesome and nutritious, cannot be used as substitutes; and we know that disease germs, like tubercle and typhoid bacilli, may remain alive from five to six months in butter kept under commercial, cold-storage conditions.

Clearly to appreciate that no adequate regulations for the protection of the public health govern the manufacture and transportation of butter requires that we should have in mind several facts, which, briefly, are as follows:

The milk from which cream is obtained to make butter is of no better quality and no more exempt from dangerous contaminations than ordinary market milk, and that raw market milk may be dangerously contaminated with disease germs is indisputably proved by the numerous epidemics of typhoid fever, scarlet fever, diphtheria and septic sore throat that have been traced to its use, to say nothing of the fatally serious intestinal troubles among artificially fed infants and cases of bovine tuberculosis among infants and children for which it must be held responsible.

Raw milk, produced under the best economically practicable conditions, may be heavily infected with disease germs, some of which multiply abundantly in milk without changing its appearance, odor or taste, and the presence of which our senses cannot detect in the cream obtained from the milk or in the butter made from the cream. Even certified milk, a high priced and relatively rare article, is not invariably safe, because tubercle bacilli have been found in some samples and no sufficient means are available to protect it against contamination with infectious material expelled from the bodies of apparently healthy and unsuspected carriers and disseminators of disease germs.

Ambulant carriers and disseminators of disease germs, who are apt to infect milk if they are dairy employees, are more numerous than they are commonly believed to be. They include individuals who are so resistant against an infectious disease that its germs, though they multiply in their bodies, do not appreciably affect their health; individuals in whom disease germs cause an affection so mild that it passes as an unimportant indisposition; individuals in the incubative stages of infectious diseases who begin to expel disease germs before recognizable and diagnostic symptoms are manifest; individuals who, consciously or unconsciously, have been in contact with those who are expelling disease germs, and individuals who continue to harbor and expel disease germs for months, sometimes years, either continuously or intermittently, after seeming complete recovery from an infectious disease.

The harm such individuals may do through the contamination of dairy products with the germs they expel is convincingly illustrated by a milk-borne epidemic of septic sore throat which occurred this year in one of our Western cities. This epidemic, which spread rapidly among the customers of one of the city's best dairies, numbered 487 cases of disease with 22 deaths, and the source of infection was found to be a dairy employee affected with a mild sore throat. The published account of the epidemic, the further spread of which was stopped by heating the milk of the responsible dairy, is unusually instructive, as it presents fairly complete data on the character and severity of the harm suffered by the persons who survived; data which are not pleasant to read, of a kind usually not sufficiently emphasized, and which therefore are likely to escape the attention they merit when the importance of epidemics is measured mainly by the number of lives they claim.

Carefully made tests prove that cream, irrespective of whether it is separated from milk with a centrifugal machine or is skimmed from its surface after it has stood for the cream to rise, contains more germs, volume for volume, than the milk from which it is obtained. A large proportion of the bacteria cling to the cream globules with a tenacity that cannot be broken by centrifugal or gravitational force. It has been estimated that approximately 60 per cent of the bacteria in milk become enmeshed in the cream and that about 40 per cent sink to the bottom as sediment.

Butter made from infected cream has been proved, repeatedly, to be infected butter. Churning cream to make butter and washing and working the butter does not remove the germs or reduce their virulence. The salt added to butter, while salt has real germicidal power, has not been found to reduce the length of time tubercle bacilli live in it.

The most potent natural enemy of pathogenic microorganisms is light. The sterilizing action of light on disease germs harbored in various substances is facilitated by desiccation, in part, probably, because drying leads to disintegration or crumbling, or a falling apart, through which the germs imbedded in an infected substance are more effectively exposed to light. Hence, if the question were asked, "In what kind of substance would disease germs remain alive and retain their virulence longest?" the reasonable answer would be, "An opaque, moist, bland substance, into which rays of light cannot penetrate, from which the moisture cannot readily evaporate, which changes only slowly through decomposition and which is neither strongly acid nor strongly alkaline."

Nothing among the numerous articles used as human food possesses the defined qualities more perfectly than butter.

But we do not have to depend on circumstantial evidence to prove that disease germs are present in butter derived from infected milk, or that they remain alive long periods of time in it. This has been concretely proved by many investigators, and in this connection one series of experiments made at the Experiment Station is interesting.

Butter was made with the cream obtained from the milk of a tuberculous cow in which the disease had extended to the udder, and tested for virulent tubercle bacilli through the periodic, intra-abdominal injection of guinea pigs. It was found, after the butter was more than five months old, that it was still sufficiently infectious to cause generalized tuberculosis in the guinea pigs.

This work was criticized by the editor of one of our important agricultural or dairy journals, I don't remember which now, who said, "It would have been more convincing if the guinea pigs had been fed the butter in the place of having it injected into their bodies."

As I knew that the most delicate test we have for the presence of living tubercle bacilli is the injection of guinea pigs, and that the development of tuberculosis in guinea pigs as the result of their injection with infected material could not be taken as proof that it contained the bacilli in sufficient numbers, or of sufficient virulence, to cause tuberculosis among persons who used it as food, I regarded the criticism as reasonable, and immediately planned another experiment, in which infected butter was fed, and not injected, and in which the experiment animals were hogs, and not guinea pigs.

In the later experiment, a number of hogs, proved free from tuberculosis by a study of their history and tuberculin tests, were fed, in addition to their regular feed, a small quantity of infected butter daily, for about two weeks. The amount received by each hog on each day was no greater than the average adult eats, and the butter used in this experiment was all a hundred days old or older. The result was that the hogs contracted tuberculosis.

No one, I am sure, will claim that infected butter which can cause tuberculosis in hogs that are permitted to eat small quantities of it is a safe food for human beings, and no one will doubt that it should be condemned as dangerous food for children, who have been proved beyond all question to be susceptible to bovine tuberculosis.

How long other disease germs than tubercle and typhoid bacilli remain alive in butter I am not definitely informed, but no evidence has been discovered that permits us to assume that they die or lose their virulence in it in a short time.

When we think of milk and its products as agents for the dangerous dissemination of disease germs, we must keep in mind that milk is a medium in which several kinds of disease germs rapidly multiply and become very numerous, and that disease germs in contaminated dairy products are not on their surface but are imbedded in their interior and distributed throughout their entire mass. Else we might say, "Why all this talk about disease germs in milk, cream, butter and cheese when there is relatively so little talk about other articles of food that may have been exposed to unsuspected spreaders of disease germs?"

Germs deposited on the surfaces of solid substances, like bread, fruit, etc., do not multiply, and through their exposure to light soon lose their virulence and die.

If the disease germs, undoubtedly often sprayed from the mouths of persons to the surfaces of solid articles of food displayed in our shops, multiplied, or long retained their virulence, or were sufficiently numerous to cause attacks of disease in others than uncommonly susceptible individuals, the population of the world would not have reached its present numbers.

In other words, there is much less need to feel apprehensive about a loaf of bread, with its hard, dry exterior, that may have been exposed, unavoidably or through carelessness, at some stage during its transportation from the oven to the consumer, to unsuspected carriers and disseminators of disease germs or other sources of infection, than about milk used either as a beverage or to make cream, butter or cheese. I do not say this because I believe it safe to handle any article of food in a careless or uncleanly manner, but because I wish to emphasize the great difference between dairy products and most other articles of food as vehicles for disease germs.

It is plainly possible that butter made from the milk of a tuberculous cow may be shipped completely around the world and thereafter cause tuberculosis in the child that eats it. No one can doubt this who knows that butter, infected with tubercle bacilli, a hundred or more days after it was made, caused tuberculosis in hogs to which it was fed in small quantities. It is also possible that butter infected with tubercle bacilli, or with typhoid bacilli from the body of an unsuspected carrier and disseminator, may be made in any State of the United States and shipped to a dozen or more other States and serve as the cause for tuberculosis or typhoid fever in every State it reaches, though hundreds or thousands of miles separate the different States.

The danger of the spread of infection from persons who are known to be affected with infectious diseases is reduced to a minimum through quarantine, though we must not overlook that most persons who contract infectious diseases become active disseminators of disease germs before the nature of their sickness is recognized and quarantine leads to their segregation, and that their liberation from quarantine too rarely is made dependent upon proof that they have ceased to be sources of danger.

Those who have studied the factors on which the spread and perpetuation of contagious diseases depend, can hardly fail to realize that two things must be ranked as of prime importance: Direct contact of susceptible individuals with unrestrained, often unsuspected, disseminators of disease germs, and indirect contact with such disseminators through articles of food in which the germs may either multiply and become very numerous or remain alive and virulent a long time.

Our health officers and physicians, who know how difficult it often is to trace epidemics, and more particularly isolated cases, of infectious disease to their sources of infection, might pertinently ask, "How often, if our means of investigation were sufficient to reveal the truth, would such epidemics and cases be proved chargeable to infected butter?"

The conclusion the facts support I believe may be stated as follows:

To secure a safe butter supply requires that we should add to the widely practiced pasteurization of milk distributed to the consumer as milk, the pasteurization of all cream used to make butter. It is the only available, economically reasonable expedient that has been proved over and over again to afford protection against the dangers that too often lie hidden in raw milk and its products.

And now I wish to say something cheerful and encouraging, and I am glad I can do so, because I would be very sorry if my attempt to define the excellent qualities of butter to serve as an agent for the wide and dangerous dissemination of disease germs should lead anyone to believe that it is wise to cut it from his diet.

In my estimation butter, next to milk, is the most important article of human food, and much of the value of milk depends upon the butter-fat it contains; and if I should be asked today whether I was willing to abandon the use of butter as food to escape the dangers that may lie concealed in it, my answer, unhesitatingly, would be, "No." A number of years ago I would not have answered so quickly or positively, and the reason for this lies in the studies I have made on the occurrence of virulent tubercle bacilli in market butter.

The available evidence fifteen to twenty years ago required that we should look upon market butter as more commonly infected with virulent tubercle bacilli than market milk, though the frequency with which such bacilli could be found in market milk was ominously great. Contrary to this, tests of market butter made a few years ago showed, though 7 per cent of the samples tested were found on microscopic examination to contain acid-fast bacilli, optically indistinguishable from tubercle bacilli, that only 1 per cent was capable of causing tuberculosis on injection into experiment animals.

A most excellent and encouraging showing. The microscopically determinable, non-pathogenic, tubercle-bacillus-like microorganisms in the butter were either harmless acid-fast bacteria or tubercle bacilli that had been killed by the pasteurization of the cream from which the butter was made.

A large number of routine tests of market butter made during the present year revealed virulent tubercle bacilli in the product of only one manufacturer. Again an excellent showing, and I am informed by those who should be conversant with the subject that the pasteurization of cream from which butter is made is now a common practice, especially in large establishments, which is increasing at a rate equal to the rapidity with which pasteurizing machinery can be obtained.

The one manufacturer whose butter was found to be contaminated with living tubercle bacilli this year, on being informed about the dangerous condition, not only at once adopted corrective measures but took special pains to make sure that they should be effective, and his conduct in this matter, I am pleased to say, is a pattern of the manner in which all butter and cheese manufacturers have acted with whom I have had contact because of the presence of disease germs in their products.

No doubt, if nothing at all was done, only a few years would pass before the pasteurization of cream from which butter is made will have become so general that butter will be one of the safest of all foods, but in the meantime it seems that we should go as far as we reasonably and economically can to protect every person against the dangers that may lie concealed in butter made from raw cream and against which the individual is incompetent, no matter how intelligent and capable he may be, to protect himself under existing conditions.

A few cases more of preventable infectious diseases, a few more unnecessary and preventable deaths, may make no great showing in morbidity and mortality tables, but this is no consolation for the victims and those who are interested in them.

The presence of dangerous microorganisms, or disease germs, in one or two among every hundred samples of butter tested is not a harrowing calamity, and they who know how great an improvement this is over the conditions of a few years ago will not look upon it as such, but it is a matter of too much importance to be ignored, especially as there is a very simple way to enable intelligent persons to protect themselves and the members of their families against butter-borne dangers. The way I would suggest is the enactment of a law that would require every butter manufacturer to show in plain letters on the wrappers or containers in which his butter is marketed whether it is made from pasteurized or raw cream.

A law of this kind would inflict no hardships; it would not force the manufacturer of butter to install and use pasteurizing machinery; it would merely require correct and sufficient labeling; it would not deprive those who prefer butter churned from raw cream from exercising their choice; it would prevent the lovers of raw butter from being deceived into securing a kind of safety they either do not want or do not believe they need, and it would make it possible, and this is the thing of prime importance, for those who know how easily butter may be contaminated with disease germs, and how long such germs may live in it, and how far such germs may be transported in it without losing their virulence, to select the kind of butter they may eat without fear, and which mothers may give to their children with confidence that it will benefit and not injure them.

It would be reasonable to demand at least that all butter intended for interstate shipment should be so marked that the consumer need be left in no doubt as to whether it is made from raw or pasteurized cream, and that the manufacturer who misrepresented his product should be made to pay for it.

As it may occur to some of you that the enforcement of a law of this kind would be difficult, I wish to say in conclusion that I am currently testing samples of butter, and that, if a law of the kind I have suggested was enacted, these butter tests would soon open a way to bring those who violated it to an accounting.

I might add that just six years have passed since I addressed this Association, at its meeting here in Washington, on the occurrence of disease germs in cheese. I pointed out that approximately 14 per cent of the samples of cream cheese I examined in the year 1915 were infected with living virulent bovine tubercle bacilli; that corrective measures were at once devised, and that cream cheese during the next year was wholly free from such bacilli. Since then I have currently tested samples of cream cheese, many of which were secured through the agency of the Dairy Division of the Federal Bureau of Animal Industry and the Federal Bureau of Chemistry from widely different portions of the country. With the exception of a few samples obtained from one manufacturer, all the numerous samples tested were free from virulent tubercle bacilli. The one manufacturer, as far as I could learn, was a new man in the cream cheese business, and his cheese now also is safe and free from living tubercle bacilli.

I promised, in my address six years ago, that cream cheese, which many physicians reasonably recommend as an excellent food for invalids and children, should be kept free, if I could keep it free, from disease germs. Hence, if I say now, we will find means to enforce a law which requires that butter shall be labeled so that the consumer may know whether it is made from raw or pasteurized cream, I am not talking altogether from the standpoint of an inexperienced enthusiast.

"They are slaves who fear to speak
For the helpless and the weak."

PROGRESS OF BOVINE TUBERCULOSIS ERADICATION WORK IN THE UNITED STATES

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Having addressed your Association last year in St. Paul, it probably would have been better had you called another person for this assignment. However, I appreciate the distinction of taking part this year because of the close relationship of this Association with the World's Dairy Congress which will have its opening session in this city tomorrow.

Tuberculosis eradication work is being conducted in every State comprising the United States. In some of the States the task of suppressing the disease in livestock is a simple one because of the slight degree of infection. In other States it is a tremendous problem because of the large number of infected herds and the high percentage of tuberculous cattle in those herds. Fortunately, there are 48 States in the Union, each having sovereignty over its own livestock and exercising its free judgment in mapping out and carrying into execution plans for eradicating the disease.

It is needless to remind an audience like this of the importance of eradicating tuberculosis of livestock. Our cattle and swine on farms on January 1, 1923, were valued at more than $3,000,000,000. It is perfectly natural that the livestock owners of America should protect an interest of such magnitude; especially is this so with respect to the ravages of tuberculosis—an eradicable disease. Our livestock owners have always shown an intense intolerance for diseases that injure their animals. Forty years ago, when pleuro-pneumonia was introduced into the United States, vigorous measures were inaugurated because of the demand of livestock owners to exterminate it. In a brief time it was eradicated and no pleuro-pneumonia has since attacked our animals. On several occasions foot and mouth disease gained entrance to America in various ways, and it was entirely suppressed. Many years ago it was found that when cattle from the Southern part of the United States were shipped or otherwise moved North and came in contact with Northern cattle, losses resulted among the native animals. Our cattlemen protested strenuously against the movement of the Southern cattle and demanded a reason why they produced disease, and their demands were so persistent that every effort was made to ascertain the cause of the disease known as Texas fever.

Smith and Kilbourne, working in the laboratory of the Bureau of Animal Industry, discovered that the cattle tick was the host of the Texas fever organism. The life history and habits of the cattle tick were studied by Dr. Cooper Curtis. Knowing the cause of the disease and the life history of the tick, there yet remained much work to be done in ridding the South of the disease. It does not respond very well to treatment and immunization against the disease is not satisfactory; even some of the cattle brought up from calfhood to maturity succumb to Texas fever, so there was no alternative but to find a means of eradicating the tick.

This work has been in progress since 1906. Satisfactory progress is being made, vast areas are entirely free of ticks and in those areas the cattle industry has undergone great improvements.

The reason livestock owners demand that a vigorous campaign be waged against tuberculosis is perfectly obvious. If it were not a matter of financial difference to the producers of cattle and swine there would probably be less demand to check the progress of the disease. However, the losses sustained annually by reason of the condemnation of carcasses of cattle and swine by meat inspection services, National, State and municipal, has made a strong impression on the minds of those persons who raised these animals, the ones who fed them, and the purchasers of these apparently healthy animals that are condemned as unfit for food. All of these interests suffering financial losses mutually have united in an energetic effort to check the constant and ever-increasing loss. The death of an animal on the farm occasionally is expected, but when the farmer puts an entire crop of alfalfa and corn into cattle and swine, he sustains a great shock when after shipping them to market he learns that a considerable percentage of them was condemned on account of tuberculosis.

It was due to the demand of the livestock owners that the Bureau of Animal Industry was directed by Congress to take up the work. I mention these various diseases because they illustrate the viewpoint of the American livestock owner toward infections. He detests animal disease and is willing that his property be taxed to raise funds to eliminate them.

The campaign in this country against tuberculosis commenced in 1917 in a very modest way with a Federal appropriation of $75,000.00 and with but a comparatively few States prepared to take up the work. The underlying principle in the campaign is that it shall progress on its own merits. No special effort is made to induce States, counties, or any organization to appropriate funds to carry on propaganda. Experience has demonstrated that in order to put a large project across it is necessary to have strong support from the owners of livestock.

The plan was launched early in 1918, and for a period of two years made headway slowly. At that time veterinarians sent into the field were obliged to travel long distances in order to test those herds whose owners had signed agreements. The work was expensive and caused considerable apprehension on the part of those in charge on account of the cost per head of applying the tuberculin test. There was then a stronger feeling against the tuberculin test than there is today; although even at this period many people are skeptical as to its reliability. Tuberculin is a product that, in many instances, in the past, was greatly abused. It was easily procured and in some instances used by individuals who were not always guided in the right direction when positive reactions were obtained. But to those familiar with tuberculin, its reliability and its limitations, there can be no other verdict but that it is one of the most reliable diagnostic agencies for the detection of disease whether it is used subcutaneously, intradermically, or ophthalmically.

After more than thirty years of use in the United States, it is the almost universal judgment of veterinarians that an animal that reacts to tuberculin is infected with tuberculosis. Within a brief space of six years, this work has developed to the point where it could be made practically State-wide, especially in those States where tuberculosis exists to any considerable degree, provided funds were available for operating expenses and for the payment of indemnities.

For example, take the great livestock State of Iowa, where prior to 1917 the annual appropriation made by the State legislature for animal disease control work was practically negligible. In this State within a period of two weeks the livestock owners of twenty-six counties have signed petitions requesting complete county tests which were presented to their respective County Boards of Supervisors. Under the provisions of the law enacted by the legislature during the past winter these boards are obliged to levy a tax of not to exceed three mills on all property for the purpose of raising funds to pay indemnity for tuberculous cattle; these funds to be used only after the State appropriation of $250,000.00 per annum is exhausted.

Not more than twelve or fifteen years ago, at the urgent solicitation of dairymen in Illinois, all acts on the statute books requiring the use of tuberculin were repealed. The antagonism toward tuberculin in that State was very bitter. The sentiment has changed; it is a remarkable change. At this time thirty-four counties in Illinois are engaged in tuberculosis eradication work, their boards of supervisors have appropriated about $135,000.00 for expenses, and among them are those in which the inhabitants were bitterest toward the use of tuberculin a few years ago.

Remarkable progress is also being made in the testing of cattle in other States, including California, Indiana, Michigan, Minnesota, Missouri, Montana, New York, North Carolina, Pennsylvania and Wisconsin. In each of these, during the year ending June 30, 1923, more than 100,000 cattle were tested under the official plan. Wisconsin led the States with about 281,000 head tested.

This list includes most of the principal dairying and cattle and swine breeding States. It, therefore, seems safe to assume that the owners of livestock in these and other States believe in the economic importance of tuberculosis eradication. The records of the Bureau show that they do believe in it to the extent that there are five million cattle under supervision in the United States for the control and eradication of the disease.

THE ACCREDITED HERD PLAN

This plan, as you know, was adopted by the United States Sanitary Association in December, 1917. It provides for the accrediting of individual herds which pass two annual or three semi-annual tests without reactors. On September 1, 1923, there were about 31,000 accredited herds; in addition there were about 33,900 once-tested free herds, and in all, 442,000 herds under supervision for the eradication of tuberculosis.

THE AREA PLAN

In outlining the plan of operation in 1917, area work was contemplated and was described at that time as eradication of tuberculosis from circumscribed areas. No attempt was made then to launch that idea; it was held in reserve until it was believed the proper time to advocate it had come. In due course of time it seemed proper to start the work on that basis, and a number of State veterinarians inaugurated the work in their respective Commonwealths. The area plan contemplates the eradication of tuberculosis from livestock within the geographical lines agreed upon, usually a county. That means that all the herds and all the cattle shall be tuberculin tested, and that the reactors shall be branded and held in quarantine until destroyed in accordance with the regulations. This work, as well as all other phases of the regulatory work, is done under the live stock sanitary regulations of the respective States. The Bureau of Animal Industry is a cooperating agency and works with the State on invitation extended by the proper State official.

There are two features of the area work that are deserving of attention. First: testing of cattle in a township. This requires the services of only two or three veterinarians. The other method is to conduct a drive in a county; that is, to put in a sufficient number of veterinarians to test all the cattle within a period of two or three weeks. In counties where there is a limited amount of tuberculosis it is entirely satisfactory to conduct a drive. There are usually detailed thirty or forty veterinarians, including the local practitioners if they desire to participate in the drive. However, in localities where there is a high percentage of the disease, this cannot be done on account of the enormous cost of indemnities.

There are at the present time more than 200 counties engaged in area work in the United States. In practically all these counties 100 per cent of the cattle are tested. It has become quite a common practice in area work for the County Board of Commissioners to employ one or more veterinarians to devote their entire time to testing. Our experience has been that it is to the interest of the local practitioners to aid in such campaign. A number of local men have taken part in these drives and thus become acquainted with a larger number of livestock owners. The area plan is growing in popularity and it is believed that eventually the campaign will resolve itself into that one project because of its superiority in many ways to the accrediting of individual herds. The work can be done more satisfactorily and there is less danger of reinfection. In short, it appeals to the livestock owner as the most practical method of making progress against tuberculosis.

MODIFIED ACCREDITED AREA

In accordance with the plans of the uniform accredited herd work, whenever all the cattle in a county have been tuberculin tested and tuberculosis is reduced to not more than one-half of one per cent of all the cattle in the county, that county may be recommended to the United States Secretary of Agriculture, who has agreed to class it in what is known as a modified accredited area, and cattle from such an area may be shipped interstate at any time for any purpose without being tuberculin tested, provided a permit is obtained authorizing the transportation company to receive such shipments. Acting under this plan there were released during July, 1923, 17 counties located in the States of Michigan, Indiana, North Carolina and Tennessee.

At the annual meeting of the American Institute of Meat Packers in 1922, a resolution was adopted to the effect that when hogs are shipped for slaughter to market points from modified accredited areas, the packers agree to pay a premium of ten cents per hundred for the same, provided they are found free of tuberculosis. In order to prevent reinfection among the herds in the modified accredited area, the various States have adopted regulations requiring the tuberculosis testing of all cattle moved into such areas regardless of whether they be intrastate or interstate shipments. Modified areas should prove of great value to livestock owners and others connected with the industry.

TUBERCULOSIS INVESTIGATIONS

It is customary in the Bureau to annually compile a summary of the various activities for each fiscal year. This report as it pertains to tuberculosis eradication has recently been completed. The following on the progress of the work and tuberculosis investigations may be of interest:

SEGREGATED TUBERCULOUS HERDS IN THE UNITED STATES

An investigation was made relative to the extent to which the segregated system of handling tuberculous cattle was being followed in the United States. Summarizing the data, it appears that on June 30, 1923, there were only 201 herds, containing 2,461 cattle, in the United States which were being maintained strictly under the segregated system. In addition to this there were 191 premises on which were located 447 diseased cattle which were being held for various reasons for an indefinite time. This is a total of 392 premises on which there are a total of only 2,908 head of cattle which have been held longer than the usual 30 day period.

A noteworthy feature in connection with this system of handling tuberculous animals is that 212 of these premises, containing 1,909 animals, or 66 per cent of the total being held, are found in six States in which tuberculosis in livestock exists rather extensively. Reports of 18 States indicate that no segregated herds are being maintained, while in five other States the records show that only five or less diseased cattle are under quarantine for any indefinite period of time. These figures are impressive when it is shown that there were condemned as a result of cooperative testing during the three years ending June 30, 1923, 250,181 head of cattle. Evidently, the progressive American farmer does not look with favor upon this method of handling the tuberculosis problem.

If I understand the sentiment of the livestock owners of the United States they do not want to trifle with the tuberculous cow, as is indicated by the very small number of segregated tuberculous herds maintained in the country. You may call it sacrifice or a waste of valuable animals, or ruthless destruction, or disregard for the posterity of the respective breeds of cattle, or whatever else you desire, but, nowithstanding the fact that many States permit the keeping of tuberculous animals under segregration on the farms, there are, comparatively speaking, but few such herds maintained in the United States. Since this campaign began more than one-fourth of a million tuberculous cattle have been officially destroyed.

Tuberculosis in calves. There is another reason why the course that is being pursued is more desirable than holding tuberculous cattle for indefinite periods on farms where tuberculosis-free cattle are maintained. I refer to the danger of continued infection of calves from tuberculous cows held in segregation. Many of us were taught that tuberculosis of prenatal origin was unknown, but that the offspring of a tuberculous mother was predisposed to the disease. We have data which prove beyond question that in some localities at least calves from two days old to two weeks old are affected with generalized tuberculosis. From one small meat-inspection establishment, 23 cases of generalized tuberculosis in young calves were reported in five months. This should be an interesting point because at several of the examinations for accredited veterinarians a question was asked about the necessity for testing calves and at least 50 per cent of the answers were that calves under six months of age need not be tested. The records show that in infected herds more than three per cent of the calves under six months of age are tuberculous. It is considered advisable to test all the cattle in the herd.

Indemnity claims. There were paid during the fiscal year ending June 30, 1923, 22,397 claims for indemnity, covering the slaughter of 67,802 head of cattle, 26 per cent of which were purebreds. The average appraisal on the cattle was $98.94, the average salvage being approximately $18.50. The average State indemnity paid was $33.55, while the average Federal indemnity was $21.48. This statement included only such claims as were forwarded to the Bureau, a large number of which had not been received at the time it was compiled.

Operating expenses. The total funds expended by the various cooperating agencies for operating expenses was approximately $1,500,000.00. Details of this indicate that there was expended by the Bureau on its field force approximately $700,000.00 with a like amount being expended by the State livestock sanitary agencies. Particularly interesting was the increased expenditures on the part of county organizations, records indicating that these officials actually expended approximately $150,000 for operating expenses, which was more than twice that expended the previous year.

Approved and accredited veterinarians. During the past year there were on the list approximately 8,400 practicing veterinarians who had been approved to conduct tests on cattle for interstate purposes, of which number 5,500 had passed the examination, placing them upon the list of accredited practitioners. These accredited men are eligible to participate in the testing of cattle under the provisions of the Uniform Methods and Rules for Tuberculosis-Free Accredited Herds. It is especially interesting to note that there were turned back to these veterinarians, herds comprising 166,000 head of cattle, which is an increase of about 65 per cent over the testing done by these men during the previous year. The approved men tested more than 200,000 head of cattle for interstate shipment, which was an increase of over 50,000 head reported for the previous year.

Area testing. That the area plan has increased in importance is indicated by the figures, which show that there were approximately 1,800,000 head of cattle tested in area work, which is about 51 per cent of the total cattle tested for the year. Records of costs of this work reported from seventy-two counties indicate that it was done at the low figure of about 34 cents per head. This covered all expenses, inclusive of indemnity incurred by all of the cooperating forces.

A PUBLIC HEALTH QUESTION

At the outset of the cooperative campaign, the public health side of the question was not discussed because it was believed that the economic reasons for eradicating the disease were apparent to all and sufficient to carry on the work as rapidly as it should go. When it became necessary to test dairy herds furnishing milk to towns and cities, the question came to the front rapidly: Why is it necessary to test these cattle? Is milk from tuberculous cattle a source of disseminating tuberculosis? The question could not, and should not, if it could, have been evaded in the light of what has transpired in the last five years.

We are sometimes told that it is commonplace and ancient history to call attention to the existence of bovine tuberculosis in the human family, but as late as October, 1922, the British Government saw fit to place on the program of the National Milk Conference, Dr. A. Stanley Griffith, Research Bacteriologist, with the British Research Council of the University of Cambridge, whose subject was "Bovine Tuberculosis in Relation to Man." Dr. Griffith was on the royal commission to investigate the relationship of bovine tuberculosis to man, after pronouncements made by Professor Koch that he had come to the conclusion that human tuberculosis differed from bovine tuberculosis and could not be transmitted to cattle and that transfer from cattle to man never took place—that this transfer was so rare that he did not deem it advisable to take measures against it.

Dr. Griffith has probably typed more tubercle bacilli than any other authority. He states in his classical essay, which I hope all of you will have the privilege of reading, that "the number of English cases in which the type of tubercle bacilli has been determined now exceeds 1,200." In 116 cases of all ages 46.5 per cent of the bacilli were identified as of bovine origin; 25 per cent of the cases were in persons sixteen years and upwards.

Some of the noteworthy statements made by Dr. Griffith are as follows:

1. The bovine tubercle bacillus produces generalized tuberculosis in every way as severe as that produced by the human bacillus.

2. The proportion of cases where tuberculosis remains localized in the mesenteric glands is not greater in the bovine series than in the human.

3. Primary abdominal tuberculosis due to the human tubercle bacillus is infrequent.

We certainly must be interested in all of these investigations because they apply in our everyday life. When we appear before a local audience, or committee, or State Legislature or other legislative body, and lay before them the facts regarding the transmissibility of tuberculosis to man, we do not infringe upon the rights of the medical profession, in my judgment. The veterinarian is familiar with the etiology, the pathology and mode of dissemination of tuberculosis in livestock and knows of its relationship and its ability to affect man; therefore it is his duty to state these facts whenever the occasion requires.

PASTEURIZATION

The pasteurization of milk, to render it safe for human consumption, is being practiced in many states throughout the United States, and is believed by some the only thing necessary to make milk safe. There are many other infective organisms besides the tubercle bacillus that are conveyed by milk, and there is no doubt in my mind that pasteurization is a necessary operation to destroy pathogenic organisms in milk. However, the practice of pasteurizing milk does not solve the question of bovine tuberculosis.

Wherever bovine tuberculosis exists in dairy herds and pasteurization is practiced to the exclusion of the tuberculin test you will find a high percentage of the disease among cattle. I recently visited a dairy section near a metropolitan city, and was told by a number of farmers that their herds were never tuberculin tested; the milk was pasteurized and shipped to the city and that was all that was required. Tuberculosis exists in from 25 to 35 per cent of all the cattle in that county.

A wonderful change has taken place among dairymen with respect to ordinances requiring the tuberculin testing of their herds. Heretofore, the adoption of such an ordinance almost invariably meant an application for an injunction and a long legal battle to oust the ordinance. Within the past two or three years, more ordinances of that kind have been adopted than were in existence heretofore, and with very few exceptions the requirements have met with the cooperation of the livestock owners.

The most striking order of this character was recently issued by the Louisiana State Board of Health. It requires the tuberculin testing annually of all dairy cows from which milk is sold. This applies throughout the State. It may be too broad in its scope, but it reflects the attitude of the health authorities of the State. As a resident of Washington and a patron of the dairy industry, I heartily endorse the proposed milk ordinance for the District of Columbia, which requires that all cows furnishing milk to the District shall be tuberculin tested, and all milk (except milk from certified herds) shall also be pasteurized. This principle, I think, should apply generally throughout the country; to be put in operation when it is practicable to do so.

There are many phases of the tuberculosis eradication work that can be improved. I want you to feel that the Bureau of Animal Industry is striving in every way possible to help relieve the livestock industry of its most menacing foe.

"The noblest motive is the public good."

MILK AS A FOOD FOR THE CHINESE

HON. TSANNYOEN PHILIP SZE,
Vice Consul of the Republic of China,
New York, N. Y.

Allow me to express to you my deep appreciation of the great honor bestowed upon me when I was invited by Mr. Weld to read a paper upon the subject of milk at the annual meeting of the International Association of Dairy and Milk Inspectors, and I beg that each one present will overlook the errors of expression which I may commit during the course of this talk. But, in spite of my imperfect use of your language, I hope that I shall be able to bring out a few points in the subject, which will be of interest to you, and to enlist your sympathetic assistance in solving some of the many problems which confront my country in making use of milk as a food for the Chinese, and especially in making milk and milk products available for artificial feeding of Chinese infants.

Having had a slight connection with one of the infant welfare stations in Washington some years ago, my interest in the question of the handling of milk and its allied products was greatly stimulated, for I perceived that before very long the use of animal milk, either as such, or in modified form, would become of vital importance in the feeding of Chinese infants. I beg your permission to make this phase of the question the subject of my paper today and ask your generosity in allowing me to deal with the subject from a humanitarian rather than a scientific point of view.

I beg to say that I realize that I placed myself in a difficult position when I assumed to discuss milk, especially cow's milk, a subject which is so comprehensive and so thoroughly studied in this country. Representing my country in the consular service, the commercial value of any subject naturally appeals to me as deserving complete and thorough study, and being fully aware that vast sums of money are spent annually in this country on the dairy farms and by dealers handling dairy products, I began a study of the subject a few months ago, and was greatly aided in my investigations by various firms which kindly permitted me to visit their factories. I tried to study the points upon which you place the greatest emphasis in the handling of milk and its allied products. Permit me to say that I deeply appreciate all the courtesies extended to me by the various firms I had the pleasure of visiting. But allow me to drop that part of the discussion which deals with the scientific or commercial phases of the question, for by attempting to discuss them I would only place myself in an awkward position, especially before this gathering which has made a life study of milk in every form and stage of its progress, beginning at the day when the calf is born and extending to the time when the cow is no longer profitable to the dairy. Therefore I beseech you to let me consider the subject of milk only from a humanitarian point of view. To deal with it in this sense I shall try to cover an area about the size of these wonderful United States, with a population roughly estimated to be about four times as large, that is, about four hundred and fifty million.

I know that you will have many questions to ask me regarding the appropriateness of presenting to this gathering a subject dealing with the problems of a nation which, geographically, lies such a distance from you, but my only excuse can be that while China gave to the world gunpowder, the compass, and many other inventions and discoveries which are more or less indispensable to you, now we are coming to you asking permission to share some of the benefits of your great knowledge and experience with things of recent discovery or relatively recent improvement, and I know that you will sympathize with me when I tell you that for exactly ten years I have wanted to have the subject of my paper presented to you in this country.

During all the ages of Chinese history to the present time Chinese infants have been fed and brought up on the human breast. You will all agree with me when I say that milk from the mother's breast for her own infant is nature's food, and that when a mother can nurse her child, its health and welfare can much more easily be assured. Most unfortunately a large per cent of mothers are unable to nurse their offspring, and the same conditions that cause mothers in this country to discontinue breast feeding apply to Chinese mothers.

With this as my introduction may I now proceed to the question of a substitute for the mother's breast. I may say that this substitute may be one of the following: First, a wet nurse; second, goat's milk; third, mare's milk; fourth, cow's milk. The last three may be in the form of raw milk, pasteurized milk, boiled or sterilized milk; sweetened or unsweetened condensed milk, dried, or otherwise prepared milk.

A wet nurse! I am presenting this form of substitute first for the reason that it is very easily obtained in China. In America the conditions are different and it is only with a great deal of difficulty that you are able to obtain the services of a wet nurse in cases where they are indicated, but in my country one is able to obtain a wet nurse at the ridiculously low wage of 2½ to 5 dollars a month, depending upon the location of the party requiring her services. From this you will readily understand that a wet nurse is the substitute of choice in China when a mother is unable to nurse the child herself. But though wet nurses are easily available and economically possible there are many other factors which must be considered. For example, we may have difficulty in ascertaining the age of the nurse's infant, or, if it is dead, the cause of its death, the health of the nurse, or history of hereditary disease, etc. In addition, a wet nurse may not be of just the sanitary habits that we should consider ideal. The care of the breasts of the nurse and of the child's mouth, etc., are matters which have to depend upon the nurse. But no matter how conscientious or dependable the woman might be I feel that very few would be as careful as we should desire.

I shall mention goat's milk as the second substitute, but in most parts of China this article for infant feeding is unheard of, though I know that the northwestern part of that vast country uses a great deal of goat's milk. Goats are easily raised and are able to thrive on practically anything given them, therefore, goat's milk as a substitute for breast feeding might sound feasible, but I feel that there are many drawbacks to its general use, and that a great deal of objection would be encountered in the regions where such milk is not considered edible.

The third form may be said to be mare's milk. I have known this substitute to be used in China, and some of you who have visited my country may have seen, occasionally, a mare led through the street of the town to be milked for anyone who desired a drink of that special beverage, but this practice is not carried out in many places and the milk is too expensive for steady use as a form of infant feeding or as a diet.

The fourth substitute for mother's milk, that is, cow's milk, will probably deserve more of your attention than the other substitutes which I have previously named, and I would appreciate it very much if you would consider that I am asking your opinion and advice as to its suitability for use in China. Every one present is familiar with the handling and distributing of cow's milk in this country, but I am sure that few of you understand the conditions existing in the country from which I come, and I hope you will allow me to go somewhat into detail in explaining the conditions that exist in China regarding this special form of substitute for infant feeding and for all other uses that might be made of it in that country. The Chinese have had but one idea about cow's milk, and that is that it is intended only for the use of the calf, in order that the calf, after it has grown, will be of value as a work animal. For in my country cows are used as horses are in the United States. The introduction of farm machinery may serve as a step toward releasing cows from farm labor, thus making them more available as milk producers. But machinery farming cannot be used as readily in China as in this country because the land generally has been cut up into small lots owned by so many individuals. At the present time fresh cow's milk in China is considered a luxury and not a necessity for human use, and the foreigners in China have been the principal consumers of fresh milk.

Until very recently these visitors to my country were contented with condensed milk, but lately, in the Treaty Ports and their near-by towns, some dealers have been providing a small amount of fresh milk.

Not very many years ago Mr. Gale Borden made his appearance in China and said at the time, when condensed milk was introduced into China, "This is my market for the Eagle Brand." We are still using the Eagle Brand sweetened condensed milk and using more of it than any other country. From the customs reports we have recently received from China I beg to quote the item concerning importation of milk:

		1921	1922
Milk	(dozens)	38,397	73,116
(Condensed) . . .	(Piculs)	42,932	53,605

Condensed milk is imported more and more each year. Now, what caused the diet of the calf suddenly to be considered as a desirable food for human beings in China? It may be explained in the following manner:

First, the Chinese mothers learned to employ diluted condensed milk as a supplementary feeding or as an entire artificial feeding for their infants. Secondly, diluted condensed milk is coming into use in a great many families as a beverage in the morning. As we more and more follow the western methods of eating, coffee with condensed milk is becoming quite fashionable. Thirdly, returning Chinese students educated in America who have acquired American ways of eating introduce western methods of eating to the natives who have not had the opportunity to go abroad. As an example, ice cream made out of condensed milk is getting to be quite in vogue. Besides the uses I have mentioned I may add that cakes and candies made with milk as one of the component parts are beginning to appear on the market. Please do not think that the Chinese did not have cakes or candies until recently, but remember that their cakes and candies were made without milk. I have mentioned the above facts to explain some of the reasons why milk is being used in increased quantities in China from year to year.

Aside from the use of milk as a substitute for infant feeding in China, it may well find a place in the dietary of sick or convalescent patients. The feeding of invalids has been one of the most difficult factors in the work of physicians in China, so if milk may become of general use in China the problem of feeding the sick will be simplified.

Here is my real puzzle: how are we going to provide sufficient quantities of fresh milk in China so that it may become a common article of diet? I shall try to outline conditions to you so that you may understand the magnitude of the problem and I ask your kind assistance in working out a satisfactory solution.

Up to a very recent date all milk consumed in China was imported in the form of condensed or prepared milk. For the past few years, however, there has been a limited demand for fresh milk by those who desire its use as a beverage or in coffee or tea. At no time, however, have we had enough milk cows to supply even this limited demand. From time to time individuals have imported cows into China from this or other countries, but unfortunately it has seemed impossible to prevent the imported herds from dying out because of one reason or another.

I began to feel, after having seen some of your great dairies, that the character of the care given cattle in this country is one of the principal factors in maintaining the herds, and I fear that, generally speaking, the farmer in China is not yet prepared to provide the necessary care for his cows. When I went through the Walker-Gordon laboratories in Plainfield, N. J., and witnessed the great care they took of every individual cow, especially in regard to the quality and quantity of feeding, I was literally astounded. Is it the feeding that is at fault in the inability of the Chinese to successfully raise their herds of cattle, or is it that our water supply contains substances which might prove injurious to the cow? Is it the grazing pastures which may be the source of disease for them? I must admit here that we do use human manure as a fertilizer in the fields. Is it possible that our chief source of trouble with the cattle is to be found in the hay harvested off these fields and used for the feeding of the cattle?

In a vast country the size of China, with such a dense population and varied atmospheric conditions, do you think it would be advisable to concentrate all milk producing concerns in one locality? But if the answer to this last question is yes, other problems confront us. We have practically no refrigerating system on our railroads, and the question of keeping the milk fresh enters our mind immediately. At the present time all milk used in China is first boiled before being served. The Chinese always have believed in having edibles well cooked. But returning students from various countries have begun to make cold drinks popular. These drinks, however, can only be obtained in northern localities, for natural ice is a scarce commodity in the south, and manufactured ice is too much of a luxury. Because of the network of canals and small rivers in the southern half of the country real cool springs are difficult to find, and even in the north the temperature of the water of the wells and springs is not sufficiently low to provide a means of keeping milk fresh.

From what I have outlined above you can readily understand why the price of milk is beyond the means of ordinary persons. I think where milk is sold it is retailed at about 6 or 7 bottles to a dollar, each bottle containing about a pint. With the average wage in China only about ten to twelve dollars a month you can readily understand that milk at the price I have mentioned must be considered entirely as a luxury instead of as a daily article of diet as in this country. Ice cream and candies made from milk are so high priced that they are far beyond the means of the average person. An ordinary sized can of condensed milk costs about 30 cents in China and can be kept a considerable time, especially the sweetened variety. Some entire families make a can of condensed milk last nearly a month, diluting a very small quantity of it each morning for breakfast. The question is how can we make the price of fresh milk come within the means of the average Chinese wage earner.

I feel assured that milk as a general article of diet will eventually be used in a very wide area in China. Probably its first large use will be in the artificial feeding of Chinese infants and in providing suitable diets for the sick. Then after that milk and milk products may become as commercially and economically important as they are in this country. But before that time arrives, it will be necessary to satisfactorily solve the problems which I have so briefly indicated to you. And may I hope that we in China shall receive the benefit of your vast experience in overcoming the difficulties that confront us in the production, handling and distribution of milk and milk products?

"That happens in a moment which may not happen in a thousand years."

REMADE MILK

Oscar L. Evenson, Food Control Laboratory, Bureau of Chemistry, U. S. Department of Agriculture

Introduction

During recent years there has been a considerable increase in the development of the powdered milk industry. At first the output of this industry was used mainly in bakeries and ice cream factories. More recently there has been an increase in the consumption of the product in liquid form, mainly as whole milk. The advent of this new product into the field of dairy industry has raised a question of considerable importance and interest to manufacturers, to consumers, and to food control officials. Does remade powdered milk have the same chemical and physical properties as the original milk? Other questions of equal importance deal with the effect of desiccation on the nutritive qualities of milk, especially on vitamines and on the bacteriological condition of the product. Some of the physical and chemical aspects of remade milk will be considered here.

The ancients powdered milk by letting it dry in the sun. In Lapland (1) milk was dried in the stomachs of reindeer and kept for winter use. According to Cazalas (2) the first attempt on a larger scale to conserve milk by evaporation was made by Gallois and Debauve in France and by Newton in England. Appert in 1810 first conceived the idea of obtaining solid tablets by concentration with the aid of heat. Martin Lignac in 1849 proposed to facilitate the evaporation by spreading the milk on hot plates and constantly agitating it. Drying between cylinders was first attempted by Grimewalde in 1855.

At the present time milk is dried by several processes which fall into two general classes, drum powders and spray powders. In the drum or film-drying process the milk, with or without previous concentration, is dried on the surface of one or more steam-heated revolving drums. The milk is either sprayed onto the revolving drums or picked up by the drums from below. In some cases the drying cylinders operate under atmospheric pressure and in other cases the cylinders are enclosed in a vacuum chamber and drying is accomplished under reduced pressure. In the spray-drying process the milk, usually in evaporated form, is sprayed under more or less pressure into a heated chamber, the manner of admitting the hot air and previous treatment of the milk varying somewhat with the particular spray process used. In the centrifugal spray process, as the name indicates, the milk is sprayed by centrifugal force. In the dough-drying process which is also used to some extent, the concentrated milk is dried by the aid of currents of hot air blown through the mass.

The recombination of skim milk powder or unsweetened condensed skim milk with unsalted butter or cream, together with water in the proper proportions, is usually accomplished by means of an emulsifying or homogenizing machine. When whole milk powder and water are used the ingredients are often recombined in a mixing tank by means of a paddle or other stirring device, or in the home in small quantities by means of an egg beater.

Investigations indicate that this product as made at present is not identical chemically and physically with natural milk. Therefore it should have a distinctive name. In England and on the continent the term "reconstituted" has been used to some extent. A distinction has been made(3) between the terms "reconstituted" and "reconstructed," the former being applied to the product made from whole milk powder and water and the latter when butter is incorporated with skim milk powder and water by means of an emulsifier. The term "manufactured" has also been used. The name "remade" has been suggested (4) and used frequently in recent literature and will also be used here.

Approximately 100 samples[1] of remade milk, using various combinations of raw materials, have been made for experimental purposes in the Bureau of Chemistry.

PHYSICAL PROPERTIES

Cream and Fat Globules and Appearance on Standing

As a result of the desiccation and the method of remaking milk, the natural state of the fat globules, especially their size and gradation in size, is altered. If the powder used has been made by spraying whole milk under more or less pressure, as in the pressure spray process, the fat is broken up to such an extent that it does not rise to the surface when milk is reconstituted from it. In this respect it has the same appearance as homogenized milk. The fat in centrifugal-spray whole milk powder is not broken up to any appreciable extent in the process of manufacture, so that the fat in a milk made from such a powder rises in a manner similar to that of natural milk. Butter separates easily from the resultant cream, however, and the product lacks the smooth consistency of natural cream. Milk made from skim milk powder or condensed skim milk and butter by means of an emulsifying machine has a small cream layer, which in most cases is very rich, almost like butter. This has also been noticed by others. (3)

More fat is dissolved by shaking with ether from such a milk than from natural milk, owing to the changed physical condition of the fat globules in the remade milk. The problem of redistributing the fat in the plasma in such a manner that the fat globules will have the same relative gradation in size as those in natural milk is very difficult. Obviously, absolute uniformity in this respect cannot be

[1] The author is indebted to Dr. H. W. Redfield for assistance in preparing a number of these samples.

obtained with any process of atomization. A larger number of small fat globules is present in emulsified milk than in natural pasteurized milk. This can be shown by centrifuging a portion of the milk and determining the percentage of fat in the lower portion or by running a portion of the milk through an ordinary cream separator and determining the percentage of fat in the skim milk. It can also be shown by a microscopical examination of the skim milk.[1]

As the way in which the remade milk is made is important in a study of the distribution of the fat globules, a brief description will be given here. The skim milk powder was first dissolved in the proper quantity of water and warmed to about 45° C. before the butter was added. The condensed skim milk was likewise properly diluted and warmed before adding the butter. The heat was finally raised to about 63° C., at which temperature the milk was held for a period of 20 or 30 minutes. It was then emulsified and cooled to about 5° C. Samples of natural milk were heated for 20 to 30 minutes at about 63° C. and emulsified in the same manner. Two types of emulsors (A and B) were used. In emulsor A the milk feeds from the top into the bowl which has a speed of about 12,000 r. p. m. In emulsor B, known as the "suction feed" type, the milk feeds from below into the bowl which has a higher speed than that of emulsor A.

The samples of natural milk used for comparison, obtained from the Dairy Division of this department, were pasteurized in the laboratory at a temperature of about 65° C. for 30 minutes.

Samples of natural pasteurized milk and remade milk were then put through an ordinary cream separator, operated at the usual speed by a motor, with the cream screw set to obtain a cream of medium fat content. Before

[1] Microscopical examination was made by Dr. E. A. Read.

each sample of milk was skimmed the separator was cleaned and the milk was warmed to 35° C. A sample of skim milk was taken for analysis when about half of the milk had run through the separator. The Roese-Gottlieb method[1] was used to determine the percentage of fat. The results obtained are shown in Table I.

The cream separator does not remove the fat from emulsified milk as completely as from milk which has not been treated in this manner. Even in mixtures containing 15 to 20 per cent of emulsified milk there is a small, though consistent, increase in the quantity of fat left in the skim milk. This is due to the presence of a larger number of small fat globules, mainly those below 1½ microns in diameter. An indication as to whether or not a sample of milk has been emulsified or homogenized may thus be obtained by determining the percentage of fat in the skim milk obtained from it by means of a cream separator. It is considered that results comparable to those reported here may be obtained with any type of cream separator.[2]

Many samples of remade milk, whether made from spray or drum powders, show a separation of solids not fat on standing for several days in cold storage, in spite of the clarifying action of the emulsor.

SPECIFIC GRAVITY

If the quantities of the different components used in making remade milk are such that the percentage of fat and non-fatty solids falls within the range of those for natural milk, the specific gravity also will tend to fall within the proper range. This was true for all of the samples the specific gravity of which was determined. On four samples of remade milk which gave a normal freezing point, Palmer and Dahle found the specific gravity to be 1.0336, 1.032, 1.0314, and 1.0314.

[1] Method of the Association of Official Agricultural Chemists.

[2] The use of a cream separator for this purpose was suggested by Dr. Charles Thom.

TABLE I—FAT CONTENT OF SKIMMED MILK OBTAINED WITH A CREAM SEPARATOR FROM NATURAL PASTEURIZED MILK, AND FROM MIXTURES OF NATURAL AND REMADE MILK.

Sample No.	Natural Pasteurized Milk: Milk Per cent	Natural Pasteurized Milk: Fat in Cream Per cent	Natural Pasteurized Milk: Fat in Skim milk Per cent	Emulsified Natural and Remade Milk: Milk Per cent	Emulsified Natural and Remade Milk: Fat in Cream Per cent	Emulsified Natural and Remade Milk: Fat in Skim milk Per cent	Remarks	Emulsor	Mixtures: Remade Per cent	Mixtures: Fat in Cream Per cent	Mixtures: Fat in Skim milk Per cent	Position of Cream Screw[1]
61	3.61	...	0.19	3.59	...	0.52	Drum powder[4] and butter	A	15	...	0.25	Average
62 (1)	3.95	...	0.20	3.95	...	0.59	Emuls. natural milk	A	..	...	...	Do.
62 (2)	3.95	26.6	0.22	3.95	...	0.54	Do.	A	..	...	...	Do.
62 (3)	...	...	...	3.79	...	0.64	Spray powder[4] and butter	A	15	...	0.25	Do.
63	4.10	22.2	0.20	3.62	28.4	0.73	Do.	A	15	...	0.26	Do.
64 (1)	3.75	35.2	0.21	4.14	32.2	0.86	Do.	A	15	32.4	0.28	Do.
64 (2)	3.75	...	0.21	3.75	...	0.63	Emuls. natural milk	A	..	...	...	Do.
64 (3)	3.75	...	0.14[2]	3.75	...	0.44	Do.	A	..	...	...	Do.
65 (1)	3.11	...	0.20	4.05	33.4	0.67	Spray powder[4] and butter-fat	A	15	32.4	0.26	Do.
65 (2)	3.11	...	0.22	3.11	...	0.58	Emuls. natural milk	A	..	...	...	1½ turns in
65 (3)	3.11	...	0.18	...	...	...	———	..	..	...	...	2½ turns out
66	3.85	...	0.20	3.30	...	0.56	Cond. skim and butter	A	..	...	...	¼ turn in
68	3.25	...	0.25	2.89	...	0.67	Spray powder[4] and butter	A	15	...	0.27	1½ turns in
69	3.93	...	0.19	3.56	...	0.57	Do.	A	20	...	0.26	-¼ turn in
71	4.02	...	0.17	3.00	...	0.46	Do.	B	20	...	0.24	No change
72	3.29	25.4	0.20	3.82	...	0.55	Cond. skim and butter	B	20	...	0.26	Do.
73	3.03	...	0.20	3.94	...	0.49	Drum powder[4] and butter	B	15	...	0.25	Do.
74	4.16	37.5	0.14	3.77	...	0.44	Spray powder[4] and butter	B	15	30.9	0.28	Do.
77	3.74	27.9	0.24	3.85	...	0.40	Do.	B	15	28.8	0.25	Do.
81	3.92	33.7	0.16	3.87	...	0.43	Whole milk powder[5]	B	20	...	0.25	Do.
83	4.77	42.2	0.19	3.90	...	0.48	Spray powder[3] and butter	B	20	...	0.26	Do.
84	...	...	...	3.50	...	0.68	Whole milk powder[5]	B	..	...	...	Do.
85 (1)	3.97	...	0.21	...	...	...	———	..	..	...	...	Do.
85 (2)	3.97	...	0.19[2]	3.88	...	0.27[3]	Whole milk powder[5]	*	..	...	...	Do.
89	4.30	35.8	0.16	3.90	...	0.24[3]	Do.[5]	Do.	..	...	...	Do.
Average			0.19[4]			0.57					0.26	

1. "Average" denotes such a position of cream screw as will give a cream of average fat content. When the screw is turned in, a richer cream is obtained; when it is turned out, the opposite effect is obtained. 2. Milk kept overnight. 3. Not included in average. 4. Skim. 5. This powder was made by the centrifugal spray process. * Emulsor not used.

FREEZING POINT

The freezing point has been recognized as one of the least variable of the physical properties of milk. It is generally conceded to be the most sensitive test available for the detection of added water. Palmer and Dahle (3) secured data on the proportions necessary to produce a remade milk with a normal freezing point. In one case slightly more powder than necessary was recommended, while another manufacturer recommended slightly less than was necessary to give a freezing point within the accepted range for natural milk. Important factors involved here are the composition of the original milk and the moisture content of the powders. The writer (7) has determined the freezing point of four samples of remade milk. The results are given in Table II.

TABLE II

FREEZING POINT AND MOLECULAR CONCENTRATION CONSTANT OF REMADE MILK

Powder used	Fat Per cent	Casein Per cent	Sodium Chloride Per cent	Lactose Per cent	Solids not fat Per cent	Mol. Conc. Constant	Freezing Point ° C.
Drum skim	0.13	2.54	0.190	4.71	8.67	71.2	—0.521
Pressure spray skim	0.16	2.70	0.159	4.67	8.86	67.2	—0.489
Drum whole milk powder	3.70	2.67	0.174	4.37	8.34	68.5	—0.499
Pressure spray skim and butter	3.47	2.76	0.175	4.35	8.62	69.2	—0.497

The figures obtained are somewhat lower than the accepted figures for normal milk. The figures obtained for the molecular concentration constant, which will be discussed later, are also below normal, indicating that the freezing point figures are substantially correct.

SPECIFIC CONDUCTIVITY

Palmer and Dahle (3) determined the specific conductivity on four samples of remade milk. With one exception, they found practically the same values for the remade samples as for natural milk, the figures ranging from 0.00545 to 0.00625.

VISCOSITY

A summary of an investigation (8) of the viscosity of remade milk will be given here.

The relation of viscosity to the total solids was shown by means of the expression $\frac{V-1}{T.\ S.}$ in which

$$V = \frac{\text{Time of flow of milk x specific gravity of milk}}{\text{Time of flow of water x specific gravity of water}},$$ and

T. S. = total solids, expressed as parts by weight of milk solids per gram of fluid milk. For a given number of samples the values for $\frac{V-1}{T.\ S.}$ for natural pasteurized milk varied from 5.68 to 7.18 and for remade milk from 6.26 to 12.60 at 25° C. When the viscosity was determined at 15° C. the figures varied from 7.20 to 7.67 for natural milk and from 7.13 to 16.63 for remade milk. These figures show that some remade milks have the same viscosity as natural pasteurized milk, indicating that the colloidal condition of the powder has not been changed in the process of desiccation, in so far as the viscosity is concerned. The high viscosity of some remade milks, whether made from drum or spray powders, is apparently due to the tendency of the heat to which the powder has been exposed to coagulate the albumin and affect the solubility. The viscosity depends to a certain extent upon the temperature at which the milk has been held. Homogenization at a high pressure has a decided effect on the viscosity, while the emulsor has little or no effect. Other investigators (3) have also found that remade milk tends to have a higher viscosity than natural milk, the increase being least noticeable in the case of milk made from pressure spray powder.

SURFACE TENSION

The surface tension was determined by Ferris and the writer (7) on 18 samples of remade milk. The surface tension was calculated from the number of drops formed by a given volume of milk at 25° C., using distilled water as a standard as follows:

$$\text{Surface tension} = \frac{\text{Specific gravity of milk} \times \text{number of drops of water}}{\text{Specific gravity of water} \times \text{number of drops of milk}}$$

The surface tension of 18 samples of remade milk ranged from 0.73 to 0.79. The surface tension of the same number of samples of natural pasteurized milk ranged from 0.74 to 0.77. The surface tension was not affected by pasteurizing, homogenizing, or emulsifying the milk.

CHEMICAL PROPERTIES

Fat

According to Krull (5) the fat in milk powder has more free fatty acids than milk fat in its natural state in milk or cream and at times an oxidation occurs. Coutts (6) believes the tallowy odor sometimes noticed is due to this oxidation. Possible changes in this respect are enhanced by long storage and the method of manufacture may also have some influence.

Hydrogen Ion Concentration

The buffer values of samples of remade milk towards acid and alkali were determined electrometrically by

Mains (7). Measurements were made at 25° C. and the values were calculated in the customary form of pH units. Titration curves were determined for various milk samples by adding portions of 0.1 N hydrochloric acid and 0.1 N sodium hydroxide to 25 c.c. portions and measuring the pH value of the resulting mixture. These curves are shown in Figure 1.

Milk made from spray powders did not differ appreciably in hydrogen ion concentration from natural pasteurized milk and the titration curves were practically identical. A drum powder, however, gave a much higher pH value than natural milk. A similar investigation, made by Palmer

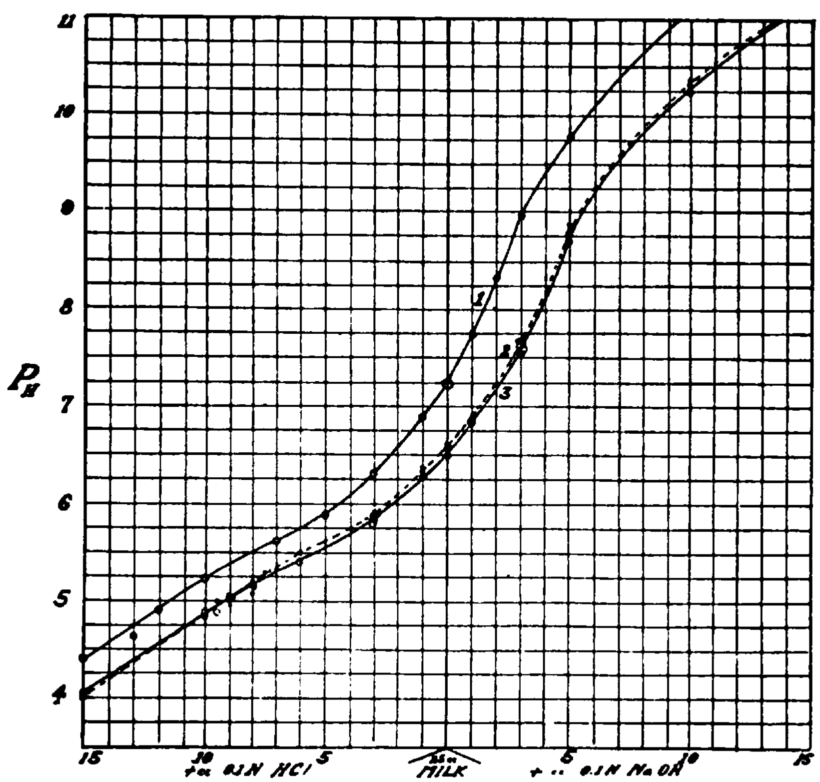


Fig. 1.—Titration curves of natural and remade milks with additions of 0.1 N hydrochloric acid and 0.1 N sodium hydroxide solutions. Curve 1, remade milk, drum powder; curve 2, normal pasteurized natural milk; curve 3, remade milk, spray powder.

and Dahle, showed that in general, remade milk had less buffer effect at low concentration of acid and alkali than natural milk.

Molecular Concentration Constant (7)

The molecular concentration constant, which like the freezing point is used to detect the presence of added water, is calculated by adding the weight in grams of lactose per liter of milk to the weight in grams of sodium chloride per liter, multiplied by 11.9, giving one gram of crystallized lactose, the isotonic equivalence of 11.9 grams of sodium chloride. This apparent constant is corrected for the volume of fat and casein, using 0.94 as the specific gravity of fat and 1.35 as the specific gravity of casein. Values obtained on remade milk are shown in Table II.

According to Monier-Williams (9) this constant varies from 70.0 to 78.1 for natural milk, while Ferris (10) obtained values from 71.1 to 82.6. Figures obtained by Mathieu and Ferre (11) ranged from 74 to 79. The remade milks given in Table II therefore appear to be below normal in this respect, this being apparently due to a slight deficiency in the content of sodium chloride or lactose, or both.

Action Towards Rennet

Investigation of a large number of samples of remade milk showed that the curd formed by the action of rennet was less firm than that of natural pasteurized milk. In some cases, especially certain drum powders, there was very little coagulation, or none. This change in the action towards rennet is probably due to the action of heat on the soluble calcium salts. Supplee (12) found that there is a decrease in the inorganic phosphorus, calcium, and magnesium in dried milk. Similar evidence is given by Bosworth (13).

Enzyme Activity

The peroxidase test is an indication of the degree of heat to which the powder has been exposed. This test begins to weaken or become negative at a temperature of about 72° C. Many of the samples made in the Bureau of Chemistry gave a positive test for peroxidase. Results obtained on application of the peroxidase test to a large number of samples of remade milk are given in a paper on the viscosity of natural and remade milk ([8]).

Casein

The literature has many references on the effect of heat on milk. In the manufacture of milk powder there is a slight loss of sulphur from the casein ([2, 14]). It is doubtful, however, if this is the case with high-grade powders made at the present time. Jensen ([15]) states that when milk is heated the casein tends to acquire a brownish tinge. This is particularly noticeable in the case of sterilized condensed milk. Upon a hitherto unobserved effect of heat on milk is based a qualitative test ([16]) for detecting remade milk, either as such or when mixed with natural milk. If the casein of milk made from milk powder is precipitated with acetic acid and thoroughly washed with water, it will give a yellow color when treated with dilute sodium or potassium hydroxide. Natural milk, pasteurized at the usual temperature of 63° C. for 30 minutes, does not give this test. The theory is advanced that the color is due to a portion of lactose which has combined with the casein and cannot be removed by washing.

Some experiments on the electrolysis of remade milk have been made by Kellems ([17]). It was thought possible that in the heat treatment to which milk powder has been exposed in the process of manufacture the protein molecule has undergone a change which would affect its rate of transference under the influence of the electric current.

TABLE III

ALBUMIN IN NATURAL PASTEURIZED MILK AND REMADE MILK

Natural Pasteurized Milk						Remade Milk						
Sample No.	Fat	Total solids	Acidity	Pasteurized for 30 min.	Albumin (N x 6.38)	Sample No.	Fat	Total solids	Acidity	Pasteurized for from 5 to 20 min.	Albumin (N x 6.38)	Remarks
	Per cent	Per cent	Per cent		Per cent		Per cent	Per cent	Per cent		Per cent	
1	3.29	12.27	0.15	65°	0.73	1	3.94	12.57	0.10	65–66°[3]	0.58	Drum skim powder[6] and butter
2	3.03	12.35	0.14	64–68°	0.57	2	3.77	12.80	0.14	61°[3]	0.51	Pressure spray skim powder and butter
3	4.16	12.38	0.14	64–68°	0.60	3	3.85	13.07	0.13	62°[3]	0.46	Pressure spray skim powder and butter
4	3.74	12.75	0.14	63–66°	0.55	4	3.75	12.50	0.14	71–72°[4]	0.51	Pressure spray skim powder and butter
5	3.92	13.02	0.14	64–66°	0.54	5	...	9.04	0.13	....	0.54	Dough process skim powder
6	4.14	13.10	0.14	64–66°	0.54	6	3.87	12.73	0.13	59°[5]	0.54	Centrifugal spray whole milk powder
7	3.97	13.00	0.13	63–67°	0.51	7	3.90	12.62	0.13	65°[2]	0.24	Spray skim powder[7] and butter
8	4.30	12.87	0.14	62–66°	0.57	8	...	....	0.13	60–63°[5]	0.49	Centrifugal spray whole milk powder
9	...	14.50	0.16	63–66°	0.55	9	...	8.95	0.14	....	0.49	Pressure spray skim powder
10	4.77	13.88	0.14	65°	0.56	10	3.53	12.30	0.14	....	0.51	Pressure spray whole milk powder
11[1]	5.39	13.89	0.16	....	0.55	11	...	8.94	0.15	....	0.42	Drum skim powder[6]
Average—					0.57							

1. Pasteurized market milk. 2. 10 minutes. 3. 5 minutes. 4. 15 minutes. 5. 20 minutes. 6. U.S. patent, 1,704,419. 7. U.S. patents, 1,078,848; 1,107,784; 1,157,985; 1,266,018.

diluted to 250 c.c. with water, and again precipitated by adding 250 c.c. of 5 per cent sulphuric acid. This precipitate was washed four times by decantation as before, but with 4 per cent sulphuric acid, and again filtered. It was then washed once with about 10 c.c. of 5 per cent sulphuric acid and once with 5 c.c. of water, and drained by suction as before. The precipitate was carefully removed from the paper, placed in glass vials, about 80 by 22 mm., and dissolved in 10 c.c. of Tollen's aldehyde reagent (5 c.c. of 50 per cent ammonium hydroxide containing 0.5 gram of silver nitrate; 5 c.c. 10 per cent sodium hydroxide) and left overnight. The solution was then diluted to one liter with distilled water. Some interesting and significant differences between natural and remade milk albumin are revealed by the color obtained in this way, differences which the ordinary chemical analysis fails to show. This test[1] on the albumin may therefore aid in a study of milk powder and also in its detection, especially in cream where the removal of the fat is somewhat laborious when the color test ([16]) is to be applied to the casein.

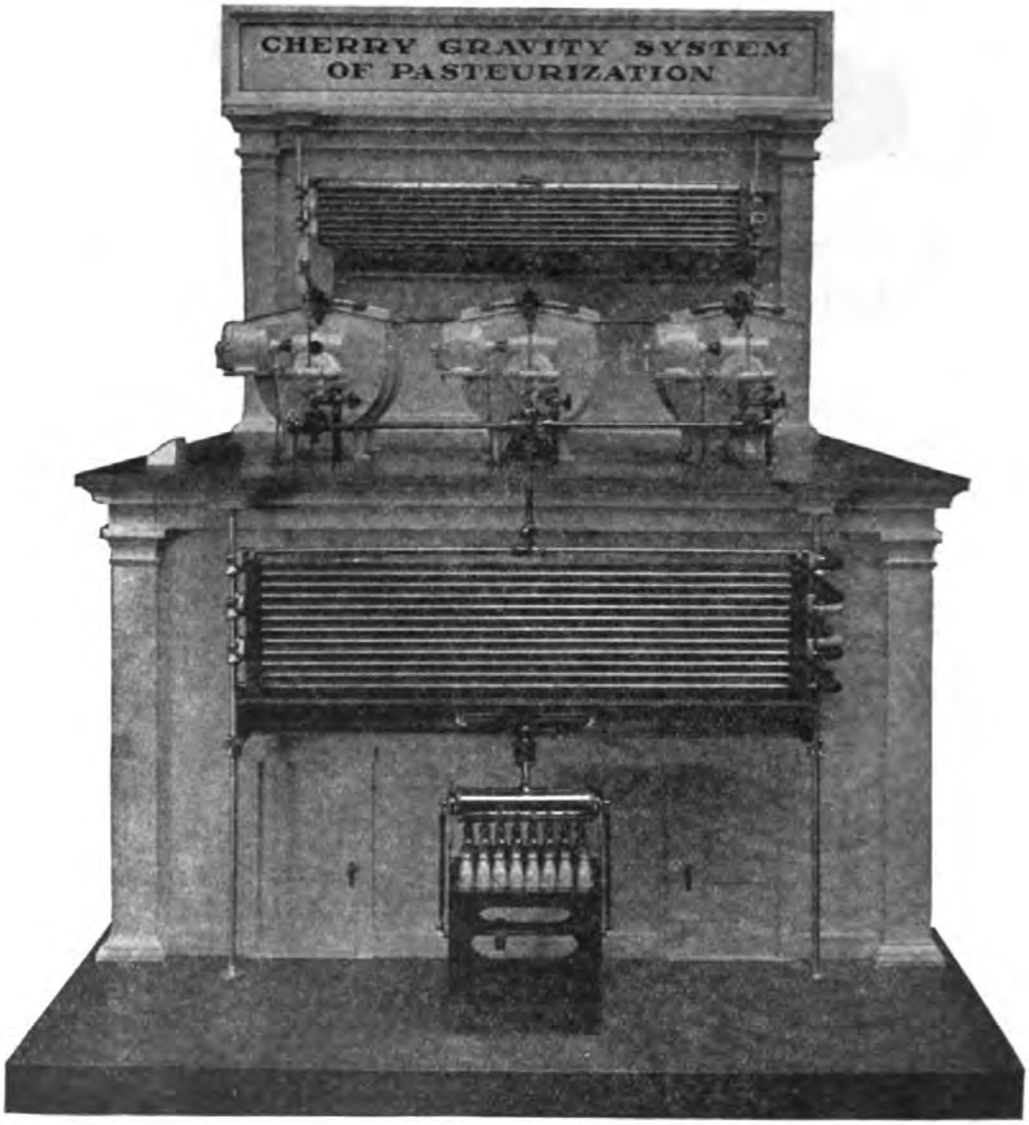
SUMMARY

PHYSICAL PROPERTIES

Cream and fat globules. The appearance and quantity of cream, as well as the gradation in size of the fat globules, depend upon the methods of remaking the milk and upon the kind of powder used. In remade milk, reconstituted from pressure-spray whole milk powder and water, the fat does not rise to form a cream line, in which respect it has the appearance of homogenized milk. A remade milk made from a powder in the manufacture of which the fat globules have not been broken up by pressure has a cream line similar to that of natural milk. Remade milk made from skim milk powder or condensed skim milk and butter by means of an emulsifying machine has a small cream

[1] It is expected that a paper giving some results obtained with this test will be published in the near future.

ADS


CHERRY GRAVITY SYSTEM
OF PASTEURIZATION