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Food Safety Knowledge and Practices among Household Food Handlers in Mangweni Village of Mpumalanga Province in South Africa

ABSTRACT

The study aimed to assess food safety knowledge and practices among household food handlers in Mangweni village, South Africa. A quantitative cross-sectional study was conducted on 120 households selected using systematic random sampling. Women over 18 years of age who were responsible for preparing food in the selected households were eligible for inclusion in the study. A simple random sample was used to select 15 from the 120 food handlers to observe their food handling practices. SPSS version 27 was used to run the descriptive statistics. Food handlers were between 19 and 43 years of age, with a mean age of 29.9 ± 1.39 . Most food handlers had high school (58.3%) or university or college (33.3%) educations. Levels of food safety knowledge were found to be poor (44.5%), good (53.9%), and excellent (1.6%). Our findings show the need for an intervention to improve food safety knowledge and practices among food handlers.

INTRODUCTION

In 2010, foodborne diseases led to 600 million illnesses globally, resulting in 420,000 deaths and the loss of 33 million healthy life years (7). The highest burden from foodborne disease is reported in low- and middle-income countries. According to the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC) (4), 61% of foodborne outbreaks in Europe and 78% of those in the United States are associated with the consumption of food from food establishments. Another assessment survey conducted in 2018 by the European Union found that 40.5% of foodborne outbreaks originate at home (5). A review in South Africa reported 1,060 listeriosis cases, with 216 recorded deaths, in 2017 to 2018 (16). Declared the largest listeriosis outbreak in the world, it was caused by ready-to-eat processed meat products.

A review of studies conducted in South Africa from 2013 to 2017 revealed 327 foodborne disease outbreaks, which resulted in illness in 11,155 individuals, 8,680 hospital visits, 494 hospital admissions, and 49 deaths (12). KwaZulu-Natal had the most foodborne disease outbreaks (43%), followed

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by Gauteng (19%) and Mpumalanga (12%) provinces. Food prepared at home accounted for 27.7% of these outbreaks.

Factors that contribute to foodborne illnesses include cross-contamination, contaminated food supplies, inappropriate cooking temperatures and procedures, dirty utensils, poor storage, and poor sanitation and personal hygiene (7). Sibanyoni et al. (13) conducted a study in Mpumalanga province among food handlers in school feeding programs. Food handlers involved in the school feeding programs are responsible for food preparation at home. Hence, this study focused on food safety at the household level. The study was conducted in Mangweni, a rural village in the Mpumalanga province of South Africa. Mpumalanga is one of the three provinces in South Africa that reported a high prevalence of foodborne illness. This study was undertaken to assess food safety knowledge and food handling practices among food handlers at the household level and to answer this question: what knowledge and practices do food handlers have regarding food safety?

MATERIALS AND METHODS

A quantitative cross-sectional study was conducted at Mangweni village of Mpumalanga province in South Africa. The researchers selected Mangweni using convenience sampling because the area was easily accessible. The target population was women responsible for food preparation in the households of the village. A list of 1,364 households was obtained from the office of the Tribal Authority, which constituted the sampling frame. The sample size was determined using Slovin's formula ($n = N/(1 + Ne^2)$) (15); the margin of error was 8.75% with a 90% confidence interval. After running the calculation, the researchers arrived at 115 households.

Using systematic simple random sampling, every 11th household in the list was included. A total of 120 households participated in the study, and five were added to offset sample attrition. To be included in the study, participants had to be women above 18 years in age who were responsible for food preparation in the household. If more than one woman in a household qualified to participate in the study, simple

TABLE 1. Demographic and household characteristics of food handlers (n = 120)

Variables	Items	n (%)
Age (yr)	19–30	62 (51.7)
	31–40	32 (26.7)
	>40	26 (21.7)
Educational level	No formal education	2 (1.7)
	Primary education	8 (6.7)
	High school education	70 (58.3)
	University education	40 (33.3)
Source of fuel for cooking	Electricity	34 (28.3)
	Firewood	48 (40)
	Both	38 (31.6)
Source of drinking water	Communal tap	116 (96.7)
	Own borehole	4 (3.3)
Types of livestock	Chickens	42 (35)
	Cattle	14 (11.7)
	Goats	10 (8.3)
	Sheep	8 (6.7)
	Pigs	4 (3.3)
Toilet facility	Pit latrine with vent pipe at the back	60 (50)
	Pit latrine without vent pipe	56 (46.7)
	Flush toilet inside the house	4 (3.3)
Trash or kitchen waste disposal hole in the yard	Yes	110 (91.7)
	No	10 (8.3)

random sampling was used to select one. If no participant was found in one of the selected households, a nearby household was randomly selected. Systematic random sampling was used to select participants for observation on food handling practices; 12 (10%) of 120 participants were selected, with three more added to offset attrition, for a total of 15 participants. The kth value was eight, obtained by the division of 120 by 15.

The University of Venda Ethics Committee approved the study. All women who agreed to participate signed an informed consent form, and they were not compensated.

Instrumentation

A structured questionnaire and an observational checklist were developed in English, guided by the study objectives, and were translated to the language used in the area, *SiSwati*. The translation was done by a language expert and was back-translated to English by a different translator as a quality check. The questionnaire consisted of demographic and household characteristics, 10 multiple-choice questions to assess food safety knowledge, and 16 open-ended questions on food handling practices. Questions were evaluated and assessed by a food expert for content validity.

Data collection

Face-to-face interviews were conducted during data collection. A checklist on food storage, preparation, and personal and environmental hygiene practices was used to observe food handlers during food preparation at their homes.

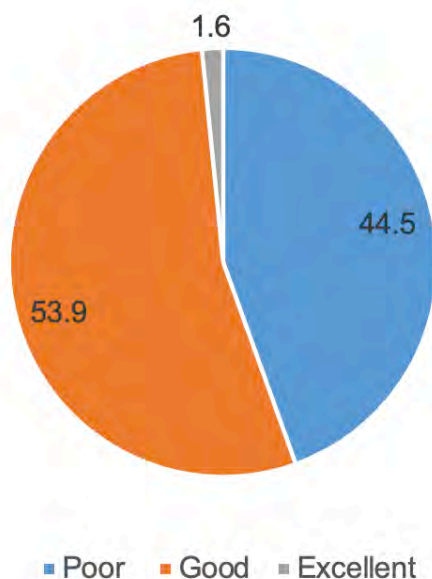


Figure 1. Levels of food safety knowledge of household food handlers. Total knowledge scores were grouped into quantiles from the 10 multiple-choice questions: poor knowledge (0 to 4 points), good knowledge (5 to 8 points), and excellent knowledge (9 to 10 points). Researchers determined the scores to interpret the knowledge levels.

A pretest of the instrument was done at Tonga, a nearby village resembling Mangweni, to verify the clarity and suitability of wording and to estimate the average time required to complete the questionnaire. The average time spent completing the questionnaire was 15 min, with 45 min of observation, depending on the preparatory activities done by food handlers.

Statistical analysis

Descriptive statistics using Statistical Package of Social Sciences (SPSS; IBM Corp., Armonk, NY) version 27 were used for data analysis. Continuous data were described using mean and standard deviations. Frequencies and percentages were used to describe categorical data. Each multiple-choice question from the food safety knowledge test had one correct answer, assigned a score of one point. The researchers interpreted the level of food safety knowledge of food handlers as poor (0 to 4 points), good (5 to 8), and excellent (9 to 10). Information on food safety practices was analyzed using thematic content analysis.

RESULTS

Demographic and household characteristics of food handlers

A total of 120 women food handlers 19 to 43 years of age (mean age 29 ± 1.39 SD) who were responsible for food preparation participated in the study. Only 1.7% of the food handlers had no formal education, 6.7% had primary education, 58.3% had high school education, and 33.3% had university or college education. Food handlers reported using electricity (28.3%), firewood (40%), and both electricity and firewood (31.6%) as their primary sources of fuel for cooking. Almost all the households had access to communal water (96.7%); only 3.3% used water from their own drilled well. In 75% of the households, livestock were available, including chicken (35%), cattle (11.7%), goats (8.3%), sheep (6.7%), and pigs (3.3%). Very few households (3.3%) had access to flush toilets, whereas 50% of the households had pit latrines. Almost all women (91.7%) reported the availability of trash or kitchen waste disposal holes within their yards. *Table 1* summarizes the demographic and household characteristics reported in the study.

Level of food safety knowledge of food handlers

The level of food safety knowledge among food handlers is presented in *Figure 1*. The scored findings revealed that 44.5% had poor knowledge (fewer than five points), 53.9% had good knowledge (five to eight), and 1.6% had excellent knowledge (nine to 10). The responses to the 10 multiple-choice questions are reported in *Table 2* (appropriate responses given in bold). In regard to hand washing, 66.7% of food handlers knew they need clean, safe water and soap to wash their hands before cooking. Most handlers (94.1%) were aware that, when shopping, they need to look for the

TABLE 2. Food handlers' knowledge of food safety (n = 120)

Questions	Responses (correct response in bold)	n (%)
1. How does one wash hands before cooking and eating?	a. Wash with warm, clean water and soap b. Wash with water c. Wipe with a damp cloth	80 (66.7) 17 (14.1) 23 (19.2)
2. What is done with the wooden cutting board after cutting meat?	a. Wipe with a wet cloth b. Rinse with cold water c. Wash and scrub with hot water and soap	26 (21.7) 49 (40.8) 45 (37.5)
3. What is the best and safe practice to do for fruit before consumption?	a. Consume as is b. Wash before consumption c. Wipe with a paper towel or cloth	97 (80.8) 7 (5.8) 16 (13.3)
4. How long is leftover meat left at room temperature?	a. The duration does not matter b. Not more than two hours c. Do not know	71 (85.8) 11 (9.2) 6 (5.0)
5. A cooler box with ice can be used to cool down hot foods and keep them safe for hours.	a. True b. False c. Do not know	87 (72.5) 31 (25.8) 2 (1.7)
6. Which proper method is safe to defrost frozen meat?	a. Immersing in warm water b. Immersing in cold water for hours c. The use of a microwave	4 (3.3) 93 (77.5) 20 (16.7)
7. Which practice is safe to do for defrosted meat?	a. Use all the defrosted meat at once b. Refreeze the meat and defrost it again for the next use c. Refrigerate defrosted meat for the next use	111 (92.5) 9 (7.5) 0 (0)
8. Which foods are picked last during shopping?	a. Dry food products b. Frozen foods c. There is no proper order to follow	10 (8.3) 17 (14.2) 93 (77.5)
9. What to check on the food package during shopping to ensure food quality?	a. Best before date or expiration date b. Sealed package c. Both a and b	5 (4.2) 2 (1.7) 113 (94.1)
10. Bacteria are some of the microorganisms that cause foodborne illnesses.	a. True b. False c. Do not know	31 (25.8) 6 (5.0) 58 (69.2)

expiration date on food labels and that food should be sealed appropriately to ensure its quality.

Of food handlers, 14.2% were aware that frozen foods should be the last items selected when shopping. Over a third (37.5%) knew that a wooden cutting board should be washed with hot water and soap after cutting meat, and 5.8% indicated that fruits should be washed before consumption.

Food handling practices of food handlers

The results of self-reported food handling practices are indicated in [Table 3](#). The findings revealed both appropriate and inappropriate food handling practices, and the appropriate practices are indicated in bold. Almost all women food handlers (90%) in the households reported cleaning the kitchen before preparing

food, and 56.6% washed their hands with clean, safe water and soap before cooking or eating. Nearly a quarter (21.7%) of the food handlers reported that before chopping vegetables with a knife that has been used to cut meat, they wash the knife with warm water and soap and wipe it with a clean cloth. Most food handlers (71.7%) indicated that they store raw meat and chicken on the lower shelf in the refrigerator, not in the freezer, before cooking. Very few (16.7%) reported that, when they have sores on their hands, they put on a bandage and wear plastic gloves when handling food. Of respondents, 51.7% reported that they place meat on the lower shelf of a cart during shopping.

[Table 4](#) presents varied practices observed regarding food storage and preparation and personal and environmental hygiene practices. More than half (53.3%) of the women

TABLE 3. Self-reported food handling practices (n = 120)

Questions	Responses (appropriate response in bold)	n (%)
1. How do you wash your hands before cooking or eating?	With warm water and soap	68 (56.6)
	With water only	26.7
	Do not wash hands	8 (6.7)
	Just wipe with a damp cloth	12 (10.0)
2. How do you defrost frozen meat or chicken?	Leave it at room temperature for hours	28 (23.3)
	Immerse it in water until it defrosts	50 (41.7)
	Use of microwave	32 (26.7)
	Leave it in the fridge for a few hours	10 (8.3)
3. During shopping, when do you pick frozen meat?	At the beginning of a shopping trip	10 (8.3)
	At the end of a shopping trip	42 (35.0)
	In the middle of a shopping trip	12 (10.0)
	At any time	56 (46.7)
4. During shopping, where do you place meat in a cart?	Mix it with other food items	8 (6.7)
	On the upper shelf of the cart	10 (8.3)
	Anywhere on the cart	40 (33.3)
	On the lower shelf of the cart	62 (51.7)
5. What kind of food(s) do you store in the refrigerator?	Porridge	4 (3.3)
	Uncooked meat	14 (11.7)
	Carrots	102 (85.0)
	Spices	— ^a
6. Where do you store fruit like bananas?	In the vegetable basket	84 (70.0)
	On the cupboard	—
	In the refrigerator	30 (25.0)
	In the freezer	6 (5.0)
7. How do you store leftovers like beef stew?	In a closed container and put in a cupboard	26 (21.7)
	In a closed container and put in a refrigerator	24 (20.0)
	Leave it in the pot	44 (36.6)
	Leave it at room temperature, uncovered	26 (21.7)
8. What do you do to your head when preparing food?	Always have short hair no need to cover	18 (15.0)
	Leave head uncovered	32 (26.7)
	Wash head and leave it uncovered	—
	Cover head	70 (58.3)
9. What do you do in your kitchen before preparing food?	Do not do anything, even if dirty	12 (10.0)
	Ensure the kitchen is clean	108 (90.0)
10. What do you do with a knife that was used to cut meat before chopping vegetables?	Wipe them with a clean cloth	82 (68.3)
	Wash with warm water and soap and wipe with a clean cloth	26 (21.7)
	Use them as they are	12 (10.0)

Continued on next page.

TABLE 3. Self-reported food handling practices (n = 120) (Continued)

Questions	Responses (appropriate response in bold)	n (%)
11. How often do you empty the trash or kitchen waste bin?	Daily	40 (33.3)
	Once a week	2 (1.7)
	Every time when is full	62 (51.7)
	Every time when is stinky	16 (13.3)
12. How do you check that milk is safe for consumption?	Expiration date	96 (80.0)
	Smell it	12 (10.0)
	Do not check	—
	Taste it	12 (10.0)
13. Where do you store raw meat/chicken in the refrigerator before cooking, not freezer?	On the door of the refrigerator	4 (3.3)
	On any shelf where there is available space	16 (13.3)
	On the upper shelf	14 (11.7)
	On the lower shelf	86 (71.7)
14. How do you prepare food with a sore on the back of your hand?	Wear a glove	42 (35.0)
	Bandage the sore and wear a waterproof glove	20 (16.7)
	Put a bandage on it	12 (10.0)
	Prepare food with the hands uncovered	46 (38.3)
15. How do you reserve food for a family member for several hours?	In the container covered and put in a warmer	10 (8.3)
	In the container covered	50 (41.7)
	Leave it in a pot	54 (45.0)
	In the container and put it in the refrigerator when cold	6 (5.0)

^a—, Indicates no responses.

food handlers covered their heads, kept short nails, and did not wear jewelry during food preparation. Again, they washed their hands with warm water and soap before and after preparing food. Two-thirds (66.7%) of the women washed vegetables before preparation. Also, 60% of food handlers were observed to rinse utensils and wipe them with a clean cloth before using them.

DISCUSSION

South Africa has nine official languages, and Mpumalanga is dominated by *isiSwathi* speakers. All women food handlers in the study speak *isiSwathi*, the local language used in the study area. Other studies on food safety that focus only on women responsible for food handling have been conducted (1, 3, 10). A study conducted in Lahore district, Pakistan, showed that most food handlers (96.5%) were men (2). Although other studies have noted the involvement of men in food handling, women remain predominantly responsible for food handling in various settings.

Most food handlers in this study were literate; 58.3% had completed high school and 33.3% had attended college or university. In Jordan, 46.6% of the food handlers had university degrees (10). According to Ahmed et al. (2), 32.7% of food handlers from Pakistan had a high school education, and a significant proportion (21.3%) had no formal education. A total of 91.7% of food handlers with tertiary education were reported in Malaysia (14). A study of education level of food handlers in Ethiopia found that 40.7% of women food handlers were illiterate and 16.8% had college or university education (3), whereas 40% had high school and 9.6% had a university education (1).

This study found a good level of food safety knowledge among 53.9% of food handlers. Food handlers in home-based food businesses in Jordan had low food safety knowledge (10). Good food safety knowledge was reported among 75.9% of women food handlers in Debarq Town, Northwest Ethiopia (3) and among 36.8% of street food vendors in Northern Kuching City, Sarawak (11). Food handlers from mainland China demonstrated very poor knowledge of food safety and handling in households (6).

TABLE 4. Food handling practices observed by researchers, using a checklist (n = 15)

Observed practices	n (%)
Storage of different food items in the refrigerator	
Stored different types of foods like vegetables, fruit, and meat separately in the refrigerator	2 (13.3)
Mixed different types of foods like vegetables, fruit, and meat in the refrigerator	7 (46.7)
Stored raw meat on the upper shelf of the refrigerator	3 (20)
Stored vegetables on the lower shelf of the refrigerator	2 (13.3)
Stored meat on the upper shelf and vegetables on the lower shelf of the refrigerator	1 (6.7)
Clean kitchen during food preparation	
Cleaned the kitchen by sweeping and mopping the floor before food preparation	6 (40)
Cleaned the kitchen by sweeping before food preparation	3 (20)
Did not clean the kitchen before and after food preparation	2 (13.3)
Cleaned the kitchen after food preparation	4 (26.7)
Trash bin and hole kept clean	
Emptied trash bin after food preparation and kept trash hole clean with no flies	6 (40)
The trash bin was not clean, and the trash hole was stinky	6 (40)
The trash bin was clean, and the hole was full of different kinds of trash	3 (20)
Personal hygiene practices during food preparation (head, nails, jewelry, hand washing)	
Heads covered, short nails, no jewelry, and washed hands with warm water and soap before and after food preparation	8 (53.3)
Heads covered, short nails with nail polish, no jewelry, and washed hands with warm water and soap before and after food preparation	1 (6.7)
Heads covered, long nails, wore jewelry, and washed hands with water after food preparation	2 (13.3)
Heads not covered with short hair, short nails, no jewelry, and the hands were washed with water before and after food preparation	4 (26.7)
Washing vegetables before food preparation	
Washed vegetables before food preparation	10 (66.7)
Did not wash vegetables before food preparation	5 (33.3)
Defrosting methods used	
Microwave	7 (46.7)
Placed frozen meat at room temperature until it defrosted	2 (13.3)
Immersed the meat in water until it defrosted	5 (33.3)
Placed meat on the upper shelf of the refrigerator until it defrosted	1 (6.7)
Rinsing utensils before using them	
Rinsed utensils and wiped with a clean cloth	9 (60)
Did not rinse or wipe the utensils	6 (40)
Cleaning knife before the next use on other food items	
Washed knife with warm water and soap before using it on the other food item	9 (60)
Wiped knife with a clean, damp cloth after cutting meat before it was used for another food item	4 (26.7)
Used one knife for vegetables and fruit without cleaning	2 (13.3)

Both appropriate and inappropriate food handling practices were self-reported and observed in this study. Inappropriate food safety practices among women food handlers have been reported in Jordan (10) and Pakistan (2). Such improper food safety practices may increase the risk of foodborne illnesses in households, especially among vulnerable groups such as pregnant women, children, and older people.

Washing hands during food handling, preparation, and serving is crucial in preventing foodborne disease outbreaks (17). More than half (56.6%) of the women in this study reported appropriate hand washing practices. During observation, 60% of the women practiced proper hand washing before food preparation. Women in home-based food businesses in Jordan reported washing their hands before food preparation (10). In Pakistan, 57.9% of food handlers reported washing their hands before cooking and serving food (2). Some studies have found a lack of appropriate hand washing practices. According to Le Nguyen et al. (8), in a study done in Vietnam, 52.5% of food vendors did not wash their hands before handling, preparing, and serving food. In the rural area of the Kancheepuram District of Tamil Nadu, 27% of the household food handlers did not wash their hands before cooking (9).

After knives are used to cut meat, it is important to wash them with warm water and soap and wipe them with a clean cloth before they are used to chop vegetables, to avoid cross-contamination. Less than a quarter (21.7%) of food handlers in the current study practiced appropriate hygiene to avoid such cross-contamination. Women in home-based food businesses in Jordan reported that they washed knives used

to cut meat with warm water and soap and disinfected them before using them to chop vegetables (10). A study done in Pakistan showed that 49.5% of the food handlers washed food contact surfaces such as chopping boards, tables, and knives with antibacterial soap before food preparation (2).

CONCLUSION

In conclusion, more than half of the food handlers demonstrated good food safety knowledge; both appropriate and inappropriate food handling practices were self-reported and observed. The findings highlight the need to initiate food safety empowerment activities, including education and campaigns to improve food safety knowledge and practices among food handlers. Data from this study will add value to the existing information and can be used as a reference. The information may assist in developing an educational tool suitable to the target population. It is recommended that further studies should be conducted on a larger population of different areas in the country to identify other risks to human health concerning food safety.

LIMITATIONS OF THE STUDY

Due to limited resources, the study was restricted to one village comprising a population of the same cultural group; thus, the authors cannot generalize the findings. Another limitation is that the evaluation of food safety practices was more challenging because of self-reported bias and the presence of the researchers during observation.

ACKNOWLEDGMENT

The authors thank the women who participated in this study.

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