



Knowledge and Practices of Meat Safety by Meat Sellers in the Tamale Metropolis of Ghana

ABSTRACT

This study assessed the knowledge and practices of meat safety by meat sellers in the Tamale Metropolis, Ghana. A semi-structured questionnaire was used to obtain data from 100 randomly selected meat sellers on their knowledge about the hazards and safety practices of meat handling. All the respondents were male, with the majority (83%) aged 18–45 years. Most (60%) of the respondents had no formal education, while almost all (95%) had more than five years of experience selling meat. The majority (67%) of respondents were aware that eating and drinking while selling meat increases the risk of meat contamination. Also, most (95%) of the respondents were aware that wearing gloves at work was important. Almost all (99%) knew that contaminated meat could cause illness. In addition, the majority (94%) of the meat sellers used soap and water to wash their equipment. None of the meat sellers sterilized their knives or other equipment, while 58% of them did not wear aprons while working. All leftover meat was stored in a refrigerator. The findings of the study suggest the

need for training meat sellers on safe meat handling and regulating the industry as a whole.

INTRODUCTION

Foodborne illnesses remain a significant component of human disease (24), and the consumption of contaminated meat plays a major role in this. Food safety continues to be a critical issue among professionals in the food service sector as well as consumers (2, 20). However, diseases spread through food are common and persistent problems that result in appreciable morbidity and occasionally death (29, 34). The World Health Organization (WHO) reported that 18% of children aged below 5 years old in developing countries die due to diarrhea globally (15). The World Health Organization has also estimated that globally 600 million people are affected annually by foodborne diseases, with 420,000 deaths as a result (37). Food safety is a matter of great concern and of public health importance, particularly when the environment in which the food is handled is heavily contaminated (30). Fresh foods, especially those of animal origin such as beef, are highly vulnerable to contamination

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with microbes that cause infections and spoilage, since meat is an ideal medium for growth of most microorganisms because of its high nutritive value (29). Post-slaughter handling of meat is associated with potential health risks to consumers because of the possibility of contamination of meat by pathogens (1). Foodborne diseases are caused by biological and chemical hazards, which can contaminate food at several points during production and preparation process (6). Incidence of foodborne diseases is reduced if strict food protection measures are in place from primary production to the consumer. Food workers have been implicated in the spread of foodborne diseases (33). Also, Campos et al. (16) indicated that food handlers are a major cause of food contamination. Foodborne disease outbreaks reported in the United States, for instance, were often associated with mishandling, with 79% from commercial or institutional establishments and 20% from homes (21). Another report indicated the presence of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers (26), while multi-drug resistant *Staphylococcus aureus* has been isolated from meat being sold for human consumption (35). Furthermore, most meats produced in Ghana are contaminated with foodborne pathogens, and thus may be a source of foodborne infections (4, 5, 8, 11, 13, 22). Despite the fact that attempts are made in most abattoirs to follow regulations set to protect consumer health, the problem of meat hygiene and safety due to handling and processing of meat remains a challenge (28). In the face of numerous efforts by stakeholders to ensure meat safety in the Tamale Metropolis, the incidence of foodborne illnesses is still high; hence there is a need to identify specific knowledge gaps among meat sellers in the Metropolis to ensure consumer health and safety, since food handlers are integral to the improvement of food safety and prevention of foodborne illnesses. This study was conducted to assess the knowledge and practices of meat safety by meat sellers in the Tamale metropolis.

MATERIALS AND METHODS

Study area

The study was conducted in the Tamale Metropolis in the Northern Region of Ghana, the only Metropolis in the five regions of the North. Tamale is the Metropolitan capital city and is also the capital of the Northern Region. It is located in the central part of the Region and shares boundaries with the Sagnarigu District to the west and north, Mion District to the east, East Gonja to the south and Central Gonja to the southwest (19). Geographically, the Metropolis lies between latitude 9° 16 and 9° 34 North and longitudes 0° 36 and 0° 57 West (19). The population of Tamale Metropolis, according to the 2010 Population and Housing Census, is 371,351 and the Metropolis is entirely urban (19).

Study design and questionnaire administration

A survey was conducted using a semi-structured questionnaire (provided as supplementary data) to obtain data on

meat sellers' knowledge, attitudes and practices of safe meat handling in meat establishments in the Tamale Metropolis. Meat sellers (respondents), as the term is used in this study, refers to street and open market meat vendors who sell only fresh raw meats. Meat all over Ghana is mainly sold in streets and open markets. Meats are mostly sold fresh and warm; that is, as soon as the animal has been slaughtered and dressed, it goes directly to the market for sale without chilling or exposure to a cold chain. Simple random and purposive sampling techniques were used to select the locations and respondents, respectively, in the Tamale metropolis. Simple random sampling was used to select eight different locations (names withheld) where meat is sold in the Metropolis. Purposive sampling was used to select 100 meat sellers, who were respondents who willingly agreed to answer the questionnaire when they were approached. The questionnaires used were developed according to comprehensive food safety literature reviews. The questionnaire was divided into four sections: demographic characteristics, knowledge of meat safety, meat hygiene practices and attitudes toward meat hygiene by meat sellers.

Ethics

The purpose of the study was first explained to the participants, and those who agreed to participate were interviewed. The confidentiality of each respondent's answers was guaranteed.

Data analysis

Data were analyzed using the Statistical Package for Social Sciences version 20 (IBM SPSS, ver. 20, Armonk, NY). Chi Square tests (χ^2) were used to determine the relationships between socio-demographic characteristics of the meat sellers and their knowledge, attitudes and hygiene practice levels. Statistical significance was assessed using *P*-values, with results being considered significant if $P \leq 0.05$. Analyzed data were presented in the form of percentages in tables.

RESULTS AND DISCUSSION

Socio-demographic characteristics of respondents

Safe meat handling, knowledge and hygiene practices by meat handlers are key to the overall safety and quality of food delivered to man. The findings of this study will contribute toward the need to improve food/meat safety in Ghana. Demographic characteristics of the respondents are shown in [Table 1](#). The results indicate that all the meat sellers were males and the majority were 18–30 years (37%) or 31–45 years (46%) old, meaning that the majority of the meat sellers were relatively young. This agrees with the findings of Mahaboubil-Haq and Adzitey (27), Adzitey et al. (9), Sulleyman et al. (31), Jianu and Golet (25) and Adesokan and Raji (3), who reported that most of those involved in meat processing are males rather than females, in contrast to other food processing ventures, because butchering

TABLE 1. Socio-Demographic characteristics of respondents

Variable	Percentage (*n)
Gender	
Male	100
Female	0
Age	
18–30	37
31–45	46
46–60	13
Above 61	4
Religion	
Muslim	100
Christian	0
Traditional	0
Education status	
No formal education	60
Elementary education	29
Senior high school education	11
Work Experience	
Less than 1 year	5
2–5 years	16
6–9 years	24
10 years and above	55
Type of meat sold	
Beef	62
Goat	19
Mutton	19
Occupation status	
Full-time	85
Part-time	15

*n = number of respondents

demands a great deal of energy and hence requires men, who are stronger than women. The age of the respondents had no influence ($P > 0.05$) on any of the parameters of meat safety knowledge and practices measured, except how often they washed their chopping/cutting tables ($\chi^2 = 9.989$, $df = 3$, $P = 0.019$) and their appearance (neatness) at work ($\chi^2 =$

21.343, $df = 9$, $P = 0.011$). Most of them washed their tables several times a day (3 or more times), but generally the tables appeared dirty because of the repeated accumulation of blood/meat particles on the tables.

All the meat sellers were Muslims and sold beef (62%), chevon (19%) or mutton (19%), meaning that these meats

were generally slaughtered according to the principles of the Islamic faith. Therefore, meats sold in the Tamale Metropolis by street and open market vendors are halal. The meat selling business is also dominated by Muslims throughout Ghana, as reported by Sulleyman et al. (31) for Accra (78.7%) located in southern part of Ghana, and by Adzitey et al. (9) for Kumasi (60.6%) located in the middle part of Ghana. Among the reasons given by the meat sellers for beef being preferred by consumers were consumer preference (60%), income (30%) and low cost of beef compared to chevon and mutton (10%).

The majority (60%) of meat sellers had no formal education, with few (29%) having completed elementary education. This result agrees with the report of Adzitey et al. (10). They indicated that 64% of butchers in the Bawku Municipality of Ghana had no formal education. The low level of education of the meat sellers in Tamale could make it difficult for them to comprehend and adhere to the strict sanitation and safe meat handling practices necessary for prevention of meat contamination. Education had no influence ($P > 0.05$) on the knowledge and practices of meat safety parameters except for having heard of meat safety ($\chi^2 = 6.412$, $df = 2$, $P = 0.041$). This agrees with the findings of Tegegne and Phyto (32), who reported no significant association between educational status and knowledge level among meat handlers in retail shops in Jigjiga town, Ethiopia, and contrasts with Adesokan and Raji (3), whose study revealed that the level of education is significantly associated with the knowledge, attitude and practice levels of safe meat handling in southwestern Nigeria.

With regard to work experience, most (95%) of the meat sellers had been in the business for more than five years. This explains why most of them knew about some of the meat safety parameters. Work experience had no influence on any of the parameters of meat safety knowledge and hygiene practices except the source of their meat ($\chi^2 = 8.072$, $df = 3$, $P = 0.045$) and whether they had ever heard about meat safety ($\chi^2 = 9.933$, $df = 3$, $P = 0.019$). Most of them got their meat from an abattoir and had heard about meat safety. Isara and Isah (23) indicated that food handlers with longer work experience are more likely to practice food hygiene and safety.

Knowledge levels of meat sellers in meat safety

With reference to [Table 2](#), the results indicate that 62% of the meat sellers had heard about meat safety and 96% were aware that meat can be contaminated by poor handling. Although 96% of the meat sellers had no form of training in meat safety, 99% of the meat sellers were aware that contaminated meat can cause meatborne disease/illness, and 67% indicated they were aware of the health risks/meat safety risks associated with eating/drinking while selling meat. Almost all (99%) of the respondents were aware that washing hands before work reduces the risk of meat contamination. All of the meat sellers were aware that it is necessary to take leave from work when infected with a skin disease and that it is necessary to refrigerate leftover meat. Furthermore, most (95%) of the respondents were aware that using gloves during work reduces the risk of meat contamination ([Table 2](#)).

TABLE 2. Knowledge of meat safety and contamination

Parameter	Response (*n)	
	Yes (%)	No (%)
Meat sellers' response to hearing about meat safety	62	38
Knowledge on meat contamination by poor handling	96	4
Aware contaminated meat can cause illness	99	1
Aware that eating and drinking while selling meat increases risk of meat contamination	67	33
Undergone training in meat safety	4	96
Aware that washing hands reduces risk of meat contamination	99	1
Aware that using gloves reduces risk of meat contamination	95	5
Meat sellers affiliated to any meat traders' association	85	25
Take leave from work when infected with skin disease	100	0
Aware it's necessary to refrigerate leftover meat	100	0

*n = number of respondents

Although the meat sellers had not undergone formal training in meat safety, they had been taught the art of butchering by their leaders. The meat sellers also indicated that they received information on meat safety from common knowledge/experience, veterinary technicians, environmental health inspectors, and the mass media (TV and radio). This result agrees with the report of Sulleyman et al. (31), which indicated that 90% of the meat sellers in Accra, Ghana had no training in safe meat handling, although according to the Food and Agriculture Organization (18), food handlers should have the necessary knowledge and skills to enable them to handle food hygienically. Therefore, training in sanitation and hygiene should be able to change personal behavior and attitudes as well as imparting knowledge (17). The lack of training may have resulted in the marked levels of poor hygiene practices recorded among meat sellers. The World Health Organization (36) has stated that food handlers should maintain a high level of personal cleanliness, should wear suitable protective clothing, head-gear and footwear, and should refrain from smoking, spitting, chewing and sneezing or coughing over unprotected food. Most of the respondents in this study admitted that they would sell their meat under a net (on top of a table covered with a net) if they had financial assistance, while some revealed that wearing gloves during work would make their hands uncomfortable and lead to accidents at work because of the slippery nature of gloves. This confirms the findings of Sulleyman et al. (31) and Adzitey et al. (9).

Meat sellers' practices and enthusiasm toward hygiene and sanitation

Practices of meat safety among the meat sellers sampled are given in Table 3. A majority (70%) of the meat sellers obtained meat from an abattoir for retail to consumers, and 30% perform backyard slaughtering. The majority (45%) of meat sellers who bought meat from the abattoir did so because they thought that it was hygienic in nature. The other reasons were that (1) it is cheaper to purchase meat from the abattoir (33%) and (2) the abattoir is the place approved by the Tamale Metropolitan Assembly (22%). Sulleyman et al. (31) also found that meat sellers in the Accra metropolis obtained their meat mainly from the abattoir. This shows that the meat sellers were obeying the local authorities' instructions to obtain meat from abattoirs and reduce the incidence of backyard slaughter. The 30% of the respondents who obtain their meat through backyard slaughter pose a serious health risk to consumers since veterinary officers do not inspect meat produced there. The majority (48%) of meat sellers sold meat on open tables, which cannot provide protection of the meat from flies, dust, smoke from vehicles, and other contaminants. Open tables also do not provide any type of controlled temperature for the meat. Our findings are similar to those of a study conducted in Accra, Ghana, that found that meats were sold in similar circumstances (31).

With regard to cleaning, most (94%) of the respondents said that they use soap and cold water in washing their equipment, and 91% of them said they either washed or scraped their chopping tables 3 or more times a day. These practices were encouraging, since Alhaji and Baiwa (12) reported that cleaning of equipment and surfaces was the most common preventive hygiene practice, and that only a few knew about the protective capacity of frequent cleaning and sanitation of meat handling facilities. However, the meat sellers do not disinfect their shops (100%) or sterilize their knives and equipment (95%). The few who sterilized their knives and equipment used hot water. The majority (96%) of the meat sellers always washed their hands before touching raw meat. The hands of food handlers can be vectors that spread harmful microorganisms through cross-contamination (14). This can occur if they ignore the importance of washing the hands during food preparation. Some of the bacteria that can be found on the hands of food handlers are *Escherichia coli* and *Staphylococcus aureus* (26).

More than half (58%) of the meat sellers did not wear an apron during work. In addition, most (94%) did not wear gloves during work, with a few (25%) admitting to smoking at the workplace. Similar observations were made by Sulleyman et al. (33). A minority (39%) of the meat sellers interviewed appeared clean, with the majority (61%) being dirty. Being "clean" means that less than a quarter of the sellers' clothes were covered by only fresh meat particles/blood splashes, while being "dirty" means that half of the sellers' clothes were covered with either fresh or old meat particles/blood splashes. Leftover meats were stored in a refrigerator. Similarly, Adzitey et al. (7) found that butchers stored their leftover meats in a refrigerator (83.8%), or preserved it by drying (10%), smoking (2.5%) and other methods (3.7%).

The enthusiasm of the meat sellers toward meat safety is shown in Table 4. The meat sellers were keen to sell meat from an enclosed net (46%), highly motivated to always wash their hands, tables, knives and other equipment (41%), much enthused about wearing clean clothing when selling meat (36%), and moderately enthused about using aprons (44%). Furthermore, they were slightly enthused about use of gloves (39%), moderately enthused about being trained in meat safety (30%), much enthused about always checking the temperature of their refrigerators (40%) and not enthused about adhering to food safety rules and regulations (37%). The enthusiasm of the meat sellers demonstrates their eagerness to accept and to adopt changes needed to ensure meat safety.

CONCLUSIONS/RECOMMENDATIONS

Meat sellers had satisfactory knowledge mainly on whether meat can be contaminated by poor handling and were aware that contaminated meat can cause illness. Although most of the meat sellers had basic understanding about

TABLE 3. Meat sellers' responses to hygienic practices

Parameter	Percentage (*n)
Where do you get your meat?	
Abattoir	70
Backyard slaughter	30
Imported carcass	0
What do you sell meat in/on?	
An open table	48
Table with an enclosed net #	13
Open table in a building	39
Frequency of washing chopping table	
Several times a day	91
At the beginning and close of work	9
Once a week	0
Frequency of disinfecting shop	
None	100
Frequency of washing hands before handling meat	
Always	96
Sometimes	3
Rarely	1
Never	0
Materials used to wash equipment	
Soap and cold water	94
Detergent and water	6
Sterilization of knives and other equipment	
Yes	5
No	95
Wear apron during work	
Yes	42
No	58
Frequency of using gloves during work	
Always	0
Sometimes	6
Rarely	0
Never	94
Smoking at workplace	
Yes	25
No	75

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TABLE 3. Meat sellers' responses to hygienic practices (cont.)

Parameter	Percentage (*n)
Ranking meat sellers on appearance	
Very dirty	12
Dirty	49
Clean	34
Very clean	5
Handling of leftover meats	
Refrigeration	100
Drying	0
Smoking	0

*n = number of respondents

Enclosed net: a table covered with a net under which meats are kept for sale.

TABLE 4. Enthusiasm of meat sellers toward meat safety

Parameter	Level of enthusiasm (% , *n)				
	Not enthused at all	Slightly enthused	Moderately enthused	Much enthused	Highly enthused
Will sell my meat in an enclosed net	2	7	16	46	29
Willing to always wash my hands, tables, knives and other equipment	1	4	19	35	41
Willing to wear clean clothes when selling	2	10	33	36	19
Like to use apron	6	26	44	15	9
Like to use gloves	34	39	17	7	3
Willing to be trained in meat safety	14	18	30	28	10
Willing to always check the temperature of my refrigerator	7	10	26	40	17
Willing to adhere to food safety rules and regulations	37	13	13	14	23

*n = number of respondents was 100

personal hygiene, hand washing and proper cleaning, this did not translate to strict food hygiene practices. The meat sellers lacked training in safe meat handling and education concerning issues relating to meat safety. The findings of this study may be useful for policy makers in determining

intervention strategies for improving meat safety in Ghana. Regular informal food safety education, demonstrations and hands-on training on meat safety is recommended for meat sellers in the Tamale Metropolis. Food safety regulations should be enforced to the letter in order protect human lives.

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