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CONSUMER MEAT-HANDLING PRACTICES AND FOOD SAFETY KNOWLEDGE IN KHARTOUM CITY - SUDAN

(With 5 Tables)

By

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SUMMARY

The interview of fifty meat-handling consumers was conducted in Khartoum city, capital of Sudan. Those respondents included meat in their diet, primary shopper and food handler in their home. Many of individuals failed to store meat at the correct temperature (20.0%) or did not correctly defrost meat (76.0%). Meat handling practices varied according to the level of education of the respondent (36.0%), and gaps in food safety knowledge were noted. There was a significant relationship between meat storage malpractice and the consumer's level of education ($P < 0.05$).

Key words: Food safety, meat handling, consumers.

INTRODUCTION

Food safety is defined as the degree of confidence that food would not cause sickness or harm to the consumer when it was prepared, served and eaten according to its intended use (FAO/WHO, 2003).

WHO (2002) reported that some (40%) of foodborne illnesses resulted from the consumption of food prepared in the home. Studies had suggested that cases of foodborne diseases originating in the home were less likely to be reported (Day, 2001; Redmond and Griffith, 2003). Redmond and Griffith (2003) estimated that between 50% and 87% of reported outbreaks of foodborne diseases had been associated with food prepared at home. Rusin *et al.* (1998) identified the kitchen as an area highly contaminated by various strains of bacteria. Therefore, that the private home was a crucial location in which foodborne diseases were engendered.

Food could be mishandled at any number of stages during its preparation, handling, and storage. The studies showed that many consumers were inadequately informed about measures needed to prevent foodborne diseases in the home (Medeiros *et al.*, 2001).

According to Bean and Griffin (1990) and Abdalla *et al.* (2008), foodborne diseases has been associated with improper storage or reheating and with cross-contamination. Some cases from foodborne diseases acquired in the home were resulted from eating undercooked food of animal origin or from engaging in unsafe food preparation practices (Klontz, *et al.*, 1995 and Abdalla *et al.*, 2008). Earlier studies in adults had shown that knowledge about food safety tended to increase with age, the level of education, and experience in food preparation (Bruhn and Schutz, 1999; Rimal *et al.*, 2001; Unusan, 2007). In many societies, women were more informed about appropriate methods of food-handling and storage than men. Better educated individuals often recognize the importance of food safety, and younger respondents had shown the greatest need for additional education about food safety (Bruhn and Schutz, 1999; Rimal *et al.*, 2001).

The prevention of foodborne disease requires the cooperation of all those who interact in the food chain (WHO, 2000). No single stage of that process can be identified as the most critical, although the consumer had been described as the "final line of defense" (Gilbert, 1983). However, no enforceable regulations for the preparation, handling, and storage of food in the home, where food safety requires an educated consumer. Several studies had identified the need for continued consumer education about the hazards of improper food-handling (WHO, 2000; Li-Cohen and Bruhn, 2002; Mitakakis *et al.*, 2004; Finch and Daniel, 2005).

The association of food poisoning outbreaks and the consumption of contaminated meat were significant in many countries (Socckett, 1995). Although food borne disease data collection systems often miss the mass of home-based outbreaks of sporadic infection, it is now widely accepted that many cases of food borne diseases occur as a result of improper food handling and preparation by consumers in their own kitchens, as shown in a review of studies from both Europe and North America (Scott, 1996). Because the reporting of food borne diseases to a specified agency was not obligatory in Sudan, data on food borne infections and intoxications were inaccurate (WHO, 2004).

The aim of the study was to investigate the consumers' knowledge about meat purchase, storage, cooking, and serving.

MATERIALS and METHODS

The study was conducted in Khartoum city, capital of Sudan, from March to May 2008. Fifty households were selected randomly from the city. All respondents, interviewed in their home had the sole responsibility for the preparation of a homemade meal, and served as the primary shopper and food handler in their family. The questionnaire used in this study was a modified version of a questionnaire from the US Food and Drug Administration (FDA, 2002a.). The purpose of the questionnaire was to correlate information from various demographic sections of an urban adult Sudanese population and food-handling practices (the purchasing, transport, storage, handling and cooking of meat). In a pilot study, the questionnaire was administered to 20 consumers matched for age, main shoppers, and food handlers in their home and the results to determine the clarity of the questions that would be administered to a larger population.

Statistical analysis

The data were analyzed with SPSS software (Statistical Package for the Social Sciences, version 11.5, SSPS Inc, Chicago, IL, USA). Frequencies as well as the percentages of responses in each category were computed. Cross-tabulation and the χ^2 test were used to examine the relationships among and between the variables. Statistical significance was set at a P value of $<.05$.

RESULTS

The consumers interviewed, 2% were men and 98% were women. Most of the consumers (46.0%) were between 18 and 34 years of age, 36.0% had been educated to the general school level, and 82.0% were married (Table 1).

The criteria in purchasing meat were quality (60.0%), stamp (18.0%), price (12.0%), fat content (6.0%) and expiry date (4.0%) respectively. Some consumers (94.0%) interviewed provided multiple responses about this criteria. Most consumers (80.0%) immediately returned home after having purchased meat, and 20.0 % usually returned home within 1–2 h after having purchased meat (Table 2).

About 20.0% of the consumers stored their meat in a freezer at temperature zero degree centigrade, whereas those who were stored it for less than 2 days at the same degree were 30.0%. But 76.0% of the respondents were stored it for more than 3 days at the same degree (0°C). Some interviewers (4.0%) stored their meat in the kitchen at room

temperature ($>25^{\circ}\text{C}$). Those who were stored the raw meat at 5°C for less than 2 days were 72.0% and 28.0% stored it more than 3 days at the same temperature. Most of respondents (58.0%) were stored the meat after removing the package, but 26.0% removed the meat from its package, sliced and placed it on an uncovered plate. Eight percent of the interviewers removed meat from package and placed it uncut on a covered plate. About 96.0% of respondents separated raw meat from other foods and only 4.0% not separated it. Most of consumers (50.0%) setting the frozen meat on a counter top of kitchen to thaw, 12.0% of the respondents never be thawed or stored it on a counter top or defrosted it in hot water. Twenty percent of them were thawed the meat in hot water and 10.0% thawed it in refrigerator. But 8.0% of the interviewers were thawed meat in cold water, 6.0% of them placed frozen meat in the sun and only 2.0% were thawed it in oven or microwaves. Thirty eight percent of homemade meal thawed meat, 34.0% sometimes refreeze thawed meat and 28.0% never refreeze thawed meat. There was a significant relationship ($P<0.05$) between meat storage malpractice and the consumers' level of education (Table 3).

The questionnaired persons that washed their hands were 70.0%, but 24.0% of them they did so sometimes and 6.0% said that they never did so. There was a significant relationship between education level and use soap for hand washing ($P<0.05$). A few consumers (14.0%) were rinsed their hands with cold water and warm water after handled meat, but 86.0% washed their hands with soap and warm water. Seventy percent of consumers were washed the cutting board on which raw meat was sliced, with soap and hot water, 12.0% of them washed it with cold water, 8.0% were just wiped it with damp cloth, 6.0% were used hot water with soap and then sanitized cutting board but 4.0% never washed it. There was significant difference ($P<0.05$) between the consumers' education level and the propensity to wash a chopping board between the preparation of raw meat and vegetables (Table 4).

Almost 80.0% of the consumers cleaned their kitchen counters and other surfaces using hot water and soap, 12.0% cleaned their kitchen counters with water at room temperature, and 8.0% used hot water and soap and then applied a bleach solution.

About 96.0% of consumers determined that a meat dish was adequately cooked by its color, and 4.0% just monitor the duration of cooking. Consumers tend to prefer well-done meat (88.0%) or medium (12.0%). When consumers were asked how they handled the leftover cooked meat, 80.0% said that they usually cool the food at room

temperature then put in the refrigerator, 20.0% refrigerated cooked meat immediately.

Most respondents (76.0%) have served leftover cooked foods reheat until they were hot and steamy, and 24.0% reheat it until sufficiently warm. There was no significant correlation between education level and meat-handling practices ($P>0.05$).

Table 1: Characteristics of the study subjects

Demographic characteristics	Category	Frequencies (No.)	Percentage (%)
Sex	Male	1	2.0
	Female	49	98.0
Age (year)	18-34	23	46.0
	35-55	21	42.0
	>56	6	12.0
Level of education	Primary	9	18.0
	General secondary	9	18.0
	High secondary	22	44.0
	Graduate	10	20.0
Marital status	Married	41	82.0
	Single	3	6.0
	Separated	2	4.0
	Widow	4	8.0

Table 2: Methods of purchasing, conveying, and handling raw meat.

Question	Answer	Frequencies	Percentage (%)
Type of meat do you buy	Only minced	0	0.0
	Meat with bone	3	6.0
	Meat without bone	0	0.0
	At least 2 of above	47	94.0
Total		50	100.0
Which factors are important in selecting meat to prepare at home?	Quality	30	60.0
	Fat content	3	6.0
	Price	6	12.0
	Expiry date stamp	2	4.0
		9	18.0
Total		50	100.0
When do you return home after having purchased raw meat?	Immediately after purchase	40	80.0
	Within 1-2 h after purchase	10	20.0
Total		50	100.0
By which method do you transport just-purchased raw meat?	A normal grocery bag	4	8.0
	A separate grocery bag for meat	46	92.0
Total		50	100.0

Table 3: Methods of storing raw meat

Questions	Answers	Frequencies	Percentage (%)
At which temperature do you store raw meat? (n = 50)	room temperature in the kitchen	2	4.0
	5 °C (40 °F) (refrigerator temperature)	10	20.0
	Zero degrees centigrade (32 °F) (refrigerator freezer temperature)	38	76.0
Total		50	100.0
For how long do you store raw meat at refrigerator temperature (5 °C)? (n = 50)	Less than 2 days	36	72.0
	More than 3 days	14	28.0
Total		50	100.0
For how long do you store raw meat at refrigerator freezer temperature (zero centigrade; 32 °F)? (n = 50)	Less than 2 days	15	30.0
	More than 3 days	35	70.0
Total		50	100.0
How do you store raw meat at refrigerator temperature? (n = 50)	In the refrigerator as bought	3	6.0
	Remove meat from its package and place it uncut on a covered plate or wrap it	4	8.0
	Remove meat from its package and place it uncut on an uncovered plate	1	2.0
	Remove meat from its package, slice it, and place the slices on a covered plate or wrap them	29	58.0
	Remove meat from its package, slice it, and place the slices on an uncovered plate	13	26.0
Total		50	100.0
Do you separate raw meat from other foods in the refrigerator? (n = 50)	Yes	48	96.0
	No	2	4.0
Total		50	100.0
How do you thaw frozen raw meat? (n = 50)	No thawing	6	12.0
	Thaw in hot water	6	12.0
	Thaw in cold water	4	8.0
	Place the frozen meat in the sun or in the stove	3	6.0
	Thaw on the kitchen counter	25	50.0
	Thaw in the oven or microwave	1	2.0
	Thaw in the refrigerator	5	10.0
Total		50	100.0
Do you refreeze thawed raw meat? (n = 50)	Yes	19	38.0
	Sometimes	17	34.0
	No	14	28.0
Total		50	100.0

Table 4: Methods of handling and preparing raw meat

Questions	Answers	Frequencies	Percentage (%)
Do you wash your hands before you prepare meat? (n = 50)	Yes	35	70.0
	Sometimes	12	24.0
	No	3	6.0
Total		50	100.0
After you have handled raw meat, how do you wash your hands? (n = 50)	Rinse them under cold or warm tap water	7	14.0
	Wash them with soap and warm water	43	86.0
Total		50	100.0
Before you use a cutting board on which raw meat was just sliced, how do you clean it before you use it to chop vegetables, etc? (n = 50)	No washing	2	4.0
	Wipe with a damp cloth	4	8.0
	Wash with cold water	6	12.0
	Wash with soap and hot water	35	70.0
	Wash with soap and hot water and then sanitized	3	6.0
Total		50	100.0
What do you use to clean kitchen counters and other surfaces that come into contact with raw meat? (n = 50)	Water at room temperature	6	12.0
	Hot water and soap	40	80.0
	Hot water and soap, then bleach solution	4	8.0
Total		50	100.0

Table 5: Methods of cooking and serving meat (n = 1090)

Questions	Answers	Frequencies	Percentage (%)
When you prepare a dish that contains meat, how do you determine whether the meat has been adequately cooked before it is consumed?	Look at its color	2	4.0
	Monitor the duration of cooking	48	96.0
Total		50	100.0
To which degree of doneness do you cook meat?	Rare	0	0.0
	Medium	6	12.0
	Well-done	44	88.0
Total		50	100.0
How do you handle leftover cooked meat?	Cool it to room temperature, then store it in the refrigerator	40	80.0
	Put it into the refrigerator immediately after the meal	10	20.0
	Leave it at room temperature overnight or longer	0	0.0
Total		50	100.0
To what degree do you reheat leftovers?	Until they are hot and steamy	38	76.0
	Until they are sufficiently warm	12	24.0
	No reheating; eaten cold	0	0.0
Total		50	100.0

DISCUSSION

In this investigation, the meat consumers were selected randomly in Khartoum city to have knowledge of food safety and practices in the home. The respondents chose the meat according to quality (60.0%), fat content (6.0%), price (12.0%), expiry date (4.%) and stamp (18.0%) and this findings in contrast with findings of McSwane *et al.* (1998) judged the quality of the purchased meat by color, texture and odor.

Most of the meat consumers (80.0%) were returned home two hours after having purchased meat, this is reducing the risk of increasing temperature (FDA/CFSAN, 2001). Also the respondents (92.0%) were use a separate grocery bag for meat (FSIS/CFSAN, 2002a).

In this study, about 76.0% of the consumers were stored meat at zero degree centigrade but 20.0% of them were stored their meat at 5°C.

These results in agreement with results of FDA/CFSAN (2001) who reported that the temperature of refrigerator should be kept at 5°C or lower and on a freezer at zero degree or lower, because the bacterial growth between 5-60°C at 20 min. Most of the consumer interviewed (76.0%) stored meat at controlled temperature. The respondents (72.0%) who stored meat in the refrigerator and using it within two days, they were reducing likelihood of food poisoning. Also those consumers when they were asked to define the longest length of time for which raw meat would be refrigerated before its use, 28.0% said 3-4 days and 70.0% said longer than 3 days in the refrigerator freezer. These findings in accordance to consumer food safety education programs that emphasized the action of temperature control in reducing microbial growth and survival and concept that storing perishable foods at the correct temperature helps to ensure food safety at home (Bryan, 1988). But in contrary with FDA/CFSAN (2001) who explained that consumers must be awarded of the importance of storing food at temperature that inhibits bacterial growth because some pathogenic bacteria can grow at temperature of zero degree centigrade.

The study subjects described the following practices of thawing raw frozen meat and some consumers were setting the frozen meat on a counter top to thaw (50.0%), or the thawing it in the refrigerator (10.0%), or thawing it in cold water (8.0%) or thawing it in oven or microwave (2.0%). These results in disagreement of FSIS (2005) who reported that foods should never be thawed or stored on a counter top or defrosted in hot water. Food that is being thawed, heated or cooled should be kept for the shortest possible time in the middle temperature zone (21-52°C) because microorganisms grow most rapidly. Low frozen meat that must be thawed quickly and should be submerged in cold water in airtight packaging or thawed it in the microwave and cooked immediately (FSIS/CFSAN, 2002b). Most consumers (38.0%) refrozeed the same piece of raw meat and this in agreement with FSIS (2003) advised that defrosted raw meat can be safety store in the refrigerator for 3-5 days before it is cooked. If the defrosted meat is not then cooked within 5 days, it can be safety refrozen without having been cooked.

Most malpractices occurred before the raw meat was cooked. The safety practice of washing hands with soap and water before preparing food makes food poisoning less likely to occur (Altekruse *et al.*, 1996). The respondents educated to high school (44.0%) or university (20.0%) level were likely to use soap than were those educated to the primary (18.0%) or secondary (18.0%) level. The FDA

(2002b) has recommended that hands be washed with warm water and soap before and after handling food specially, raw meat. Some consumers (4.0%) demonstrated poor sanitation producers that can result in the cross-contamination of foods by chopping ready-to-eat foods on an unwashed cutting board previously used to slice meat. The package of meat in the refrigerator temperature also can be increased cross-contamination.

Cutting boards could be sanitized if they were washed with a solution of 5 ml (one teaspoon) of chlorine bleach in one quart of water (FDA/CFSAN, 2005). Sudanese meat consumers tended to prefer medium (12.0%) or well done (88.0%) meat and this is a common practice to judge of safety of a cooked meat by its appearance (Killinger *et al.*, 2000; FSIS, 2003; Badrie *et al.*, 2004).

Conclusions

The results of this study identified a gap in food safety practices that occurs from the time at which meat is purchased until it is served. Those educated only to the primary school level paid more attention to the price of meat. The education of meat consumers is an effective strategy for reducing the incidence of foodborne diseases and minimizing the economic losses associated with their treatment. Effective public education programs targeted at the microbiologic, chemical, and physical sources of foodborne diseases are essential to eliminating poor food hygiene practices and to ensuring the safety of foods prepared at home.

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