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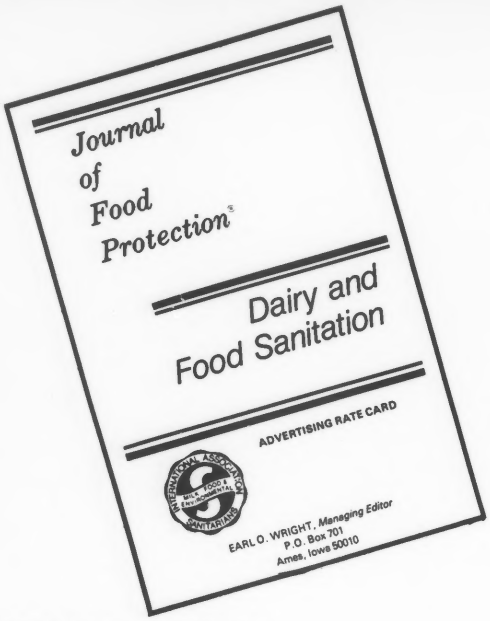
- Sensory Evaluation As A Quality Assurance Tool In A Commissary Foodservice System
- Simple Device for Cleaning an Ice Cream Scoop
- Benefits of Salt in Food Products

A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.



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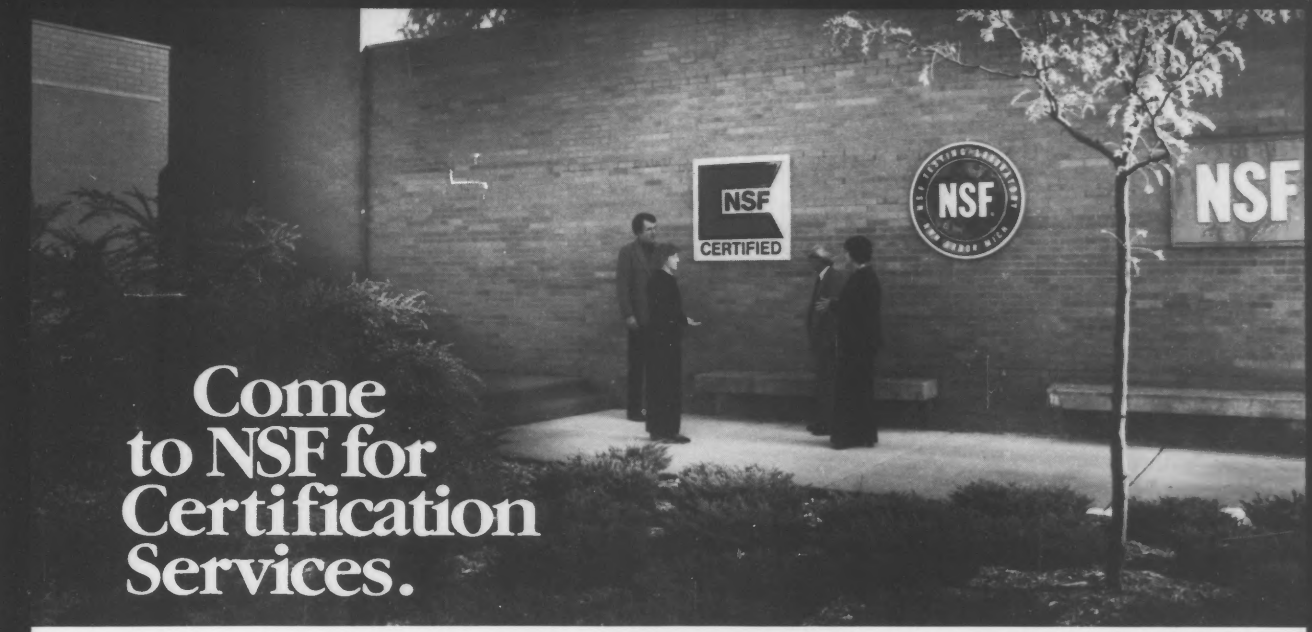

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Dairy and Food Sanitation

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Simple Device for Cleaning an Ice Cream Scoop

A. MATES

Public Health Laboratory
Ministry of Health
P.O. Box 9526
Haifa, Israel

Ice cream scoops are used for dispensing ice cream in soda fountain establishments. A simple device for cleaning the scoop based on a siphon was presented. The importance of the use of this device for cutting contamination rates in bulk ice cream fountain establishments was presented and discussed.

Retail handling and dispensing of ice cream involves soda fountain sanitation. One of the major hazards of the microbial contamination of the ice cream, in such an establishment, is the unclean scoop. The scoop is usually kept in vessels containing cold water, samples of which show extremely high bacteria counts. The way the scoop is kept is responsible for the high count observed in the ice cream from various fountains (*3*). Tanner (*4*) mentioned that at soda fountains where the scoop was kept in running water, the total bacterial count as well as the coliform were less than those kept in still water. Furthermore, he suggested that in those samples where the water had a high bacterial count this was probably due to a slower running of the water through the reception vessels containing the dispensing device.

In most establishments in this country the scoop is kept in vessels containing cold water and a survey of these containers show high bacterial counts. On the other hand keeping the scoop in running water is expensive and wasteful anywhere, and especially so in a country with limited water resources. Therefore, we have developed a device which will be useful in maintaining a high sanitation standard and which will also be economically feasible and not water wasteful.

MATERIALS AND METHODS

Ice cream samples. Ice cream was collected either in their original container or in sterile containers prepared in the laboratory.

Bulk samples. Aseptically 100 gram of ice cream was tranferred to a sterile samples container. For testing the degree of contamination of the ice cream, the sample was taken with a sterile spoon from the surface to the depth of 1 cm in the same way as the reatiler sells the product. The sample was collected and transferred to the laboratory in dry ice.

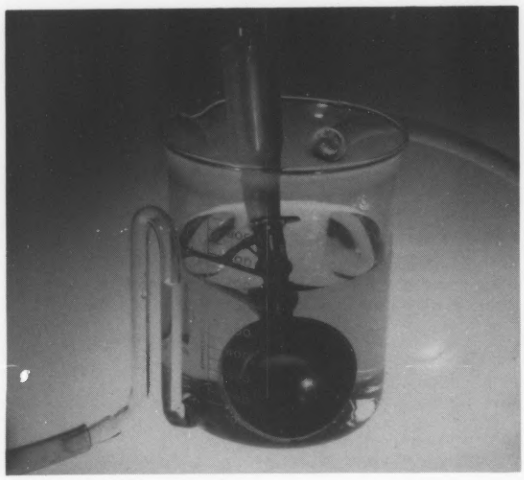

Figure 1. *Cleaning scoop device.*

Preparation of sample. The ice cream sample was left at room temperature for 15 minutes, and rotated several times for complete melting. Then the ice cream, 11 gr. of the sample, was weighted and mixed with 99 ml of phosphate buffer (2) and the appropiated dilution was prepared in the same buffer.

Standard plate count. Was performed by the method described (2) using plate count agar incubated at 32° for 48 hours.

Coliform counts. An initial 1:10 and further dilution of the ice cream dilution was prepared in phosphate buffer. 1 ml of the appropriate dilution was transferred to a 90 mm petri dish and 15 ml of molten violet red bile agar was added and mixed throughly with the sample.

The plates were allowed to solidify and were incubated at 35°C for 24 hours and the suspected colonies were verified.

Fecal coliforms were counted by the M P N method and verified as described by the Food and Drug Administration (*1*). Pathogenic E. coli 0114, obtained original from Israel Central Laboratory, was counted in the sample as fecal coliform and verified by serologic methods.

Cleaning scoop device. The laboratory model of this device was made from glass and is presented in Figure 1. The principle is an automatic siphon with siphonizing cycles every five minutes which require about 12 liters of water an hour. We suggest that the automatic siphon cleaning scoop should be made of stainless steel. The inlet tube should be made of 0.5 inch rubber tubing which could be easily connected to tap water. The drain tube should be made with 0.5 inch rubber tubing to be connected to the pipe. The water enters from the top to prevent back-flow.

TABLE 1. *Standard plate counts and coliform counts from water and ice cream in various fountain establishments.*

No. of fountain establishment	Water analysis			Ice cream analysis				
				Sample No.	Before use		During use	
	Type of Water	S.P.C. cc	Coliform cc		S.P.C.	Coliform	S.P.C.	Coliform
1.	Tap water	$1.5 10^2$	neg	1	$1.0 10^3$	<10	$1.0 10^5$	$2.0 10^3$
	Rinsed vessel	$5.3 10^2$	neg	2	$6.0 10^3$	<10	$6.0 10^4$	$2.0 10^3$
	Vessel water xx	$1.0 10^7$	$2.0 10^3$	3	$2.0 10^3$	<10	$1.5 10^5$	$2.0 10^3$
				4	$4.0 10^3$	<10	$2.0 10^5$	$2.0 10^3$
				5	$5.0 10^3$	<10	$3.0 10^5$	$2.0 10^3$
2.	Tap water	$1.0 10^2$	neg	1	$2.0 10^4$	<10	$6.0 10^5$	$2.0 10^3$
	Rinsed vessel	$8.0 10^2$	neg	2	$4.0 10^3$	<10	$9.0 10^4$	$1.2 10^3$
	Vessel water xx	$1.0 10^7$	$1.0 10^2$					
3.	Tap water	$2.1 10^2$	neg	1	$5.0 10^3$	<10	$1.2 10^5$	$2.0 10^3$
	Rinsed water	$1.0 10^3$	neg	2	$5.0 10^3$	<10	$2.0 10^4$	$2.0 10^3$
	Vessel water xx	$6.0 10^5$	$2.0 10^3$					
4.	Tap water	$1.2 10^2$	neg	1	$5.0 10^3$	<10	$8.0 10^5$	$1.4 10^3$
	Rinsed vessel xx	$5.0 10^2$	neg	2	$4.0 10^3$	<10	$9.0 10^4$	$1.0 10^3$
	Vessel water xx	$1.0 10^6$	$2.0 10^3$	3	$1.0 10^3$	<10	$2.0 10^4$	$8.0 10^3$
5.	Tap water	$3.0 10^2$	neg	1	$2.0 10^3$	<10	$2.0 10^4$	$1.0 10^2$
	Rinsed vessel	$2.1 10^3$	neg	2	$1.0 10^4$	<10	$9.0 10^4$	$2.0 10^3$
	Vessel water xx	$1.0 10^5$	$2.0 10^3$					

xx = Vessel water - water samples from vessels where the scoop was during use.

A water pressure regulator for constant delivery of the amount of water could be used in those places where the water pressure is irregular.

RESULTS

a) *The microbiology quality of the water where the scoop is kept and the respective ice cream*

Five fountain establishments were tested for their ice cream contamination during the marketing of the product. Samples were taken from the original bins, and three days after dispensing began with a sterile spoon from the surface of the ice cream. Tap water, water from the rinsed cup before used, and three hours after normal usage were analyzed.

The results presented in Table 1 indicated that there is an increase in the total bacterial counts and in the number of coliforms. Furthermore the presence of fecal coliforms in some of the water and in the ice cream was identified.

b) *Comparison of the bacteriological contamination of the water where the scoop was maintained and the respective ice cream*

Further analysis to establish the possibility of ice cream contamination, using this method of handling, was performed in the laboratory where the scoop was kept in beakers containing water at various outside temperatures. The experiment was performed for 3 hours with the scoop used in a comparable way as in the fountain establishment ice cream delivered every five minutes. From the results presented in Table 2, we were able to note an increase in the bacterial counts and coliform in the water vessels and in some instances also in the ice cream tested.

Our data would suggest that the outside temperature of the water was not an important factor.

c) *Comparison of the bacteriological results of the water from the device where the scoop was kept and the ice cream contamination*

The scoop was kept in the device previously described with water being changed every five minutes. The temperature of the water, which entered the device, was 25°C. The experiment was performed for 5 hours with the scoop immersed in the ice cream every five minutes. The results

TABLE 2. *Changes in the bacterial count of the water where the scoop was kept and the respective ice cream.*

Outside temperature	Time/hour	Water where the scoop was kept		Ice cream	
		SPC/cc	Coliform/cc	SPC/gr	Coliform/gr
	0	6.0×10^2	<10	5.0×10^3	8.0×10^2
	1	3.6×10^3	18	-	-
24°					
	2	3.0×10^4	20	-	-
	3	7.5×10^4	20	2.0×10^4	4.0×10^2
	0	3.0×10^2	<10	5.0×10^3	8.0×10^2
	1	2.5×10^3	60	-	-
27°					
	2	2.0×10^4	80	-	-
	3	8.0×10^4	90	7.0×10^4	7.0×10^2
	0	2.0×10^2	<10	2.0×10^3	8.0×10^2
	1	3.5×10^3	40	-	-
30°					
	2	4.0×10^3	60	-	-
	3	3.0×10^4	100	3.0×10^4	6.0×10^2
	0	4.0×10^2	<10	5.0×10^3	2.0×10^2
	1	8.0×10^3	<10	-	-
34°					
	2	2.0×10^4	16	-	-
	3	4.0×10^4	20	2.0×10^4	3.0×10^2
	0	5.0×10^2	<10	1.0×10^3	>10
	1	4.0×10^3	20	-	-
36°					
	2	3.0×10^3	30	-	-
	3	4.0×10^3	20	3.0×10^3	10

TABLE 3. *Changes in the bacterial count of the water in the device and the respective ice cream.*

Time in hours	The water where the scoop was kept		Ice Cream	
	SPC/cc	Coliform	SPC/cc	Coliform
0	2.0×10^2	<10	2.0×10^4	80
1	-		-	-
2	1.5×10^2	<10	1.6×10^4	90
3	1.5×10^2	<10	2.1×10^4	90
4	2.0×10^2	<10	1.0×10^4	90
5	2.0×10^2	<10	2.0×10^4	100

presented in Table 3 show that there is no increase in the water and ice cream bacterial counts.

d) *Transfer of E. coli 0114 from the water where the scoop is kept to the ice cream*

A water container where the scoop was kept in fountain establishment was filled with sterile water containing pathogenic E. coli 0114. The water and the ice cream were analyzed for 4 hours for the presence of bacteria which was absent from ice cream. The results presented in Table 4 show that the bacteria was transferred from the vessel to the ice cream.

Similarly our cleaning device was also filled with a bacterial suspension and the contamination of the water and the ice cream was followed for 120 minutes. The results presented in Table 5 show that the possibility of contamination of the ice cream is low.

DISCUSSION

Ice cream sold in the soda fountain establishment is kept for long periods of time in open bins, and there is a constant transfer of bacteria by the scoop from one to another by the scoop itself or via the water in the vessel, where the

TABLE 4. *Transfer of E. coli 0114 from the water where the scoop is kept to the ice cream.*

Time in minutes	Vessel water	Ice Cream	
	E. coli 0114 /cc	E. coli 0114/gr	Dose E. coli 0114 per person eating ice cream (120 gr)
Before start	0	0	0
0	100	0.4	48
30	2400	4.3	516
90	4300	0.9	108
120	280	9.3	1116
150	230	9.3	116
180	70	2.4	288
210	210	2.3	276
240	150	9.3	1116
270	930	24	2280
300	730	46	5520

TABLE 5. *Transfer of E. coli 0114 from the scoop cleaning device to the ice cream.*

Time in minutes	Container water	Ice Cream	
	E. coli 0114/cc	E. coli 0114/gr	Dose of E. coli 0114 per person eating ice cream (120 gr.)
Before Start	0	0	
0	400	0.7	84
30	0	0	
60	0	0	0
120	0	0	0

scoop is kept. Furthermore not all the flavors are changes at the same time and contamination which could occur in one would spread to the rest of the ice cream, even to newly-opened ones, via the scoop. This contamination would last until all the containers are changed completely and the scoop thoroughly cleaned. The water in which the scoop is kept could also become contaminated (Table 1) and contamination could spread to the ice cream containers. (Table 4). Furthermore the possibility of the passing of fecal coliform from the water to the ice cream increases the hazard of this product to the population especially to young children. For this reason a continuous cleaning of the scoop will decrease contamination (Table 2,3,5) and cut off the chain of transfer of the contamination from one ice cream bin to the others at the soda fountain.

The results indicate that this type of device or any other technical version would considerably improve the bacteriological quality of the ice cream sold in these establishments, thus decreasing the hazard to the public of consuming contaminated ice cream.

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Dairy and Food Sanitation, Vol. 3, No. 8, Pages 288-292 (August 1983)

Sensory Evaluation As A Quality Assurance Tool In A Commissary Foodservice System

RONALD F. CICHY, Ph.D.

School of Hotel and Restaurant Management
University of Denver
Denver, CO 80208

Any foodservice operation can be regarded as a system of interrelated activities designed to deliver a series of products to the point at which they are available for consumption by the target markets. The target markets have definable needs that must be satisfied by the foodservice operation if the organization is to remain viable and realize a profit. The objective of any foodservice management group is to define these needs and meet or exceed the clientele's expectations (1). The objective of this research was to apply quality assurance and quality control principles, especially the Hazard Analysis Critical Control Point (HACCP) concept, to a commissary foodservice system and to discover whether the quality assurance/quality control principles will enable managment to define and meet their target market's expectations (2). The focus of this research is limited to a comprehensive treatment of one product produced in this commissary foodservice system. The product chosen was a double-deck hamburger sandwich. This product is the highest volume ground beef menu item produced by the commissary foodservice system and is subject to all the possible abuses of any foodservice system. The commissary's annual production of this product is in excess of 800 tons. Once produced, the ground beef patties are shipped to over 100 satellite low-to-medium priced, full-menu, table-service restaurants. The annual sales volume of this mid-west food corporation exceeds $125 million (3).

Definitions of Quality

What constitutes quality in foodservice operations? Although varying with the nature of the operation, almost every component of the dining-out experience, including menu variety, prompt service, food preparation techniques, and ambience is an indicator of quality. To provide quality, the restaurateur must establish standards for personnel, equipment, sanitation, raw materials, food preparation, presentation, and service. The customer's perceived value is based on quality and price and is also affected by other factors. Quality makes a product what it is. The term "quality", without being carefully defined in relation to some standard, means either very little or too much.

The average consumer associates quality with subjective personal preferences, as something that is liked or disliked, excellent, superior, great, or good. Quality, from a technique or scientific viewpoint, can be defined as an orderly classification of the chemical and physical characteristics of a product. Flavor, texture, appearance, consistency, palatability, nutritional values, safety, ease of handling, convenience, storage stability, and packaging are the essential elements that must be evaluated in establishing product quality. Management equates quality with certain economic factors, such as the cost of the product, profits generated and consumer acceptance within the intended selling price range.

Quality of foods may be defined as the composite of the characteristics that differentiate individual units of a product (4). These characteristics influence the degree of acceptability of the unit by the buyer. Quality may mean excellence in relation to certain things that a consumer wants in a particular product. Food quality is evaluated by sensory, chemical, and physical methods. Two dominant factors emerge in the definition and evaluation of quality: the actual physical or chemical measurement of the product and the acceptance of the product by the consumers based on whether or not it completely satisfies their "wants". The development of a quality product and organizational image, coupled with a consistent marketing effort, can enhance a firm's market share.

Quality is never the result of the efforts of the quality control or quality assurance department alone. Rather, quality is the one factor that the entire organization must address and support. It is a valued organizational goal

and outcome. It is management's responsibility to establish quality as an attitude that permeates the entire organization. The development of quality judgment in employees is highly significant to satisfactory production. Quality in production refers to the taste, appearance, texture, nutritional value, and level of excellence of the food served. Clear concepts of quality are best developed through first-hand experience.

Quality control has been defined as the operational techniques and activities that sustain a quality of product or service that will satisfy given needs; also the use of such techniques and activities (5).

Without a quality control program, a foodservice firm cannot serve a consistent standard. A good quality standard should cover essential characteristics that indicate quality in a product. The modern-day concept of "total quality control" involves sensory evaluation in all stages of product flow, from inspection of incoming raw materials through surveillance of the finished products. It is now recognized by most companies that quality controls are vital and, in many instances, represent the very life blood necessary to compete successfully in today's competitive and changing markets (6). On the other hand, some companies still view quality control programs as an expense with no direct profit to the firm (7).

Quality assurance includes all the planned systematic actions necessary to provide adequate confidence that a product or service will satisfy given needs (5). The primary responsibility for the safety, wholesomeness, and nutritional quality of food rests with the food processor, not the Food and Drug Administration or any other governmental organization. The consumer's best hope for safety and quality in food lies in the development and maintenance of adequate quality assurance programs. Quality assurance systems must be installed in a company's operation to provide some degree of assurance that the products manufactured and shipped are not adulterated or misbranded. The quality assurance system must include ingredient inspection and control, manufacturing control, and distribution control.

An effective quality assurance program should embrace all available means of testing, and sensory evaluation is one of the most important. The establishment of an effective quality assurance program in any food operation requires, in part, that the program be well defined, adequately communicated, and clearly understood by all participants and put into practice. The program must standardize and clearly specify all formulae, manufacturing and storage conditions, product handling, processing, and finished goods inspection. The quality assurance effort must also involve on-going testing and monitoring of physical, chemical, sensory, and microbiological qualities.

Assurance of quality in a foodservice operation must follow the same basic principles that apply generally to food operations producing packaged products. Restaurants, unlike commissary foodservice systems, are unique, however, in that products flow directly into the hands of the consumer, with minimal opportunities to accumulate output, sample, analyze, and withdraw unacceptable products. In contrast, a commissary foodservice system may provide increased opportunities for a dynamic quality assurance program, since food production and service areas are located in separate facilities.

Sensory Aspects of Ground Beef

The quality of food is a composite of microbiological, nutritional, and sensory attributes. Sensory methods are used to determine whether foods differ in such qualities as taste, odor, juiciness, tenderness, or texture, and the extent of these differences. Sensory tests are also used to determine consumer preferences among foods and whether a certain food product is acceptable to a specified consumer group.

The two general types of sensory evaluations of foods are consumer tests to determine acceptability and difference tests to determine quality differences. Sensory evaluation is concerned with human evaluation and measurement of physical stimuli. Laboratory panels are not miniature consumer surveys. Some companies, however, prefer to use employee panels to assess preference or acceptability of a food product before testing that product on consumers. Employee panels can be utilized to predict consumer acceptability or preference responses, provided the employee panels are composed of persons similar to the potential consumers who will comprise the non-employee panel.

Sensory quality standards for retail meats may include appearance, such as color, size, and shape; kinesthetics, such as texture, mouthfeel, consistency, and viscosity; and flavor senses, such as taste and smell. The purpose of sensory standards is not as much to focus on consumer protection as it is to serve as a means for processors to determine consumer preferences. The objective then becomes the tailoring of the product to satisfy these consumer preferences. Sensory attributes, which are generally buyer-seller specifications, are ultimately valuable purchasing tools of the consumer.

Sensory evaluation makes an important contribution to an effective quality assurance program. Sensory principles can be applied in all stages of product flow, from incoming inspection to in-process controls to final product inspection and product surveillance. Sensory testing has been included in the quality assurance programs of several leading food companies because it offers three important advantages. Sensory evaluation identifies the presence or absence of perceptible differences; pinpoints the important sensory characteristics of a product in a fast, quantifiable manner; and identifies particular problems that cannot be detected with other analytical techniques.

Sensory Analysis of Ground Beef Patties - Methods and Analysis

Sensory evaluation can be considered a service function regardless of where or how it is positioned in an organization. Ideally, this service function should be an integral part of the

decision-making continuum. Sensory evaluation may be structured as strictly a part of research and development. Alternatively, sensory evaluations of the firm's products can provide information to bridge the gap between the research and development department and the promotional aspects of marketing. In addition, sensory evaluation can be used as a branch of marketing research to check advertising, market positioning, and packaging rather than the physical and quality aspects of the product itself.

The complete process flow diagram for production of ground beef patties is illustrated in Figure 1. The commissary receiving department performs no sensory evaluation of the delivered fresh or frozen beef plates, or boneless beef. Only the number of boxes delivered are verified and compared to the invoice. The lab staff performs odor, color, and appearance checks, in addition to total plate count (TPC) and percent fat tests, on "randomly" chosen samples of frozen beef delivered to the commissary.

When the fresh and frozen beef is processed by the meat room personnel, (see Figure 2) the product is evaluated by the meat room supervisor based on appearance, odor, and texture. The lab staff informally evaluates the finished ground beef patties, based on sensory criteria of odor and appearance, when analyzing the product for percent fat. The USDA inspector at the commissary primarily performs a sensory inspection (sight,smell, and touch) of the patties. This individual conducts no analytical tests, but relies on the results of the commissary lab analyses. The USDA inspector relies on his experience to indicate whether or not the product is acceptable.

Periodically, an "executive" taste panel consisting of the commissary owners, the vice-president for commissary operations, the commissary manager, and the individual in charge of all retail operations evaluates selected food products. The taste panel utilizes preference tests to evaluate food products based on individual likes and dislikes. Menu items are added or deleted based on the preferences of the "executive" taste panel.

The only danger in only using an "executive" taste panel lies in the fact that panel members may not accurately reflect the target market's preferences. The goal of sensory evalua-

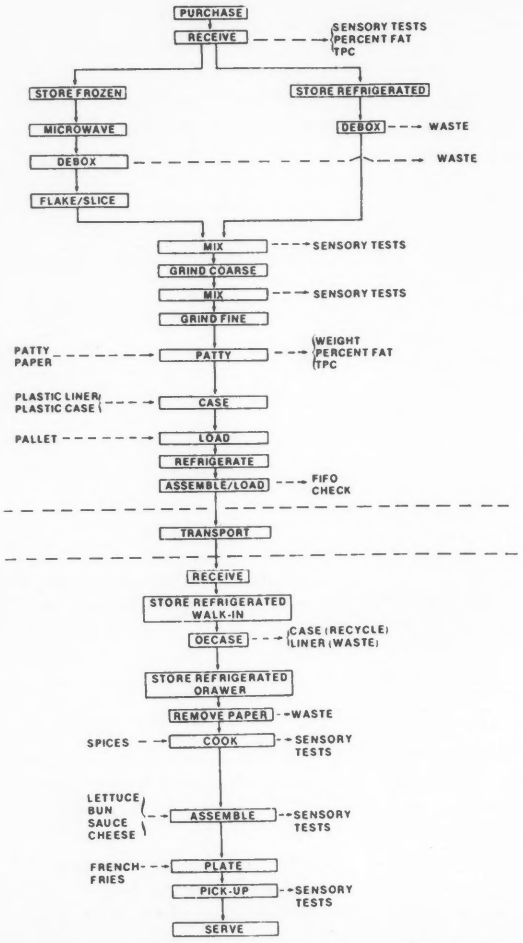

Figure 1. *Complete process flow diagram for ground beef patty sandwich production in a commissary food service system.*

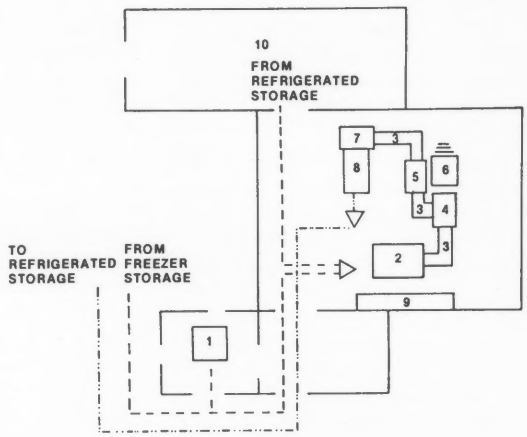

Figure 2. *Plan view of commissary meat room illustrating raw product and ground beef patty flow (not drawn to scale).*

tion should be to determine whether the product offered is in a condition that is satisfactory to the consumer. This consideration should pervade all aspects of quality assurance, especially the area of sensory analysis.

When ground beef patties are delivered to the restaurant, a case or bag count is verified against the invoice. The product's temperature, weight, sensory condition or the sensory condition of the delivery truck are not checked. A visual check of the cooked and assembled ground beef patty sandwich is normally performed before the menu item is served to the customer.

Periodically, a field inspector from the commissary inspects the individual restaurants using a Standards of Performance report which was developed by the commissary management. This once-a-month inspection involves an evaluation of the cooked ground beef sandwich based on sight only. In addition, the restaurant's dining room and staff are periodically evaluated using a Service Inspector's Report. This latter report form does not cover a sensory evaluation of the ground beef sandwich.

Sensory Evaluations - Important QA/QC Tools

Sensory evaluations can be some of the most important QA/QC tools used to evaluate product quality. To be effective, these evaluations must be based on the sensory guidelines and specifications approved by management and conducted by trained personnel. Sensory evaluations should take place during all stages of product flow, from incoming raw material inspections through finished product preparation and service in the restaurant. Sensory analysis can be an effective part of the corporate strategic quality plan if the organization has well-defined sensory quality standards. These standards must be based on the needs and wants of the target markets. The firm's sensory evaluation program should be examined on a regular basis to determine its benefit and effectiveness to both the organization and its target markets.

Incoming inspections of fresh and frozen beef represent the necessary first step in controlling the quality of the finished product. Sensory evaluations are one of the criterion for QA/QC commissary staff incoming product accept/reject decisions. These inspections should focus on the product's odor and appearance. If the delivered beef has an off-odor, it is unacceptable. If the beef shows evidence of freezer burn or other unusual appearance, it is a likely candidate for rejection.

The objective of incoming product sensory evaluations is to minimize the likelihood that defective or nonconforming products will be processed for sale. In addition to product sensory tests, the supplier's delivery truck should also be checked for signs of contamination and infestation. These inspections can only occur on a regular basis if the receiving function is a planned and organized effort. Commissary QA/QC staff should be notified in advance of product delivery so the necessary inspections can be scheduled and performed. The sensory evaluation of incoming products will provide QA/QC personnel with information to be used to compare the product quality to the established specifications. When a product is determined to be outside of these specifications, it is rejected and the supplier is informed of the reason.

Sensory evaluations are an important part of the determination of in-process product quality as well. Storage areas for raw materials and finished products should be checked daily for signs of product spoilage, unacceptable storage conditions, and contamination. Both trained production employees and supervisors can use their senses of sight, smell, and touch to evaluate the beef sensory quality during processing. These investigations must be based upon the specifications approved by management. These standards and specifications form the basis for the sensory evaluations by both employees and QA/QC staff members.

The last chance to identify product nonconformance to standards before shipping to the restaurants is the finished product inspection. Finished product inspection should be based upon evaluations of the ground beef patty texture, color, odor, and taste. In-plant sensory panels, consisting of trained and selected employees, should conduct routine product evaluations. These routine taste panels will also provide an audit of the effectiveness of the incoming and in-process evaluations. These taste panels are not to be utilized to establish marketplace quality, as this can be determined only by the target market. The purpose of these taste panels is to examine the finished product in relation to the specifications established by management based on the target market's desires.

Incoming beef patties delivered to the restaurant should be examined by a trained and selected employee during the receiving inspection. Product sensory characteristics of odor, appearance, and flavor should be used as the basis for accept/reject decisions. The trained and selected employee should use established specifications to determine whether the ground beef patties are fit for preparation and service to the customers. In addition, a sensory evaluation of the delivery truck should be a regular part of the receiving routine.

Products should also be monitored during storage to minimize losses due to spoilage and contamination. Before being cooked, the ground beef patties should be periodically evaluated for odor and appearance. Once prepared and assembled, a final product inspection must take place by both the cook and the service person to determine whether the product meets the established specifications. No product should be served to the customer that does not meet these management quality criteria.

Periodically, restaurant personnel must be encouraged to taste all products served in the operation. These product tastings can be a regular part of the restaurant's employee meetings. The objective of these product tastings is to familiarize the preparation and service personnel with the product so that they can intelligently provide information to customers during personal selling contacts. In addi-

tion, these product tastings demonstrate management's interest in maintaining quality and employee involvement and interest. They provide the impetus for monitoring product quality in the restaurants.

The firm's clientele should be encouraged to make comments regarding the operation's food quality. These comments must be communicated to management so that action can be taken if a problem is identified. Fundamental to the success of sensory evaluations of food products is the establishment by management of standards and the training of personnel to carry out the investigations. Management must realize that they cannot be in all places at all times to evaluate the product sensory status. Therefore, management must rely on the efforts of trained employees if the program is to be successful.

Summary

The organization's management should recognize that the goal of product sensory evaluations is to provide information regarding the firm's quality efforts. Sensory evaluations of products should be an integral part of the operation's strategic quality plan. The mission of any service organization is to satisfy the needs and wants of its target market at a profit. Once these needs are determined and product specifications are established, sensory evaluations provide information regarding how well the organization is progressing toward satisfying these needs. Sensory evaluations are an essential part of the corporation's strategic quality plan geared toward achieving the firm's stated mission.

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Benefits of Salt in Food Products

MARTHA E. RHODES, Ph.D.

Bureau of Food Laboratory,
Fl. Dept. of Agriculture & Consumer Services

The attack is on and salt is indicted as the villain. The marketplace is rushing to respond to calls for sodium reduction. The journals are filled with articles on the effects of replacing sodium. Food and Chemical News alone had 96 stories on sodium labeling and reduction in 1982. The harmful effects of excessive sodium and salt intake are not debatable for many epidemiological studies show a relationship between sodium intake and hypertension; however, the furor over sodium has clouded the beneficial effects of salt in our food supply, and my main purpose will be to detail for you some of the benefits and to sound a note of caution before salt is replaced without the scientific evidence of safety.

Salt - wars have been fought over it. It has occupied a unique position down through history. The books of Numbers and Chronicles in the Bible refer to the use of salt to seal a promise or covenant, and the Bible contains numerous other references to the purifying and flavoring effects of salt. Greeks used salt to buy and sell slaves: a good slave was "worth his weight in salt". The ancient Egyptians recorded their numerous preservation techniques with salt in carvings on their tombs. An ancient Chinese artist rendered the extraction of brine from salt springs with it conduited to evaporation pans.

Even my pay check or salary received Friday is specifically related to salt. The word salary comes from the Latin *salarium*, referring to the salt that was part of a Roman soldier's pay. The salting of meat and fish has a somewhat obscure and macabre history linked back to Egyptian use in embalming according to Reay Tannahill in *Food in History*. Salt even related to social status. I will be watching at the banquet tonight to see if Bill has me seated "above the salt" or "below the salt".

While our total dependance on salt for some food items may have diminished, it still maintains an essential function in our bodies and food supply. Salt functions as an important electrolyte maintaining blood volume and pressure. Salt controls passage of water in and out of cells. Sodium plays a critical and irreplacable role in the transport of certain solutes across cell membranes. While we may think of salt only as a seasoning, another main purpose is as a preservative - preventing spoilage of a large number of different foods. Salt controls fermentations; it solubilizes and extracts proteins in meats, it controls water activity in foods and improves water retention. Our body is actually composed of 0.2% sodium, with the majority occurring in the extracellular fluids and skeleton. Why then the concern? How much are we consuming? Estimates vary, the American public may be consuming as much as 10-12 g of salt a day, or 4800 mg sodium. Estimates of our actual daily needs range only around 200-300 mg sodium per day or 0.5 g of salt. The National Academy of Sciences has estimated that 1100-3300 mg of sodium is the safe daily intake level. This equates to a salt level of 2.8-8.4 g. To attempt to reduce this level in the American diet, the Food and Drug Administration proposed a five pronged program in 1981 involving voluntary reduction of salt in processed foods, development of new regulations to deal with sodium labeling, expanded consumer education programs, continued monitoring of sodium consumption, and consideration of legislative proposals to broaden sodium labeling.

The purpose of this paper is not to delve into these proposals but a brief examination of the types of new labeling and reduction appearing on the market will be relevant. Baby food companies were alert to the sodium problem and began eliminating added salt several years ago. These items as well as fresh fruits, cereal grains, and beverages may be labeled as sodium free or 5 mg sodium or less. Fresh or frozen vegetables and certain snacks may be designated as low sodium in the 35 mg range, while breads, fish, meat and poultry could fall in the moderately low sodium levels around 140 mg.

Now, where can the sodium or salt levels be legitimately reduced? Of the 10-12 g consumed per day, approximately 30% is found naturally occurring in foods. Another 30% of 3-5 g of salt is in the form of added food ingredients, while the remaining 4 g comes from the discretionary use of the salt shaker. Just the removal of the salt shaker can be seen as a great reduction in intake.

Eliminating the salt shaker, where are the sodium sources in our diet. Grains account for 32%, meat products 28%, vegetable products 15% and dairy products account for 11% of the sodium in our diet. Many ingredients in grain products are in the form of sodium salts: preservatives, enrichments, dough conditioners, etc. In addition, the various types of individual cereals vary widely. The sodium content of meats also varies widely from a low of 55-69 mg sodium for a 3 oz piece of beef or chicken drumstick to a high of 822 mg sodium in 3 oz corned beef or 1114 mg in 3 oz of ham. Vegetables can be a deceptive source of high levels of sodium depending on the type of processing involved. Until recently canned vegetables often contained 2-300% greater sodium levels than fresh or frozen because of the conviction that it was necessary as a seasoning for consumer acceptance. Market studies are now revealing that the low sodium designation may be just as great a marketing edge as the "natural" label of the past few years. An Ohio company recently introduced 13 meat loaf items with reduced salt level and achieved a 72% increase in sales in a matter of months from this change in formulation. Other significant sources of sodium can unexpectedly come from certain foods such as soups and condiments. These few examples illustrate quite clearly the great variations in sodium level from chosen additions as food ingredients. These sodium ingredients function as; sensory additives (66.4%), nutritional additives (10%), preservative qualities (70.5%), and other technological functions (72%). The benefits are clear, the areas of safe reductions are not so clear. Let us examine more closely some of the specific benefits.

We can examine the beneficial aspects of salt in foods by several different systems: 1) by food product or class, 2) by function within a food, and in the area of preservation 3) by organism affected. Lets look at the benefits of salt in a particular product, cheese. Zehren in a 1982 symposium related that salt in cheese restrains growth of undesirable organisms, favors growth of desirable organisms, expels moisture from the curd, and is responsible for characteristic body texture and flavor. Numerous difficulties have been encountered in sodium replacement for low sodium cheeses have found low acceptability because of bland flavor. The entire dilemma of flavoring low sodium foods is receiving increasing emphasis with recent articles in Food Processing and other journals relating to achieving palatability acceptable to consumers, and what flavorings may be used to overcome the blandness or the bitterness caused by the potassium replacement that many are attempting. Certain classes of foods use salt to selectively control certain microorganisms and fermentations to stabilize tissues; for example, cucumbers during pickling.

Vegetables and fruits are highly perishable and chiefly water. When placed in a watery solution, they will soften and begin to putrify and ferment in 24 hours. Salt plays the all important role of suppressing the undesirable microbial growth while allowing the natural flora of lactic acid bacteria to ferment the carbohydrates present. The increasing acidity, then along with the salt, controls the desired production of a palatable end product. The length of time required for the fermentation and the percentage of salt required varies from product to product.

For cucumbers, salt may be initially present at 8% and be increased to about 16% after fermentation is completed and tissue characteristics are achieved. This percent salt is too high for commercial products but gives a salt stock that can be held for several years with no spoilage except by certain yeasts and molds. The commercial sour pickles, sweet pickles and processed dill pickles can all be made from this stock by leaching and removing some of the preservative salt.

Cabbage in many winter diets of old was an important, albeit unknown, source of vitamin C. Naturally, it will store only 3-4 months. However, if the cabbage is shredded and mixed with about 2.25% salt by weight, the salt will draw the juice from the cabbage and control putrefactive growth while selecting for the various lactics whose fermentation will give us the final sauerkraut.

Olives undergo a very similar process. After the bitter alkaloid oleuropein is removed by lye a curing and fermenting in salt brine is permitted. Salt is also important in better controlling the fermentation of *Streptococcus lactis* and *Leuconostoc citrovorus*.

Fermentations are complex ecosystems with many microorganisms interacting. Salt is a controlling factor. It 1) functions in fermentations to cause high osmotic pressure and plasmolysis of cells, 2) dehydrates foods by drawing out and tying up moisture, 3) ionizes to release the chlorine ion toxic to microorganisms, 4) reduces solubility of oxygen in moisture, 5) sensitizes the cell against carbon dioxide, and 6) interferes with action of proteolytic enzymes.

Oriental fermented products rely on molds as sources of hydrolytic enzymes. Soy sauce for instance is a mash of soybeans and crushed wheat inoculated with a koji starter culture of *Aspergillus oryzae* and soaked in a 24% salt brine.

Fish may be dry salted in 4.5% salt and further preserved by smoking.

The United States is the leading salt producing nation. The states of Louisiana, Michigan, New York, Ohio and Texas produce 88% of U. S. salt. In 1977, 43,412 thousand tons of salt worth $452 million were taken from the seas, mines, and wells in the U. S. The majority of the salt, approximately 53%, comes from brine wells where water is pumped down into the salt bed dissolving the salt and the brine pumped to the surface for later evaporation. The remainder of the salt comes from mines (34%) and from evaporation of sea water (13%), which contains about 1/4 lb of salt per gallon.

Let's examine salt effects by function. One function of salt is in the controlling of water activity. Childers et al. (1982) determined the interaction of sodium chloride concentration and drying time on the water activity of salami. Increasing salt decreased drying time. This was not totally concentration dependent.

The third way in which salt functionality can be examined in the area of preservation is by the effects of specific organisms. Salt is generally inhibitory to many types of microorganisms. Five percent will essentially control all putrefactive growth. Although some halophilic or halotolerant bacteria along with certain molds can grow around 20%, the vast majority of all types of microorganisms are readily inhibited here. *Staphylococcus aureus* is the most resistant of the food poisoning bacteria to the levels of salt; this fact is utilized in isolating this bacteria within the laboratory - 10% salt is added to the selective medium to inhibit other bacteria yet allow staph to grow. *Vibrio parahemolyticus* is a marine microorganism requiring salt for growth. Beuchat has demonstrated optimum growth of this organism at 2.9% salt yet Sakazaki and Rodel in different studies have shown a rapid decline in growth with increasing salt levels over the optimum, with a maximum of 11% for any growth. This is not a specific effect of water activity. Chun et al. demonstrated the lethal effects of equivalent glycerol concentration. My doctoral research was also specifically on the requirement of sodium for substrate transport across cell membranes. This function cannot be replaced by other ions. In reading the literature concerning salt effects, one will encounter the term ° salometer which relates to the saturation of water with 25% salt would be a reading of 100°C. The percentage of salt may be determined by dividing this reading by 4. Salmonella has a very low salt tolerance for growth but survival varies in low water activity foods and affects heat resistance.

The effects of water activity reduction by salt on enterotoxin production by staphylococcus was demonstrated by Troller. Only limited enterotoxin production could be measured at A_w 0.97 after 60 hrs while an A_w of 0.99 gave a rapid enterotoxin production. This effect is not due to water activity reduction alone. Robach and Stateler studied inhibition of *S. aureus* by certain synergistic combinations of sorbate with salt, TBHQ, BHA and EDTA. Tompkins et al. expanded these studies of combinations to a food system.

Childers et al. (1982) in a study of salt effects of Trichinae in Genoa salami showed a definite effect of salt concentration on trichinae viability. Salt also greatly affected drying times. With no salt added, viable parasites were detected through day 25, with 1.67% salt viability was found in 50% of the samples through day 10, but with 3.3% salt no viable trichinae were found after day 10. Other results showed that if the fermentation temperature is sufficiently high, salt and drying time can be reduced. Terrell et al. compared various chloride salts on the viability of trichinae. This group had previously reviewed reduction or replacement of salt in various processed meats, and in several studies indicated that this was apparently limited to potassium chloride. In this study, sodium, magnesium, calcium, and potassium chloride were examined for their effects both with and without nitrite addition. All salts reduced pH values. Sodium and calcium reduced total aerobic counts. Nitrite addition did not affect this aspect. The use of potassium and sodium chloride showed greater trichinae deaths. They concluded however, that for maximum protection against trichinae this required 1) heat pork to 58.3°C or freeze for adequate periods and 2) maintain brine at 8% sodium chloride. They concluded that based on the data from this study that additional confirmation by in vivo studies for viable trichinae and microbial effects should be completed before considering changes in chloride salts used in processed meat formulations.

Historically, a great function of salt in meats has been in preventing *Clostridium botulinum* growth and toxin production, and it is in this area that the most research concerning the benefits of salt has occurred. Rieman and Tompkins and Christiansen documented that 10% sodium chloride is sufficient to control all types of *C. botulinum*. Schmidt found that this level of salt would give a resulting water activity of 0.935. The problem is readily apparent, however. This quantity of salt in a processed meat is not palatable. Most hams range from 1 - 3%. Salt concentrations considerably lower can be effective however due to the complex interactions among pH, nitrite and heat. Pivnick reported the nitrite - salt interactions in luncheon meats and warned that severe hazards should be anticipated if one or more factors were reduced without appropriate adjustment of the others. Recent work by Deibel showed that an increase in the salt concentration from just 2.2 to 2.6 percent resulted in delayed botulinal toxin production from day 3 - day 7. Graham has indicated these complex interactions of processing and additives. He categorized foods based on the interaction of these factors in the control of *C. botulinum*. Salt plays an integral and irreplaceable part in six of the eight categories of foods. Pivnick and Barnett found that the critical levels of salt needed to inhibit *C. botulinum* in meats varies with individual products and depends largely on pH varying from below 5 to 6.5. Sebald recorded the statistics involving frequent botulism outbreaks with home cured meats, particularly hams in Europe, due to inadequate control of salt and nitrite. If we had to rely on heat alone, cured meats would be inedible as shown by Silliker, therefore a combination of factors must be relied on. Pelroy et al. showed that as nitrite and salt were increased, toxin production could not be demonstrated. The decreasing quantities of type E toxin formed in the increasing quantities of salt is revealed in the data of Boyd and Southcott. The complexity of this interaction between pH, salt and nitrite was perhaps best illustrated in the often quoted work of Roberts and Ingram. Any change in one factor must be offset with a change in the other for adequate control. Dr. Mike Foster of the Food Research Institute reminded us in a 1982 article on Food Safety: Problems of the Past and Perspectives

of the Future:

> "Historically, most bacterial food poisoning in the United States is associated with mishandling either in the home or in the food service establishment. Outbreaks traceable to errors in processing plants are rare. When they do occur they are often associated with changes in processing or packaging technology whose effect is not determined before the product is on the market".

This is my main concern. I can find many papers on the effects of potassium and other salts replacement on chemical, sensory and physical properties of foods, but there is a dirth of information concerning the microbiological effects of salt reduction or replacement. A study recently reported by Vanderzant and others on replacement of salt in inoculated ground pork shows that although no differences were found on Micrococcus and Moraxella growth, lactobacilli were increased with sodium replacement. They were quick to note however, that this was done with pure cultures and did not take into account the complex interactions between the usual flora of the meat.

In conclusion, any efforts to reduce a disease condition that affects 18% of American adults or an estimated 60 million hypertensive individuals must be supported. Yet as others have pointed out, it is somewhat remarkable that efforts of agencies, scientists and nutritionists have all focused on sodium. In normal physiology of man, animals and bacteria like, sodium is linked closely to potassium, magnesium and calcium balance. Cardiovascular research is now also implicating a complex interaction of excess caloric intake with improper electrolyte balance including but not limited to sodium. That sodium is important in the whole area of hypertension is not debatable. Any nutrient consumed over safe levels must be reduced. The American public must be convinced —

To push the salt shaker away is necessary,

To reduce high sodium levels in foods where its only function was sensory may be essential,

To replace or reduce sodium in foods where it is acting as a preservative alone or in synergism with other chemicals is dangerous.

The jury is still out on the question. The main problem remains - the jury has yet to see the evidence for a proper decision.

News and Events

C. K. Johns Memorial

The family of C. K. Johns has established a memorial fund in his name at Olds College, where he began his studies. The annual scholarship will be given to a student in the Dairy Training Program.

Donations to the C. K. Johns Memorial Fund should be sent to:

The Olds College Foundation
Box 88
Olds, Alberta, Canada T0M 1P0

Edward Kaeder

Deepest sympathy is extended to the family of Edward Kaeder, Stillwater, MN, who died May 5 at the University of Minnesota Hospital.

Mr. Kaeder, 62, was employed in the field service department of Mid-America Dairymen for thirty years. Involved in milk quality control, he was supervisor of member services at the time of his death.

Active in several organizations, he was a member of the International Association of Milk, Food and Environmental Sanitarians; Minnesota and National Mastitis Councils; Minnesota Sanitarians Association; Minnesota Dairy Technology Society and Northwest Wisconsin Fieldmen's Association.

Family members include his wife, Violette, and children, Cosette, Shelly, Marilee, Jackie, Jill, Kennan and Joseph.

Cheese Giveaway Program Hurts Sales

The U.S. Department of Agriculture will be giving away less cheese due to a drop in commercial sales.

In ordering a 52 percent cutback in the cheese giveaway program that was started about a year ago, Secretary of Agriculture John Block cited two reasons - needy people who qualify for free cheese normally buy their own, and some people who are not so needy receive free cheese rather than buy it.

"Evidence that the cheese giveaway program was hurting cheese sales started showing up during the last quarter of 1982," said Dr. Bud Schwart, dairy marketing specialist with the Texas Agricultural Extension Service, Texas A & M University System. "During that quarter commercial sales were down 8 percent from a year earlier. But the real shocker came last February when commercial sales were down a staggering 29 percent from February of 1982.

Applebaum Receives Hoyt Award

Rhona S. Applebaum has received the $1,000 Richard M. Hoyt Memorial Award from the American Dairy Science Association.

She was cited for her Ph.D. research in food science while at the University of Wisconsin-Madison.

Applebaum found that aflatoxin is not eliminated or reduced by conventional milk processing or during storage, and identified ways to chemically inactivate or remove aflatoxins from milk and dairy products.

The findings offer hope that contaminated milk can be treated and used rather than discarded.

Applebaum received the award during the 78th annual ADSA meeting held at the UW-Madison, June 26-29. She is currently director of scientific affairs for the Chocolate Manufacturers Association, McLean, VA.

Pfizer Award to Irvine

Dr. Donald M. Irvine, professor in the Department of Food Science at the University of Guelph, Guelph, Canada, is the recipient of the 1983 Pfizer Award in Cheese and Cultured Products Research.

Presented on June 28th at the 78th annual meeting of the American Dairy Science Association, the award honors Dr. Irvine for innovative research that led to the development of a unique Canadian cheese called "Stella Alpina."

Consisting of a bronze plaque and a $1,000 honorarium, the award was presented by Dr. Rajen S. Mehta of Pfizer's Technical Development Department, Milwaukee, WI Operations.

According to the citation, Dr. Irvine "foresaw the need for diversifying the Canadian cheese industry to include cheeses other than cheddar."

Methods devised by Dr. Irvine have met with rapid acceptance by the dairy industry. These include 1) adoption of the stirred curd process, 2) scale-up of technology for making processed cheese from whey

protein obtained by reverse osmosis, 3) successful adaptation of laboratory scale Queso Blanco cheese to commercial operation and 4) common use of yield data from the Cheddar Cheese Bulletin for standardizing a protein-to-fat ratio of cheese milk.

Notable for its creativity, Dr. Irvine's research has led to the publication of 42 papers in refereed journals and 23 articles in non-refereed journals and bulletins. He has taught short courses on different cheese varieties at Guelph and has presented numerous papers at world research conferences.

A member of the ADSA for 36 years, Dr. Irvine has served as national director and president of the Canadian Institute of Food Science and Technology. He also served as ADSA membership chairman for Eastern Canada and was a co-convenor of the 1974 annual meeting at Guelph.

The Pfizer Award was established in 1958 to recognize research achievement and to stimulate fundamental investigations in cheese chemistry. It is administered by ADSA and its selection committee.

Cruess Award to Oblinger

Dr. James Oblinger, professor of food science and human nutrition at the University of Florida, was presented with the 1983 Wm. V. Cruess award today by the Institute of Food Technologists at its 43rd annual meeting here.

The award honors a person who has achieved excellence in teaching food science and technology. It consists of a bronze medal donated by the Northern California Section of IFT and a $1,000 honorarium.

Dr. Oblinger received his B.A. degree in bacteriology from DePauw University in 1967. He then moved to Iowa State University for graduate training, and earned his M.S. and Ph.D. degrees in food technology in 1970 and 1972 respectively.

Dr. Oblinger's research interests lie in the area of food microbiology, emphasizing decontamination techniques, foodborne pathogens, microbial interactions, and the effects of processing techniques on the microflora of foods. He attempts to integrate his research experiences into his classroom and laboratory activities, and his students appreciate the practicality of his approach.

Dr. Oblinger has been active in IFT's Florida Section, having served in most offices up to section chairman in 1982. He is a member of the American Society for Microbiology, the International Association of Milk, Food & Environmental Sanitarians, the American Meat Association, and a number of regional associations as well. He received the Professional Scientist Award of the Southern Association of Agricultural Scientists in 1976, and is a member of the honorary societies Phi Kappa Phi, Sigma Xi, and Phi Tau Sigma.

Training Booklet from Cornell Univ.

The absolute importance of good personal hygiene -- and how to practice it, is the sole message to food handlers in a new training booklet from Cornell University.

In an easy-to-read, brief text supported by graphic photos, "Safe Food Preparation: It's In Your Hands!" explains the dangers of handling dirty utensils, touching parts of the body, cleaning up spills, or similar acts while preparing foods.

Written by food scientist R. B. Gravani, in the New York State College of Agriculture and Life Sciences at Cornell, the eight-page training aid is directed at workers who prepare or handle foods on a commercial or institutional level.

Gravani emphasizes the importance of clean clothes, personal cleanliness, and frequent handwashing to reduce the threat of food contamination by "hitchhiking" bacteria.

Gravani's recommendations apply to both new and experienced food handlers and preparers in virtually all situations, from gourmet restaurants to take-out snack bars, including cafeterias, caterers, camps, and institutional kitchens.

"Safe Food Preparation: It's In Your Hands!" (S-128) is available in units of 10 copies for $3.95 (including

shipping and handling) from Cornell Distribution Center, 7-SF Research Park, Ithaca, NY 14850.

Food service managers and supervisors should inquire about the companion slide-script training package available from the same address.

Radiation Processing

Radiation processing of food "is versatile and has the potential to provide more food, of good taste, with fresh-like quality and of wholesome and nutritional value to consumers...", according to a newly released Scientific Status Summary from the Expert Panel on Food Safety and Nutrition of the Institute of Food Technologists. Moreover, its costs, in money and energy, should "make it competitive with older food processing methods."

Irradiation is a "cold" process, according to the IFT, so nutritional losses are minimal. Also, there are fewer adverse changes in flavor, odor, color, or texture. Irradiation is a very flexible process, so it can be used to process a variety of foods in a wide range of sizes and shapes -- whole crates or potatoes, sacks of flour, whole turkeys, or sandwiches of sliced meat, fish or chicken.

It can also be used to extend the shelf-life of foods before they spoil. In fact, predicts the scientific society, this will probably be its first application, in a manner similar to pasteurization of canned ham and other highly perishable foods. In contrast to presently used pasteurization, however, the resulting food products would not be cooked, and hence could be used in other kinds of recipes or serving styles.

Radiation processing may thus make it possible to ship chilled coastal fish and seafood to Midwestern markets without freezing, for example.

At higher "doses," radiation can also be used to prepare "commercially sterile" food products, which could then be stored on pantry shelves at room temperature like canned foods. According to the IFT Status Summary, such products could include shelf-stable pork sausage and corned beef briskets. Irradiation can also be used to control insect infestation in cereals and flour, or in fresh or dried fruits, instead of chemical fumigation. Since it is a "cold" process, it can be used to decontaminate spices without driving off their unique flavor and odor-producing compounds.

"In-depth food irradiation studies in the United States began in the early 1950's, when both radiation sources and processing equipment were developed to a practical point," according to the IFT Status Summary. "Most of the studies have been government sponsored, because regulations required advance approval from the U.S. Food & Drug Administration (FDA) before any particular irradiated foods could be publicly sold....A similar circumstance prevailed in other countries."

The current renewed interest in food irradiation results from recent actions by the U.N.'s World Health Organization and the U.S. FDA. The WHO has recommended that foods treated at relatively low levels of radiation (less than 1 megarad) should be considered wholesome and approved for human use without further testing; the FDA has announced that it plans to issue a proposal which would essentially allow approval of all foods irradiated at one-tenth that level without individual testing. According to the IFT Expert Panel, this amounts to evaluating food irradiation as a process like canning or freezing, rather than examining each irradiation food product for approval as a new food additive.

The food technologists stressed, however, that government approval of food irradiation, if and when granted, will not automatically mean that supermarket shelves will be loaded with radiation-processed foods. "The cost of irradiated foods to the consumer must be competitive with the cost of foods produced by alternate processing technologies, or they must satisfy some other perceived consumers need at a reasonable cost, if they are to be accepted and successful in the market place. Irradiation of foods must also be seen as useful enough by processors to justify the costs of the equipment needed and the process."

Farm Water Supplies

An adequate and safe water supply is essential to the production of healthy livestock and poultry. Farm water supplies must be protected against contamination from microorganisms, chemicals and other pollutants. Compounds that occur naturally in water may also affect livestock health.

"Water Quality for Livestock and Poultry," Extension Folder 646 is a new publication from the University of Minnesota Agricultural Extension Service. The 12-page folder discusses those water quality factors that have been shown to cause livestock health or production problems and are likely to occur in Minnesota.

The publication was authored by University of Minnesota faculty in veterinary medicine and animal science. Roger Machmeier, extension agricultural engineer and coordinator of the subject matter from the animal and poultry specialists, says that the publication covers nitrates, sulfates, total dissolved solids, iron, microorganisms, pesticides, blue-green algae and other factors.

Each factor is identified, related to livestock health, and a solution prescribed. The names of the contributing University specialists are listed so the reader may obtain more information of specific questions.

"Water Quality for Livestock and Poultry" is available through Communication Resources Distribution, 3 Coffey Hall, University of Minnesota, St. Paul, MN 55108 or from local county extension offices. Single copies are available free of charge for Minnesota residents.

H. B. Fuller Opens New Sanitation Chemical Production Plant

A new sanitation chemical production plant, designed to provide increased customer service for West Coast dairymen and food processors has been opened by the Monarch Chemicals Division of H.B. Fuller Company.

The new facility, located within the H.B. Fuller Company plant at 57 South Linden Avenue, South San Francisco, California, will manufacture the comprehensive line of *Monarch®* sanitation chemicals for dairy farms and milk and food processing plants.

John McDonald has been named production manager of the new South San Francisco plant. McDonald who joined H.B. Fuller Company in 1974, most recently was plant manager for the company's South San Francisco Multi-Clean Products Division plant.

H.B. Fuller Company is a manufacturer of adhesives, sealants, coatings, paints and specialty waxes, as well as floor maintenance equipment and sanitation chemicals. The company has plants and technical service centers in 41 U.S. cities and 29 countries worldwide.

Self-help Price Supports

Assessing farmers for price supports helps those supports exist, according to Jerome Hammond, a University of Minnesota agricultural economist.

"Through the assessments, farmers can receive prices above free market levels without costing the government a lot of money," says Hammond.

Hammond's recent report on self-help price supports used the U.S. dairy industry as an example.

Farmers are now assessed per hundredweight of milk they sell. According to the report, the cost of the dairy price supports is offset by these assessments. The money from the assessments helps to buy and dispose of milk products that cannot be sold at price support levels.

This way the excess milk products are removed from the market. Milk prices should then rise, according to Hammond's report.

Hammond says that self-help price supports will work because the demand for milk products isn't greatly affected by price changes. He also assumes that administrative costs and the costs of handling and processing the excess milk aren't so high that they offset the price gains.

Copies of the report, "Self-Help Price Supports: Assessing Producers for Costs of Product Removal" are available from the University of Minnesota, Department of Agriculture and Applied Economics, St. Paul, MN 55108.

NCIMS Recognition Awards

Special recognition awards were presented at the National Conference on Interstate Milk Shipments by the National Milk Producers Federation Interstate Milk Shipments Committee on May 10, 1983 in St. Louis,

MO. The recipients were: William Trobaugh - Thornton, CO; Bob Stevens - Washington, DC and Don Race - Camillus, NY.

William Trobaugh was recognized for his long service to the National Milk Producers Federation and the Interstate MIlk Shipments Conference upon his retirement. William Arledge, chairman of the National Milk Producers Committee made the award.

Don Race was recognized in appreciation of his dedication to the NCIMS and the development of the History of the NCIMS. Bill Arledge and Boyd Cook, vice chairman of the National Milk Producers Committee, made the award.

Bob Stevens was recognized for his many years of service to the dairy industry and the IMS Conference.

Nissen Awarded 3-A Honor Plaque

Robert L. Nissen, Vice President and General Sales Manager of Ladish Co., Tri-Clover Division has been awarded the 3-A Honor Plaque, the highest honor given to those making outstanding contributions to the success of the 3-A Sanitary Standards Program.

The presentation of the plaque to Nissen was made on behalf of the Dairy Industry Committee by Dr. Warren Clark, Jr. at the spring meetings of the 3-A Sanitary Standards Committees in Nashville, TN, May 17-18, 1983. The award is the eighth to be made to an industry leader since it was established in 1963.

The Dairy Industry Committee represents the milk processor and supplier; it is comprised of eight national associations: American Butter Institute, American Dry Milk Institute, Dairy and Food Industries Supply Association, Evaporated Milk Associaton, International Association of Ice Cream Manufacturers, Milk Industry Foundation, National Cheese Institute and the Whey Products Institute.

Nissen's association with the 3-A program began in the mid-60's as a member of the Task Committee on Fittings Standards. He has since served as chairman of the Dairy and Food Industries Supply Associations' Technical Committee as well as the 3-A Steering Committee.

During Nissen's term as chairman of the Technical Committee many of the present policies and procedures of the 3-A program were developed and implemented. At a time when membrane processing in the dairy industry was considered a radical concept, he recognized its value and pioneered the idea of Sanitary Standards for this process.

3-A Standards and Practices for the cleanability of dairy processing equipment safeguard the public health by protecting the product against contamination from the equipment itself or foreign elements of dust, dirt or liquids. The program is conducted through the voluntary participation of dairy processors, equipment manufacturers, public health officials and sanitarians and their trade and professional associations.

Beckman Appointed as Manager-Quality Assurance, Crepaco

Crepaco, Inc. announced the appointment of Dennis K. Beckman as Manager-Quality Assurance. Mr. Beckman has an extensive background in various manufacturing and quality assurance disciplines. He was associated with International Harvester for 18 years, most recently as Corporate Manager, Manufacturing Quality Audit.

An enginering graduate from Iowa State University, Mr. Beckman also received an M.B.A. from the University of Iowa.

Dr. Warren Clark presents 3-A Honor Plaque to Robert L. Nissen

New Cheesemaking Process

Applying more science to the art of cheesemaking could be the most important development since cheese was first made from curdled milk.

On the drawing boards are low-fat, low-salt and traditional cheeses that take less time to manufacture and age. And cheese-lovers needn't worry. The new process should lower costs and enhance cheese flavors...naturally.

The new generation of cheese won't be commercially available for some time, according to Norman Olson, director of the Walter V. Price Cheese Research Institute at the University of Wisconsin-Madison. However, researchers with the institute report several promising developments.

Per capita consumption of cheese has increased in recent years, one of the few gains for dairy products. Total consumption of dairy products still lags behind milk production, saddling the dairy industry with surpluses and political and economic problems.

Olson notes that many of the 400 cheese varieties resulted from accidental modifications. A more systematic approach is required to tailor cheeses to changing consumer preferences.

Aging lends a characteristic flavor to cheese, but it's expensive, costing 2-3 cents per pound a month to. Some types of cheese take more than 6 months to age.

Researchers are stydying several enzymes known to hasten ripening with potential savings of millions of dollars. They recently found that some enzymes give a bitter flavor to low-fat cheese and result in a softer cheese. That bitterness disappears as whole-milk cheese ages, say Olson and co-workers R. Grappin, T. C. Rank and M. E. Johnson.

Olson and food chemist Robert Lindsay and co-workers S. D. Braun and J. K. Rippe are studying microencapsulation during which small "capsules" of natural enzymes and substrates are injected into cold milk. More uniform distribution of these natural ingredients allows more control over flavor development and cuts ripening times, sometimes in half.

"Every system of microencapsulation tried to date has been successful," says Olson. Currently, capsules are bubbled through cold milk with a modified airless paint sprayer. The capsules are actually small globules surrounded by materials such as milkfat.

Researchers have studied 6 to 8 compounds so far but have much more work ahead. More than 100 compounds that may be associated with flavor development have been identified in cheddar cheese alone.

The researchers also found that microencapsulation of two enzymes markedly reduced required amounts of co-factors required for both enzymes. The essential co-factors from one enzyme are "recycled" by the other enzyme, and vice versa. The system offers substantial savings since some enzymes and co-factors cost more than $2,000 per pound.

Many consumers prefer less salt as well as less fat and different flavors.

Lindsay and graduate student C. Karahadian found the flavor and texture of processed cheddar cheese was acceptable when 40-50 percent of the sodium phosphate salts added for emulsification were replaced by potassium phosphates.

"Consumers like the salty taste of cheese, although they may be concerned about sodium intake," says Karahadian. Microbiological tests will determine the keeping qualities of low-salt processed cheese.

The researchers reported their findings at the 78th annual meeting of the American Dairy Science Association held at UW-Madison, June 26-29.

Cattle Cloning

Efforts under way at the Minnesota Agricultural Experiment Station to develop cattle cloning techniques could someday translate into a fast, efficient system for producing a large number of animals with genetically desirable traits, says station scientist Alan Hunter.

Cloning--splitting a single embryo to produce several identical animals--has been a focus of research for about a year and a half. Although the cloning process itself

has not yet been perfected in cattle, attempts to develop techniques that are essential to the process have resulted in a number of "spinoffs."

One major advance has been the development of a technique for ripening immature eggs in the laboratory. According to Hunter, an ovary can now be removed from a day-old heifer and the eggs matured and fertilized within a relatively short time.

"This first stage could lead to cutting down the generation interval in cattle as much as three years," he says.

An early pregnancy detection test is another discovery that has come out of the cloning research. By looking for the presence of certain hormones in a cow's blood, researchers have been able to confirm pregnancy as early as two weeks after fertilization occurs.

The next step, Hunter says, is to get embryos to develop in a test tube. After an egg is fertilized, it normally divides to form a clump of cells. But attempts to get cattle embryos to survive beyond the four-cell stage in the laboratory have not yet been successful.

Defining the Mastitis Problem

Someday farmers may diagnose the cause of mastitis by simply sending a milk sample to a lab for analysis. "We'll probably still have to visit the farm to determine the exact cause, but we're getting closer to being able to accurately define the mastitis problem and pinpoint the source," says Ralph Farnsworth, research veterinarian, University of Minnesota."

"We probably won't see a new drug or serum designed to cure mastitis," Farnsworth speculates. "We have sufficient means to control it right now, but we have to determine what we need to use and how to use it."

Minnesota Agricultural Experiment Station researchers are working on a bulk tank screening method to diagnose mastitis. They are also examining the effect of milking machines on blood circulation of the teat and cow preparation methods in the cause and prevention of mastitis.

"Mastitis is extremely complicated. There are many factors that affect it," says Farnsworth. "Our research will allow farmers to pinpoint solutions to mastitis in their herds. Rather than changing things arbitrarily, hoping that something will work, they can determine the specific factor causing the problem and change only that thing."

The bulk tank screening method developed at Minnesota is a supplement to the DHIA somatic cell program. The DHIA cell count can tell farmers if they have a problem and to what extent. The screening method can define the problem further and suggest ways to solve it, Farnsworth adds.

Aseptic Packaging

Indian Summer has launched into aseptic packaging with a major commitment of some $2 million for two process/packaging lines.

"As one of the country's largest apple juice/cider producers, the advantages that aseptic packaging (both for our own name brand and private label) provide are tremendous" says Crowley, Marketing/Sales Mgr.

Indian Summer offers the consumer a high quality 100% fresh juice or cider without additives or preservatives; long shelf life and still passes on a 20% per-ounce savings versus can single serve apple juice.

Packaged in Combibloc aseptic cartons with drinking straw attached, the 250ml Indian Summer name brand apple juice and apple cider have been introduced in 10 states. 1 liter size will be available in the fall of 1983.

"Response has been excellent" says Crowley.

"In terms of our selection of the Combibloc aseptic packaging system such advantages as aesthetics, headspace and the design of the package played a key role in the decision.

New Product News

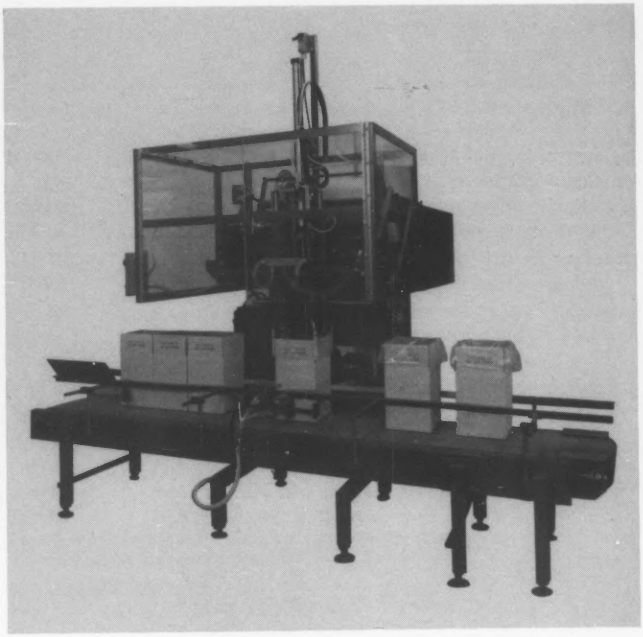
•The series 1575 Automatic Bag Inserter is available from Bemis-Packaging Service Industries for bag-in-box applications in the dairy industry.

The inserter automatically selets a gusseted polyethylene bag from a roll of perforated stock, inserts the bag into an erected corrugated container or plastic milk case, with all flaps vertical, and cuffs the top over the container flaps. Products are then protected from contamination when placed into the containers.

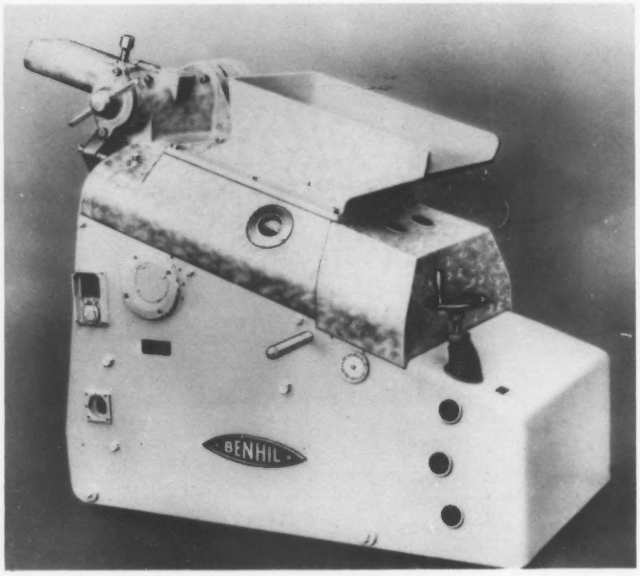
The 1575 is furnished with an 8-foot indexing conveyor to receive erected containers from the case erector and properly positions the container at the bag inserting station. Both the inserter and conveyor are available in corrosion resistant construction and NEMA 4 electrics for operation in high humidity environments.

Speeds up to 15 bags per minute can be achieved depending on case width and depth. Films in the 1.5 mil to 4 mil range can be accomodated.

For further information contact: Susan Messick, Packaging Service Industries, a Bemis Company, 315-27th Avenue NE, Minneapolis, MN 55418. 612-340-6222.



Automatic Bag Inserter



Benhill Butter Homogenizer

•The BENHILL TYPE 8471 BUTTER HOMOGENIZER can process up to 3100 pounds per hour and permits packaging of butter direct from cold room storage. The action of the Microfix 8471 actually improves quality of butter by insuring precise water dispersion throughout the butter - resulting in better color, improved butter spreadability and extended shelf life. No loss of water occurs during packaging operation. Fully automatic. Can be used in conjunction with whipping operations or where larger quantities of butter or fat must be reworked into a softer consistency.

For more information contact: Len E. Ivarson, Inc., PO Box 23335, Milwaukee, WI 53223. 414-351-0700.

Insect Control Guide by Geerpres

•An "Insect Control Guide" issued by Geerpres examines the physiology and habits of insects and how this knowledge can be used in facilities where sanitation requirements and/or worker discomfort make control necessary.

Included in the booklet are descriptions and specifications of five, new commercial Insect Control Devices (ICDs) being introduced to the trade this year by Geerpres.

The new, high-wattage ICD's have double the attraction light of most competitive models, according to Robert E. Fritsche, Vice President-Marketing. Light is further enhanced by a reflective center column, he said, making the units effective even in lighted areas. The center column contains all electronics to simplify maintenance.

In response to demands from users, an optional galvanized, double-loop security chain provides deterrent to casual theft.

The Geerpres "Insect Control Guide," cuts across the vast body of research conducted on insects to provide the layperson with the basic knowlege needed to understand insect problems and how to solve them, Fritsche said.

According to the "Guide," electronic ICDs constitute only a part of a program needed to control flying insects. An effective program will use ICDs in conjuntion with employee instruction, insecticides and physical barriers.

"The basic thrust of the 'Guide.'" Fritsche said, "is that we must understand the problem before we can solve it. We hope Geerpres has contributed to that knowledge."

For more information contact: Geerpres, PO Box 658, Muskegon, MI 49443. 616-773-3211.

British-made "Shaker Machine"

•A simple British-made, hand-operated machine is used with packets of instant milkshake powder and cold water to produce flavored drinks with significant quantities of vitamins C, B1, B2 and niacin.

The molded plastic SHAKER MACHINE is designed for safe and simple operation. One or two packets are emptied into the mixer and water is added up to the one-or two-drink marker (6 oz or 12 oz); the lid is replaced and the handle turned to stir the mixture.

The machine's few moving parts have no sharp edges, and the unit is easily dismantled for washing. A mixing chamber eliminates any chance of splashing.

Currently, strawberry, banana, black cherry and chocolate (which is also said to make a delicious hot drink) flavors are available. The mixture is said to have a shelf life of at least six months, and does not deteriorate in hot climates.

Although the ingredients are almost universally acceptable, the packets can be produced in special blends to meet local requirements if sufficient quantities are ordered.

Inquiries from prospective US customers, agents or distributors are welcomed by the company or may be sent to BIS.

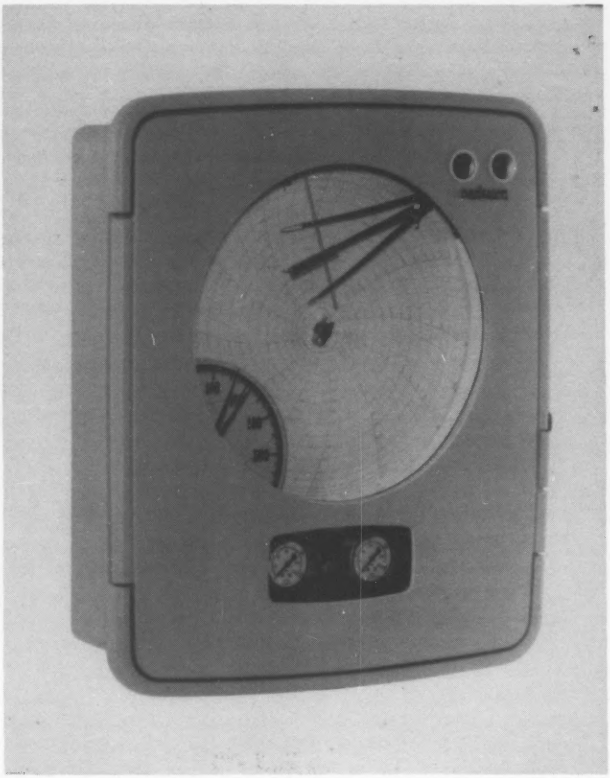
For more information contact: Mr. Stephen Briggs, Managing Director, Howard House, 17 Church Street, St. Neots, Huntingdon, Cambridgeshire PE19 2BU England.

•A new HTST controller from the Anderson Instrument Company, manufacturers of instrumentation for the sanitary fluid processing industries, incorporates design innovations which refine the control of high temperature short time pasteurization. For example, field-adjustable setpoints can be set to any temperature on the chart range without affecting calibration. This feature provides the user with a twofold benefit: it permits the pasteurization of a wider range of products than is possible using conventional HTST controllers, and it does so without requiring pasteurizer shutdown each time the setpoint is changed.

The new controller helps enhance the quality of the pasteurized product, even more so than other HTST controllers, by virtue of its rapid response and control accuracy and repeatability. For example, diversion on-off control is actuated by solid state electronics and a fast-acting optic switch, both of which contribute to the controller's negligible deadband. And the vapor-filled temperature-recording system responds quickly, even with capillary runs as long as 100 feet, thus minimizing any possibility of unnecessary diverted flow.

In addition to the new HTST controller, Anderson offers a cold milk temperature recorder or a recorder/controller in a matching, diecast aluminum, polyurethane-painted case. All controllers come with a two-year warranty, the longest in the industry.

For more information contact: Anderson Instrument Company, Inc., RD 1, Fultonville, NY 12072. 518-922-5315.



HTST controller from Anderson Instrument Co.

•Babson Bros. Co., builder of Surge dairy farm equipment, has designed a heat exchanger specifically for small-scale dairy producers, who want to reduce milk cooling and water heating costs.

The "Half" Kube Kooler is half as big as the original Kube Kooler, but it is just as efficient. It circulates well water or ice water through a copper waterway which surrounds the stainless steel milkway. The water pre-cools the milk, while the milk heats the water.

The unit is ideal for small milkrooms -- it measures just over 12 in. deep. It can be suspended from the ceiling or mounted on the wall to upgrade present milk cooling systems or reduce the initial cost of the condensing units for a milk cooling system. The Half Kubes can also be used as the third heat exchanger in large instant cooling systems or side-by-side to reduce height requirements.

For more information, contact your Surge dealer, or write: Babson Bros. Co., 2100 S. York Rd., Oak Brook, IL 60521.

•A new Century Series line of controls for the food processing industry has been introduced by the Wisconsin Electrical Manufacturing Co. It utilizes a programmable controller and standardized components which can be economically designed to automate a wide range of food processing functions.

The WEM Century control has the capability to automate weighing, measuring, mixing, batching, and formulating of both liquids and solids, and baking. It provides continuous monitoring of all functions and alerts the operator to any alarm condition. And because all operations are under constant observation from a single console, processing requires a minimum of employees.

The control system offers such features as dynamic freefall compensation for solids and liquids with automatic recalculation of freefall, automatic liquid addition, automatic small amount net weighing, hand-adds prompting and temporary formula modification to meet varying production conditions. The system also includes manual back-up.

A microcomputer can be interfaced to acquire and generate reports of production and inventory data. On-board troubleshooting programs permit easy maintenance by the user.

For more information contact: L. Forbes Hotchkiss, Wisconsin Electrical Manufacturing Company, Inc., 2501 S. Moorland Road, New Berlin, WI 53151. 414-782-2340.

Dairy Quality

Reprinted from Capsule Laboratories Newsletter, Dairy Quality Update

This DAIRY QUALITY will point out some ideas that may help understand how sources of post-pasteurization contaminants can be identified. Research by Marshall and Appel (*1*) and Maxcy (*2*) have demonstrated that gram negative post-pasteurization contamination can be very low. Experiences of Capsule laboratories in troubleshooting quality problems has shown that very low levels of post-pasteurization contamination can be normal, however, these low levels can result in servere quality defects.

Table I below shows the relationship between the contamination rate and growth of the contaminant, and the corresponding Standard Plate Count at various days of storage.

These data were generated assuming a contaminant would enter the milk at the rate of one bacteria cell per 100 mls of milk. It is assumed that the contaminant has a generation time of 6 hours (at 45F) which is a realistic generation time for a typical gram negative psychrotrophic organism such as *Pseudomonas*. For this example, we are assuming an initial Standard Plate Count of 500 and that none of these thermoduric bacteria are psychrotrophic. Therefore, taking into account the inherent variability of the Standard Plate Count, you can see that the Standard Plate Count will represent the thermoduric bacterial contamination until Day 5. After 5 days of storage, the Standard Plate Count is dependent upon the growth of the psychrotrophic contaminant. In other words, the Standard Plate Count only becomes significant in reflecting microbiological quality or post-process contamination after 5 or 6 days of storage.

Table I not only points out that the Standard Plate Count may not reflect microbiological quality until after 5 days of storage, but it also indicates that proper sample size and incubation of products or line samples is needed to reflect the true microbiological quality.

There are several sources of post-process contamination; namely, HTST, storage tanks, lines, fillers, and the package. It is important to take large (50 mls or more) aseptic samples and incubating these samples for a minimum of 5 days at 45 F when using a Standard Plate Count or the Moseley Count for determining post-process contamination and microbiological quality.

The growth rate of the contaminant is a controlling factor influencing the microbiological quality of fluid milk and not the rate of post-process contamination. For this reason, laboratory methods used to determine post-process contamination or microbiological quality must deal initially with large samples and promote only the growth of psychrotrophic bacteria.

In summary, post-process contamination at extremely low levels can cause severe quality defects when the contaminants have a fast growth rate at refrigeration temperatures. For continuous monitoring purposes, the use of line analysis with large samples is necessary to identify these sources of post-process contamination. It is Capsule Laboratories feeling that the most reliable method of identifying post-process contamination is continuous line analysis using large volume samples and handling these samples in the same manner as the Moseley Keeping Quality Test. However, monitoring systems of this nature take 7 to 9

TABLE I: CALCULATED BACTERIAL POPULATION OF PASTEURIZED MILK AT VARIOUS DAYS OF STORAGE AT A POST-PASTEURIZATION CONTAMINATION RATE OF 1 BACTERIA/100 MLS OF MILK.

Days of Storage at 45F	Number of Generations	Growth of Contaminants*		Thermoduric Bacteria**	SPC
		Log	Pop./ml		
1	---***	---	---	500	500
2	4	.8	---	500	500
3	8	.4	2	500	500
4	12	1.6	40	500	540
5	16	2.8	630	500	1,100
6	20	4.0	10,000	500	10,000
7	24	5.2	160,000	500	160,000
8	28	6.4	2,500,000	500	2,500,000
9	32	7.6	40,000,000	500	40,000,000

Generation Time 6 Hrs. - Of Contaminants

*Growth calculated by log b = log a + N log 2 for bacteria in exponential growth (3).
**Initial SPC of 500 (assuming no thermoduric psychrotrophic bacteria).
***One day allowed for lag phase.

days to obtain meaningful data. Rapid methods do have the advantage of obtaining data sooner, but these methods do have some limitations which will be discussed next month.

(1) Marshall, R. T. and R. Appel. 1973. Sanitary conditions in twelve fluid milk processing plants as determined by use of the rinse filter method. J. Milk Food Technol. 36:237.
(2) Maxcy, R. B. 1967. Nature and growth response of the microflora of pasteurized packaged milk. J. Milk Food Technol. p. 213.
(3) Nickerson, J. T. and A. J. Sinskey. 1972. Microbiology of Foods and Food Processing, American Elsevier Publishing Company, Inc., New York.

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Book Review

Cheesemaking Practice, by R. Scott, Ph.D., Applied Science. Publisher LTD., London, 1981, 475 pages.

The author notes that one volume covering the entire subject of cheesemaking was impossible. The intent of the text was rather to provide general information concerning cheesemaking to anyone interested in learning about the process. Dr. Scott, the author, hoped his text would "Whet the appetite of cheesemakers to delve further into the subject." A bibliography of books, articles and reprints is included at the end of the book to provide other sources of information on the subject.

The author notes that cheesemaking has been handed down from one generation to the next and was essentially a farmhouse industry until the 18th century. After that time scientific investigations began to impact on the cheesemaking process. Today cheesemaking is both an "art" and a science. Many academic sciences such as chemistry, biochemistry, microbiology, mathematics, economics, engineering, and computer science are involved in the process of making cheese.

The text has eighteen chapters which deal with the many phases of cheesemaking. An appendix is included which contains 99 selected cheese recipes from throughout the world. There are over 90 figures and pictures and 67 tables in the book.

The first four chapters of the text introduce the subject by reviewing the history of cheese, world production and cheese markets, the nutritional aspects of cheese, and a brief discussion on cheese varieties. Chapter five presents the cheese curd making process. Chapter six very briefly outlines the bacteriology of raw milk for cheesemaking. Two sections in this chapter deals with the bacteriological quality of milk and some bacteriological testing of raw milk. The material represented is very brief and does not do justice to the importance of the subject. Chapter seven reviews several methods for testing milk for acidity and chemical quality. Chapter eight presents information concerning additives used in cheesemkaing. Here the author notes that the various countries of the world will enforce different regulations regarding these additives. Chapters nine through thirteen discuss in detail the cheesemaking process from preparation of the milk to the ripening stage. Chapter fourteen briefly reviews how cheese is graded and why it can spoil. Whey is dealt with in chapter fifteen. The disposal of whey can be a major public health concern. Scott discusses disposal of whey, whey treatment and some alternative uses of whey. Chapter sixteen reviews the uses of recipes in the cheesemaking process. Chapter seventeen reviews the mechanization of cheesemaking. This chapter offers the field sanitarian an opportunity to review the various pieces of equipment which are used today in the cheese industry. A brief review of observations on future trends in cheesemaking is presented in the last chapter.

The text is easy to read but has a lot of British word usage and word spellings. It is very easy to find subjects discussed in the text because of a very good Table of Contents and Index. Also, a list of illustrations is provided giving the title and page number of all illustrations presented in the text.

The author clearly believes that cheesemkaing is an "art" and a "science" which cannot be learned from a book but must be experienced by practicing under the supervision of an experienced cheesemaker.

The book does not deal with the disposal of waste products associated with cheesemaking other than discussion in chapter fifteen as earlier discussed. This area would be of great concern to the field sanitarian.

CHEESEMAKING PRACTICE is a good reference text and could be utilized as a textbook for those studying the subject.

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Characterization of glycosidases produced by *Psudomonas fluorescens* 26, A. Marin and R. T. Marshall, Department of Food Science and Nutrition, University of Missouri-Columbia, Columbia, Missouri 65211

J. Food Prot. 46:676-680

Six synthetic glycosides were used to characterize glycosidic activities of a cell-free filtrate of *Pseudomonas fluorescens* 26. The filtrate was prepared after growing the bacterium in glucose-enriched minimal growth broth. Temperature and pH optima for glycosidic activity were as follows, respectively, β-D-fucosidase: 15°C and 6.0, β-D-mannosidase: 25°C and 6.0, β-D-glucosidase: 25°C and 5.5, β-D-galactosidase: 30°C and 6.5, N-acetyl-β-D-glucosaminidase: 45°C and 7.0, and N-acetyl-β-D-galactosaminidase: 45°C and 6.0. Activation energies of B-D-galactosidase, β-D-mannosidase, β-D-glucosidase and N-acetyl-β-D-glucosaminidase were 25.4, 12.3, 9.8 and 6.0 Kcal/mol, respectively. β-D-fucosidase and N-acetyl-β-D-galactosaminidase appeared to have non-Arrhenius behavior, so activation energies were not calculated for them. All six glycosidases were heat-sensitive to conditions of pasteurization of milk.

Effect of Agitation on Bacterial Aggregates in Pure Cultures and Raw Milk, Robyn E. O'Connor, K. N. Ewings and Neil W. Hollywood, Otto Madsen Dairy Research Laboratory, Queensland Department of Primary Industries, Hamilton, Queensland 4007, Australia

J. Food Prot. 46:681-685

A comparison of the effects of various mechanical agitation treatments on bacterial aggregates was performed on 8 pure cultures and 27 raw milk samples. Although both syringing and blending produced significant increases in total counts and psychrotroph counts, blending for 2 min gave the greatest increase in count. Use of the direct epifluorescent filter technique (DEFT) confirmed that syringing and blending reduced bacterial clump size to approximately 2 cells. These agitation treatments markedly improved the correlation between DEFT counts and plate counts.

Defining Optimal Conditions for Making Cottage Cheese from Reconstituted Milk Powder, C. H. White and J. M. Ryan, Department of Dairy Science, Louisiana Agricultural Experiment Station, Louisiana State University, Baton Rouge, Louisiana 70803

J. Food Prot. 46:686-689

Cottage cheese was manufactured from milk powder reconstituted at solids levels ranging from 8.0 to 20%. The reconstituted cheese milk was held at 6°C for four time periods (0, 12, 24 and 36 h), followed by inoculation with 1% bulk lactic starter. Values determined were yields expressed in three dfferent ways and total solids. The study was first conducted in the laboratory using 3-L containers for each treatment effect. This was to be used as a screening technique with the optimal results then being tested under pilot plant conditions. The 0-hold resulted in a shorter setting time than any of the other hold periods. The four optimal solids levels obtained in the laboratory study were determined on the basis of moisture characteristics, yield, cost and setting time. Those solids levels evaluated in the pilot plant study were 10.5, 12, 13 and 15%. Two hold times were selected for the pilot plant study, with those being a 0-hold and a 12-h hold at 4.4°C. All results were compared to two controls, a non-fortified (9.0% total solids) and a fortified (10.5% total solids) skim milk. Cost comparisons at the various levels were made. Over all conditions of this study, cottage cheese made from 10.5% reconstituted nonfat-dry milk with a 0-hold appeared to be best as measured by moisture control, set time, cost, adjusted yield and appearance of curd at varying stages. In the pilot plant study, there was no significant ($P<0.05$) difference in any measurable parameter between the 0- and 12-h holding period. There was very little difference between the 10.5 and 12.0% cheese, except for price (12% cheese would cost 2 to 3¢ more per pound of dry curd than 10.5% cheese) and appearance of the curd (10.5% curd was slightly less matted with fewer "fines"). Work is presently underway to study creaming factors of this cheese. The two control cheeses were approximately the same as the 10.5% reconstituted skim milk cheese with regard to quality factors but were cheaper (about 10¢/.454 kg dry curd).

Use of Fertile Egg Injection Technique to Assess Toxicity of Chlorinated Compounds Found in Drinking Water, M. Hekmati, R. L. Bradley, Jr. and M. L. Sunde, Departments of Food Science and Poultry Science, University of Wisconsin, Madison, Wisconsin 53706

J. Food Prot. 46:690-692

Screening of contaminants found in drinking water and those used to render water potable showed none to be extremely toxic. Other contaminants varied in toxicity from practically non-toxic to highly toxic. Sanitizers used in the food industry, sodium hypochlorite and iodophor, while presenting slight to moderate toxicity in undiluted concentrations, showed insignificant toxicity at use levels.

Influence of Temperature and Gas Permeability of Packaging Film on Development and Composition of Microbial Flora in Vacuum-Packed Bologna-Type Sausage, H.-J. S. Nielsen, Food Technology Laboratory, The Technical University of Denmark, DK-2800 Lyngby, Denmark

J. Food Prot. 46:693-698

Studies were done on the influence of gas permeability of packaging film on microflora of vacuum-packed Bologna-type sausage at three storage temperatures, i.e., 2, 5 and 10°C. Greatest development of total aerobic plate count and *Brochothrix thermosphacta* was observed in film having the highest permeability. The packaging film influenced the maximum counts and growth rates of organisms. Growth of both gram-positive cocci and yeast were stimulated in packages having the greatest permeabilities, whereas the opposite occurred for the lactic acid bacteria. Large numbers of gram-negative bacteria were found in all series. These consisted of *Enterobacteriaceae, Moraxella/Moraxella*-like bacteria and atypical *Vibrio*. Only *Enterobacteriaceae* were highly influenced by the nature of the packaging film. Organoleptic analyses showed a clear association among odor, the development of microflora and the gas permeability of packaging film.

Preservation of Lactic Acid Bacteria on Anhydrous Silica Gel for Three Years, Maria C. T. De Silva, Maria A. Tessi and Maria A. Moguilevsky, Instituto de Technología de Alimentos, Universidad Nacional del Litoral, C. Correo 428 - 3000 Santa Fe, República Argentina

J. Food Prot. 46:699-701

This study, which covers three years of storage, analyzes the application of silica gel preservation methods to lactic acid bacteria widely used in yogurt and cheese fermentation. Strains of *Streptococcus lactis, Streptococcus lactis* subsp. *diacetylactis, Streptococcus cremoris, Streptococcus thermophilus, Lactobacillus bulgaricus, Lactobacillus helveticus* and a yogurt culture were adsorbed on anhydrous silica gel in screw-cap tubes or in ordinary test tubes which were subsequently flame-sealed under vacuum. During 3 years, the bacteria were tested for viability by incubation in sterile milk. All of the bacteria retained their acidifying activity, with the exception of the yogurt culture. Extending preservation for more than 2 years had a negative effect on the activity of the yogurt culture. Results obtained support the use of screw-cap tubes which, in general, were suitable to preserve suspensions of lactic acid bacteria adsorbed on anhydrous silica gel.

Survival of *Campylobacter jejuni* during Poultry Processing and Pig Slaughtering, J. Oosterom, G. J. A. De Wilde, E. De Boer, L. H. De Blaauw and Hetty Karman, Laboratory for Zoonoses and Food Microbiology, National Institute of Public Health, P.O. Box 1, 3720 BA Bilthoven; Meat Inspection Service, Anjelierstraat 2, 7641 CG Wierden; Food Inspection Service, P.O. Box 9012, 7200 GN Zutphen; Meat Inspection Service, Veelaan 3, 1019 AP Amsterdam; and University of Agriculture, Wageningen, The Netherlands

J. Food Prot. 46:702-706

Experiments were done to assess the survival of *Campylobacter jejuni* during different stages of poultry processing and pig slaughtering. Natural sources of *Campylobacter* contamination, i.e., spinchiller water, chicken intestinal contents and pig feces, were used for this purpose. *C. jejuni* in chicken intestinal contents had D-values ranging from 0.18 to 0.39 min at 60°C to 1.96 to 10.82 min at 52°C. Experiments with surfaces of pig carcasses contaminated with pig feces and held in the cooling room of a pig slaughterhouse showed an overnight reduction of *Campylobacter* until below the detection level. Further experiments in the laboratory showed that this reduction was due to drying of the skin surface. *C. jejuni* was very sensitive to drying. When contaminated spinchiller water was spread on tiles of different materials (aluminium, stainless steel, Formica and ceramic), the organism survived as long as a moistened surface could be observed. They could not be isolated once surfaces were visually dry. Freezing affected *C. jejuni* only during the first few hours; after an initial drop of number, *Campylobacter* could survive on chicken carcasses and chicken livers at -20°C for more than 64 and 84 d, respectively.

Production of Lipase by *Byssochlamys fulva,* H. Chander and H. Klostermeyer, Süddeutsche Versuchs- and Forschungsanstalt für Milchwirtschaft, Institut für Chemie and Physik, Weihenstephan, Freising, Federal Republic of Germany

J. Food Prot. 46:707-709

Byssochlamys fulva exhibited maximum growth and lipase production at 30°C in 6 d at pH 7.0. Aeration enhanced lipase yield by 22%. Growth medium containing maltose showed maximum production of lipase followed by glucose, mannitol, fructose, xylose, sucrose and galactose in decreasing order. Among the nitrogen sources tested. lipase yield was maximum with 2% casamino acids. Tributyrin induced lipase synthesis, whereas other lipids inhibited lipase production.

Bacteriological Survey of Frozen Meat Ravioli Produced at Establishments Under Federal Inspection, Douglas F. Campbell, Martha Y. Workman, George W. Krumm and Ralph W. Johnston, U.S. Department of Agriculture, Food Safety and Inspection Service, Food Microbiology Branch, Beltsville, Maryland 20705; U.S. Department of Agriculture, Food Safety and Inspection Service, Field Services Laboratory Division, Athens, Georgia 30604; and U.S. Department of Agriculture, Food Safety and Inspection Service, Microbiology Division, Washington, D.C. 20250

J. Food Prot. 46:710-713

During visits to 20 federally inspected establishments producing meat ravioli, 577 production line samples and 480 finished product units were collected for bacteriological analyses. Four types of finished, packaged ravioli were encountered: (a) whole ravioli boiled at least 5 min; (b) raw pasta stuffed with a cooked filling; (c) only the meat component cooked; and (d) uncooked ravioli. The microbiological quality of frozen ravioli was affected more by the filling than the pasta. Slow freezing resulted in increased bacterial levels in the finished product. For the boiled ravioli, 100% of the finished product sets contained less than 50 coliforms per g, four of five sets had less than one *Escherichia coli* per g, and 100% had fewer than one *Staphylococcus aureus* per g. Four of five sets of packaged boiled ravioli had aerobic plate counts (APC) of less than 10,000 per g. For the raw pasta with a cooked filling-type ravioli, the geometric means of 9 sets were: coliforms, 47 per g; *E. coli,* 6.7 per g; *S. aureus,* 10 per g; and APC, 170,000 per g. For the ravioli with only the meat component cooked, the geometric means of 27 sets were: col-

iforms, 190 per g; *E. coli*, 1.8 per g; *S. aureus*, 3.9 per g; and APC, 300,000 per g. For uncooked ravioli, the geometric means of 7 sets were: coliforms, 490 per g; *E. coli*, 19 per g; *S. aureus*, 5.7 per g; and APC, 690,000 per g. Only one finished ravioli unit in 480 contained *Salmonella*.

Sporothrix schenckii Isolated from Edible Black Fungus Mushrooms, Nuria Kazanas and George J. Jackson, Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204

J. Food Prot. 46:714-716

Sporothrix schenckii, a fungus which is pathogenic to humans, was recovered from imported desiccated black fungus mushrooms [*Auricularia polytrichia* (Mont.) Sacc.] usually used in preparing Far Eastern cuisine. Identification was based on microscopic and gross morphology, dimorphism at 25 and 37°C and reactivity with fluorescein-labeled antibodies specific for the yeast-cell form of the fungus. This is the first known report of *S. schenckii* in or on edible mushrooms.

Accelerated Processing of Boneless Hams to Dry-Cured State, N. G. Marriott, J. B. Tracy, R. F. Kelly and P. P. Graham, Department of Food Science and Technology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061

J. Food Prot. 46:717-721

Three different cure mixtures were applied at the rate of 5% of the weight of fresh boneless hams before tumbling at 21°C for 3 h continuously at 22 rpm. The hams were held 12 h at 4.4°C for salt (NaCl) equalization, smoked for 4 h, cooked to an internal temperature of 71°C and aged for 14 d. Sensory evaluations were made and residual salt, moisture and nitrite (NO_2^-) were determined. Panel scores were similar for all treatments that were tumbled. Percentage salt and moisture were similar for the three treatments but the control (non-tumbled) had the lowest concentration of NaCl and NO_2^-. Residual NO_2^- levels for hams treated with 0.1 or 0.2% sodium nitrite ($NaNO_2$) were not different ($P>0.05$). The highest NO_2^- level was detected in hams cured with nitric oxide.

Efficacy of Germicidal Hand Wash Agents Against Transient Bacteria Inoculated onto Hands, A. Z. Sheena and M. E. Stiles, Departments of Food Science, Foods and Nutrition and Microbiology, The University of Alberta, Edmonton, Alberta, Canada T6G 2M8

J. Food Prot. 46:722-727

The efficacy of germicidal hand wash agents against transient bacteria (*Escherichia coli* and *Pseudomonas fluorescens*) in ground beef rubbed onto hands was determined using a hand rinse sampling technique. The reduction in *E. coli* and *P. fluorescens* counts on selective growth media and the change in count on Baird-Parker medium were used to indicate action against transient and resident bacteria, respectively. Most of the agents tested, including 4% chlorhexidine gluconate, iodophor (0.75% available iodine), Irgasan DP 300, *para*-chloro-*meta*-xylenol (PCMX) as well as the non-germicidal soap, gave marked reduction in counts of *E. coli* and *P. fluorescens* (>90% reduction), even after one 15-s wash. The hand dip treatments with iodophor (25 ppm available iodine), hypochlorite (50 ppm available chlorine) or QAC (930 ppm benzalkonium chloride) were generally less effective than hand wash treatments, especially against *P. fluorescens*. Iodophor (0.75% available iodine) and 4% chlorhexidine gluconate significantly reduced more *E. coli* on hands than the other agents.

Transoceanic Shipment of Chilled Beef Variety Meats, G. C. Smith, B. W. Berry, J. H. Lennon and J. W. Savell, Meats and Muscle Biology Section, Department of Animal Science, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843

J. Food Prot. 46:728-730

Ninety each of beef livers, hearts, tongues and kidneys were transported in a refrigerated van from Palestine, Texas to Rungis, France. Product arrived at destination 21 d after departure (24 d after removal from the animal) and was evaluated for color and odor by a four-member experienced USA panel and by variety meat buyers at the Rungis market. Vacuum packaging most successfully protected color and odor of tongues and hearts, kidneys had acceptable color and odor if not wrapped, and livers were most desirable in color and most acceptable in odor if wrapped with polyvinyl chloride film. Buyers on the Rungis, France market paid a premium for those variety meats which were vacuum packaged in relation to comparable USA product that was transported in the frozen state. Beef variety meats can be successfully transported to European markets without freezing.

Isolation of _Vibrio cholerae_ from the American Eel, _Anguilla rostrata_, C. S. Hu and J. A. Koburger, Department of Food Science and Human Nutrition, University of Florida, Gainesville, Florida 32611

J. Food Prot. 46:731-732

Nineteen eels (*Anguilla rostrata*), collected from the Suwannee River estuary in Florida, were examined for *Vibrio cholerae*. Nonagglutinable *V. cholerae* were isolated from 11 of the eels for an isolation rate of 58%. Isolates from 6 of the eels were confirmed by the Smith serotyping system and found to be types 17, 68 and 175.

Microbiological Quality of Cocoa Powder, Dry Instant Chocolate Drink Mix, Dry Nondairy Coffee Creamer and Frozen Nondairy Topping Obtained at Retail Markets, W. L. Payne, A. P. Duran, J. M. Lanier, A. H. Schwab, R. B. Read, Jr., B. A. Wentz and R. J. Barnard, Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204 and Minneapolis Center for Microbiological Investigations, Minneapolis, Minnesota 55401

J. Food Prot. 46:733-736

A national survey was conducted of the microbiological quality of three dry ingredients used in beverages and one frozen nondairy topping obtained at retail markets. Geometric mean aerobic plate counts (APCs) of units examined at 35°C were as follows: 1,313 units of cocoa powder, 6,600 CFU/g; 1,552 units of dry instant chocolate drink mix, 290 CFU/g; 1,559 units of dry nondairy coffee creamer, 37 CFU/g; and 1,532 units of frozen nondairy topping, 34 CFU/g. At 30°C, the geometric mean APC was 34 CFU/g for frozen nondairy topping. Geometric means for most probable number determinations of coliform bacteria and *Escherichia coli* were <3/g for the four products. Geometric mean values for *Staphylococcus aureus* in three of the products were < 10/g; no *S. aureus* was found in cocoa powder. Geometric mean values for yeasts and molds in dry instant chocolate drink mix and dry nondairy coffee creamer were 8 and 6 CFU/g, respectively.

Factors that Contributed to Foodborne Disease in Canada, 1973-1977, Ewen C. D. Todd, Foodborne Disease Reporting Centre, Bureau of Microbial Hazards, Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 46:737-747

Factors that contributed to foodborne disease in Canada between 1973 and 1977 were identified and grouped into two kinds: (a) those that concerned contamination, survival and growth in food and (b) those that involved persons who were susceptible to illness and who ignored warning sensory signs. Improper cooling and faulty processing (including corrosion of containers, incidental additives and insufficient cooking) were the most important factors involving food. *Staphylococcus aureus, Salmonella* spp., *Clostridium botulinum, Clostridium perfringens,* rancid compounds, extraneous matter, metals, caustic soda and solvents were the main etiological agents interacting with the factors to cause illness. Errors in food handling in foodservice establishments and homes resulted mainly in microbiological growth, contamination or survival, whereas those in food processing establishments resulted mainly in chemical contamination. Where those at greatest risk of illness were identified, institutionalized, ill or elderly persons were largely affected by microbiological problems in foodservice establishments, and infants by chemical contamination of processed food. Sensory factors, such as undesirable appearance, taste or smell of food, did not necessarily prevent the food from being eaten and causing illness. Educational programs need to be designed to inform consumers of risks of eating contaminated food.

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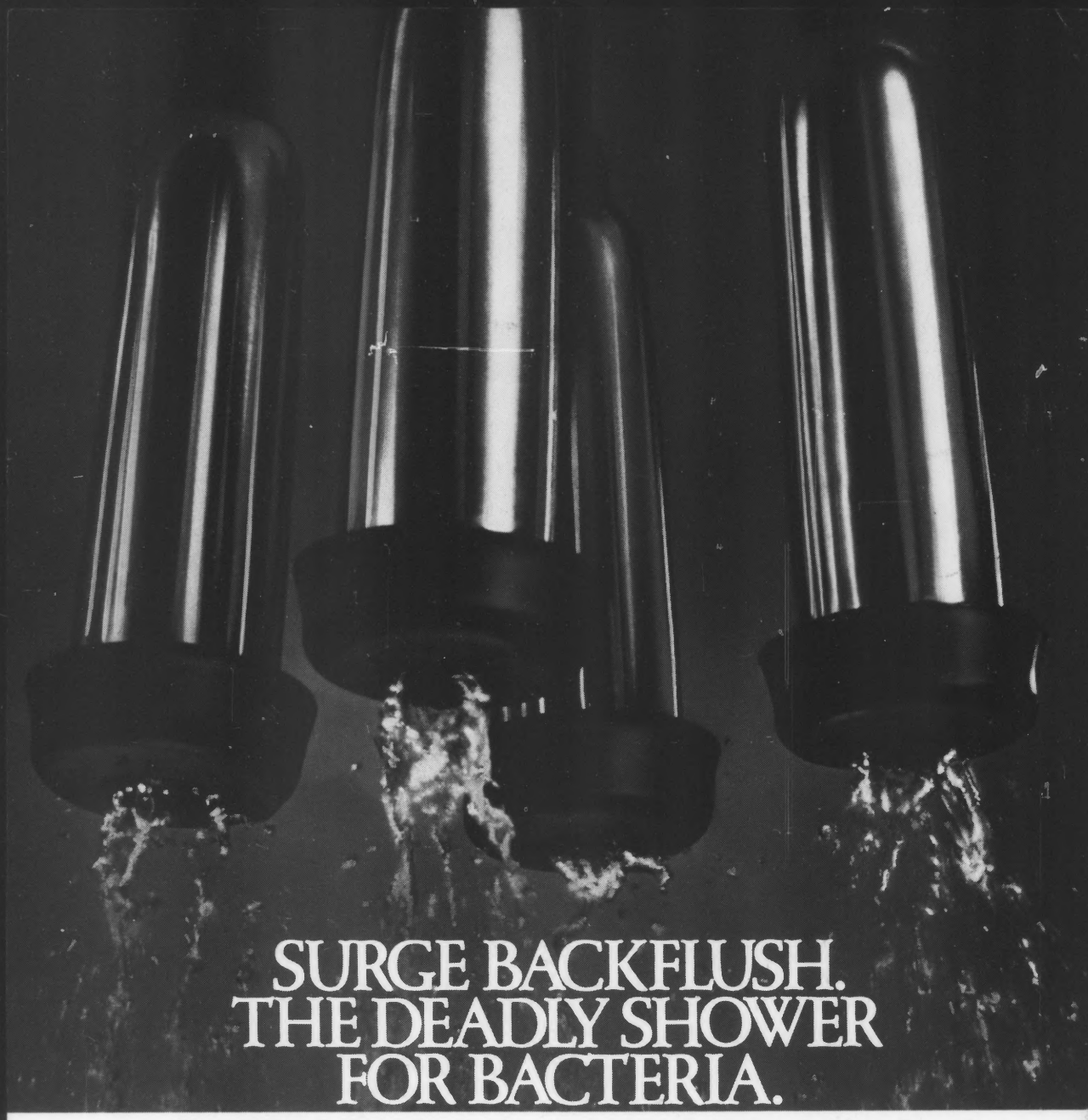

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