



WHO Five Keys to Safer Food Handling: Knowledge and Practice among Food Handlers in Sokoto Metropolis, Sokoto, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author IAR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OMO and AUK supervised all stages of the work. Author YM managed the data collection and validation. Author BAI reviewed and modified. Authors MOR and KJA reviewed methodology. Author AUA worked on data collection and analysis. All authors read and approved the final manuscript.

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ABSTRACT

Background: The (WHO) developed the five keys to safer food which was designed to be practical and straightforward for food handlers. In recognition of the role they play in preventing Foodborne Disease (FBD) outbreak. In this study, we aimed to determine the knowledge and practice of the

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five keys to safer food among food handlers in food establishments in Sokoto Metropolis, Nigeria.

Methods: We conducted a cross-sectional study between August and November 2019. We recruited 366 food handlers working in restaurants using a multistage sampling technique. We assessed knowledge and practice of five keys to safer food, and we examined the predictors of knowledge among the participants using chi-square and binary logistic regression at a 5% level of significance.

Results: More than two-thirds, 288 (78.7%) less than 40 years and less than half, 163 (44.5%), were involved in cooking the food. One hundred and twenty-seven (34.7%) have greater than five years' experience. Overall, less than one-quarter, 87 (23.8%) had good knowledge of the five keys to safer food handling. One hundred and thirty-two (36.1%) wash hands before and during preparation most times. Two hundred and fifty-three (69.1%) never wash their hands after using the toilet, and 144 (39.3%). Age (adjusted Odds Ratio [aOR]: 10.05; 95% CI = 4.0 - 21.04), gender (aOR: 2.70 95CI = 1.44 - 5.09) and Education (aOR: 3.67; 95% CI = 1.92 - 7.01) were significant predictors of knowledge.

Conclusion: There is poor knowledge, and most of the practices of the five keys to safer food were below the required for food safety. Therefore, we recommend that the Sokoto state ministry of health coordinate training interventions on five keys to safer food with particular attention to those older than 40 years and those without formal education.

Keywords: Food handlers; food hygiene; knowledge; practice.

1. INTRODUCTION

Every human being has the right to healthy and safe food in sufficient quantity [1] that is essential for healthy living. In addition, safe food contributes to a country's food and nutrition security and stimulates sustainable development [2]. However, outbreaks of FBDs occur frequently around the world [2]. Each year, over half a billion people worldwide lose their health, and close to half a million people die after consuming contaminated food [3]. In the United States, the Centers for Disease Control and Prevention (CDC) estimates that roughly 1 out of 6 (the equivalent of 47.8 million) people fall sick, 128,000 are admitted to the hospital, and 30000 dies of Food Borne Diseases (FBDs) every year [4]. In Europe, more than 23 million people fall ill yearly and 5000 die from consuming contaminated food [5]. The burden of FBDs is thought to be highest in developing countries, especially Africa [3]; however, available data on the occurrence of FBDs represents only "a drop in the ocean" as the exact number of cases are unknown mainly due to poor surveillance systems and underreporting of cases, especially in the developing countries [2].

It has been reported that about 70% of FBD outbreaks are due to contaminations by food handlers [6,7]. The contamination results from poor personal hygiene or use of unclean utensils or a dirty environment [8,9]. The poor handling of food and the poor adherence to required standards of hygiene enables pathogens to come

into contact with food which can survive and multiply in sufficient number to cause illness in the consumer [6]. Proper food preparation and handling can prevent most of the FBDs [10].

In the 2000s, the WHO developed the five keys to safer food designed to be practical and straightforward for food handlers. The five keys were developed in recognition of the need to educate food handlers due to the central role they play in preventing FBD outbreak [10]. The core messages of the Five Keys to Safer Food are: keep clean, separate raw and cooked food; cook thoroughly; keep food at safe temperatures, and use safe water and raw materials.

In Sokoto metropolis, increasing demand for ready to eat or prepared food has become imperative for some due to the limitation of time for people to prepare meals for themselves due to increasing commercial activities. This has led to increased demand for food consumption from various food service establishments. Also, it has become a trend for people to eat out or take their loved ones to eat out, especially during celebrations. The demand for ready-to-eat food has led to the influx of food handlers from neighbouring states and the Niger Republic who might not necessarily have the requisite knowledge and training for proper food handling. Therefore, this study was designed to assess the knowledge and practice of the WHO five keys to safer food among handlers in the foodservice establishments in Sokoto metropolis. The findings of this study may help public health

policymakers and environmental health program managers in the development and implementation of food hygiene and safety measures in line with the WHO five keys to safer food. In addition, it could be taken as a benchmark in other states in Northern Nigeria and throughout sub-Saharan Africa.

2. METHODS

2.1 Background on Study Area

Most of the restaurants in Sokoto state are concentrated within the metropolis, where this study was conducted. Sokoto metropolis consists of four LGAs: Sokoto north, Sokoto South, Kware and Wammako. Different categories of food handlers are found in the restaurants: cooks, dishwashers and servers.

All the restaurants sell common local foods such as rice, beans, massa, tuwo, gari, amala, and a few serve continental and oriental dishes. Most of the raw materials used in food preparation in restaurants are gotten from the main market (also called the meat and fish market). However, some also get their raw materials, especially those that buy in bulk, from the bush market (Kasuan daji).

2.2 Study Design and period

The study was a cross-sectional study from August to November 2019

2.3 Study Population

The study population comprised all commercial food handlers in Sokoto metropolis, including all men and women; those working full time or part-time as food handlers during the study period.

2.4 Inclusion criteria

Food handlers working in commercial food outlets and street food shops for at least six months of work experience were included.

2.5 Sample Size Determination and Sampling Technique

We used the formula for calculating the sample size for descriptive studies $n = Z\alpha^2 pq/d^2$ [11] using a level of confidence (z) of 1.96, prevalence (p) of good knowledge of food hygiene of 0.609 [12] from a previous study, and a precision level (d) of 0.05.

A multistage sampling technique was used to select the food handlers for the study. In stage one, a simple random sampling technique (balloting) was used to select two LGAs (Wamakko and Sokoto North LGAs) from the four metropolitan LGAs. In stage two, four wards were selected using simple random sampling (balloting) from 11 wards in each of the selected LGAs. Stage three, a census of all the available restaurants with their food handlers in each of the selected wards, was first done. Then, a proportionate allocation was used to determine the number of food handlers selected per ward. A simple random sampling using a table of random numbers was used to select the food handlers.

2.6 Data Collection Method

A pre-tested structured questionnaire was used to gather data from the study subjects. The instrument was adapted from various studies [10,13-18]. The questionnaire contains the following sections: Sociodemographic characteristics, Knowledge of Five keys to safer food and practice of WHO five keys to safer food. The research instruments were pre-tested on 37 purposively sampled food handlers (10% of sample size) in five randomly selected restaurants in one LGA (Dange Shuni) not selected for this study.

The Content Validity questionnaire was assessed by researchers in the department of Community Medicine UDUTH Sokoto. The reliability of the questionnaire was assessed by checking for Test-Retest (intra-observer) reliability: This was assessed by calculating the Intra-class Correlation Coefficient (ICC) of the questions. This was achieved by re-administering the questionnaire to the same respondents selected for pretesting of the instrument after two weeks.

Open Data Kit (ODK) was used to collect the data from the respondents. The questionnaire was translated into local language (Hausa) that all the respondents could understand. The questions were read to the respondents and the available responses were given to them. If a question was not understood by the respondent, it is repeated until they are comfortable to give a response. Once data collection is complete for each respondent, the data collector sends the completed form to the chief researcher's server where the data is aggregated. The aggregated data is downloaded from the server in SAV format to the computer for analysis. Skip logic

was used in developing the form on ODK, so all questionnaires were completely filled without any missing data.

2.7 Data Analysis

Data were analysed using IBM® SPSS version 25. Respondents knowledge of WHO five keys to safer food were scored and graded on a 24-point scale.. One point was awarded for a correct response, while a wrong response and don't know were scored 0. This gives a minimum score of 0 and a maximum score of 24 points. Those that score >15 of 24 points were considered to have 'Good knowledge' while those that score <=15 points were graded as "Poor Knowledge".

The food handlers' practices were assessed with self-reported responses with five possible responses: *always, most times, sometimes, rarely and never.*

Proportions were used as descriptive measures for categorical variables. Bivariate [crude Odds Ratio (cOR)] and binary logistic regression adjusted Odds Ratio (aOR) with corresponding

95% CI were used to assess the strength of association with different variables. The maximum margin for error in all analysis was set at 5% (i.e. Alpha); therefore, any statistical test with $p < 0.05$ was considered to be statistically significant.

3. RESULTS

Using the sample size formula above, we got a sample size of 366 respondents for this study. A total of 366 respondents completed the questionnaire, giving a response rate of 100%. We found the reliability of the questionnaire using the ICC to be between 0.732-0.955.

The median age of the respondents is 28 years (IQR 14). More than two-thirds, and 281 (76.8%) and 288 (78.7%) were females and less than 40 years, respectively. Almost three-quarters, 224 (61.2%) have a formal education and less than half, 163 (44.5%), were involved in cooking the food. One hundred and twenty-seven (34.7%) have greater than five years' experience (Table 1).

Table 1. Sociodemographic profiles of respondents

Variables	Number of respondents (n= 366)	Percentage
Age (Years)		
<40	288	78.7
≥40	78	21.3
Gender		
Female	281	76.8
Male	85	23.2
Marital status		
Unmarried	232	63.4
Married	134	36.6
Tribe		
Hausa/Fulani	142	38.8
others	224	61.2
Education		
Informal	142	38.8
Formal	224	61.2
Job description		
Cooking	163	44.5
Serving/Dishwashing	203	55.5
Years of experience with food handling		
<5yrs	239	65.3
≥5yrs	127	34.7
Food hygiene training		
No	222	60.7
Yes	144	39.3

Table 2. Knowledge of five keys to safer food handling

Variables	Number of respondents (n= 366)	Percentage
Key 1: Knowledge of cleanliness		
Knew it is important to wash hands before handling food	349	95.4
Knew it necessary to use soap for handwashing	331	90.4
Knew wiping cloths can spread microorganisms	287	78.4
Knew it was unhygienic to wear jewellery when cooking	252	68.9
Knew that it is unhygienic to cook in an unclean surrounding	244	66.7
Knew proper cleaning of utensils decrease the risk of food contamination	209	57.1
Knew was unhygienic to cook without an apron	201	54.9
Knew it was unhygienic to sneeze into hands	164	44.8
Knew it is unhygienic to keep nails uncut	146	39.9
Knew the reason for drying hands after washing was to prevent the spread of bacteria	38	10.4
Key 2: Knowledge of separation		
Knew that raw food should be stored separately from cooked food	215	58.7
Knew that raw meat should not be stored above other foodstuffs in the refrigerator	179	48.9
Knew that the same cutting board should not be used for raw and cooked foods	128	35
Key 3: Knowledge of thorough cooking		
Knew that cooked food should be kept very hot before serving	268	73.2
Knew that cooked foods need to be thoroughly reheated	135	36.9
Knew that food is cooked on the outside may not necessarily be cooked on the inside	79	21.6
Key 4: Knowledge of safe temperature		
Knew that improper storage of foods might be a hazard to health	248	67.8
Knew that it was not safe to cook when sick	239	65.3
Knew that refrigerating food only slows bacterial growth	186	50.8
Key 5: Use safe water and raw materials		
Knew that fruits and vegetables have to be always washed before consumption	299	81.7
Knew that using caps, masks, protective gloves, and adequate clothing reduces the risk of food contamination	243	66.4
Knew that food prepared in advance increases the risk of food contamination	119	32.5
Knew that only looks do not determine the safety of water	67	18.3
Knew that wounds should be covered with waterproof dressing when cooking	52	14.2
Overall knowledge		
Good	87	23.8
Poor	279	76.2

The majority of the respondents knew that it was important to wash hands before handling food, 349 (95.4%), and it was necessary to use soap for handwashing 331 (90.4%). Only 38 (10.4%) knew that the reason for drying hands after washing was to prevent the spread of bacteria. Slightly above half, 215 (58.7%) knew that raw

food should be stored separately from cooked food, while only about one-third, 128 (35%) knew that the same cutting board should not be used for raw and cooked foods (Table 2).

About three-quarters, 268 (73.2%) knew that it should be kept hot before serving, while only 79

(21.6%) knew that food cooked on the outside might not necessarily be cooked on the inside. Two hundred and forty-eight (67.8%) knew that improper storage of food might be a hazard to health, and about half, 186 (50.8%) knew that refrigerating food only slows bacterial growth (Table 2).

More than three-quarters, 299 (81.7%) knew that fruits and vegetables have to be washed always before consumption. Two hundred and forty-three (66.7%) knew that using caps, masks, protective gloves, and adequate clothing reduces the risk of food contamination, while only 52 (14.2%) knew that wounds should be covered with waterproof dressing when cooking. Overall, less than one-quarter, 87 (23.8) had good knowledge of the five keys to safer food handling (Table 2).

A higher proportion of those who were 40 years or older, 41 (52.6), had good compared to those less than 40 years, 46 (16.0%) and the difference in proportion was statistically significant, $p < 0.001$. Respondents with formal education, 63 (28.1%) had good knowledge compared to 24

(16.9%), $p = 0.014$. Respondents with five or more years of food handling experience, 41 (32.3%) had good knowledge compared to those with less than five years, 46 (19.2%), $p = 0.005$ (Table 3).

Regression analysis showed that those 40 years or greater were more likely to have good knowledge of Five keys to safe food handling (aOR: 10.05; 95% CI = 4.0 - 21.04). Those who had formal education were more likely to have good knowledge (aOR: 3.67; 95% CI = 1.92 - 7.01) (Table 4).

One hundred and thirty-two (36.1%) reported they wash hands before and during preparation most times. Two hundred and fifty-three (69.1%) reported that they never wash their hands after using the toilet. One hundred and forty-four (39.3%) reported that they cover their hair when cooking or handling food most times. Sixty-four respondents (17.5%) reported that they never separate raw and cooked food during storage. One hundred and fifty-one (41.3%) respondents reported that they reheat cooked food until it is piping hot before serving it (Table 5).

Table 3. Association between knowledge of five keys and sociodemographic variables

Variables	Knowledge		Chi-square	p-value	cOR (95% CI)
	Good	Poor			
Age group					
<40	46 (16.0)	242 (84.0)	45.354	< 0.001	0.17 (0.10 - 0.30)
≥40	41 (52.6)	37 (47.4)			
Gender					
Female	59 (21.0)	222 (79.0)	5.580	0.023	0.54 (0.32 - 0.92)
Male	28 (32.9)	57 (67.1)			
Marital					
Unmarried	52 (22.4)	180 (79.3)	0.644	0.422	0.817 (0.49 - 1.34)
Married	35 (26.1)	99 (73.9)			
Education					
Informal	24 (16.9)	118 (83.1)	6.042	0.014	0.52 (0.31 - 0.88)
Formal	63 (28.1)	161 (71.9)			
Job description					
Cooking	48 (29.4)	115 (70.6)	5.228	0.022	1.76 (1.08 - 2.85)
Serving/Dishwashing	39 (19.2)	164 (80.8)			
Food hygiene training					
No	47 (22.2)	175 (78.8)	2.104	0.147	0.70 (0.43 - 1.14)
Yes	40 (27.8)	104 (72.2)			
Years of experience with food handling					
<5yrs	46 (19.2)	193 (80.8)	7.778	0.005	0.50 (0.31 - 0.82)
≥5yrs	41 (32.3)	86 (67.7)			

cOR = crude Odds Ratio CI = Confidence Interval

Table 4. Predictors of knowledge of five keys to safer food handling among food handler in Sokoto metropolis

Variables	aOR	95% CI for aOR		p value
		Lower	Upper	
Age (≥40 vs <40)	10.05	4.80	21.04	<0.001
Gender (Male vs Female)	2.70	1.44	5.09	0.002
Education (Formal vs Informal)	3.67	1.92	7.01	<0.001
Job description (cooking vs serving/dishwashing)	1.56	0.87	2.80	0.136
Years of experience (≥ 5yrs vs <5yrs)	1.34	0.72	2.51	0.362

aOR = adjusted Odds Ratio CI = Confidence Interval

Table 5. Reported practices of five keys to safer food hygiene among food handlers in Sokoto metropolis

Variables	Always	Most times	Sometimes	Not often	Never
	n (%)	n (%)	n (%)	n (%)	n (%)
Key 1: Practice of cleanliness					
Wash hands before and during food preparation	59 (16.1)	132 (36.1)	78 (21.3)	34 (9.3)	63 (17.2)
Wash hands after using the toilet	2 (0.5)	4 (11)	39 (10.7)	68 (18.6)	253 (69.1)
Wash hands after touching unwrapped raw foods	46 (12.6)	125 (34.2)	108 (29.5)	47 (12.8)	40 (10.9)
Keeps fingernails short	49 (13.4)	132 (36.1)	78 (21.3)	54 (14.8)	53 (14.5)
Covers nose /mouth when sneezing	48 (13.1)	139 (38.0)	102 (27.9)	38 (10.4)	39 (10.7)
Wears apron when cooking	110 (30.1)	177 (48.4)	60 (16.4)	7 (1.9)	12 (3.3)
Cover hair when cooking or handling food	55 (15.0)	144 (39.3)	66 (18.0)	32 (8.7)	69 (18.9)
Key 2: Practice of food separation					
Clean surfaces and equipment used for food preparation before re-using on other food	59 (16.1)	120 (32.8)	77 (21.0)	38 (10.4)	72 (19.7)
Use separate utensils for raw and cooked foods	59 (16.1)	149 (40.7)	81 (22.1)	31 (8.5)	46 (12.6)
Separate raw and cooked food during storage	55 (15.0)	119 (32.5)	75 (20.5)	53 (14.5)	64 (17.5)
Key 3: Practice of thorough cooking					
Cook food thoroughly	41 (11.2)	116 (31.7)	96 (26.2)	46 (12.6)	67 (18.3)
Reheat cooked food until it is piping hot throughout	67 (18.3)	151 (41.3)	89 (24.3)	29 (7.9)	30 (8.2)
Key 4: Practice of safe temperature					
Thaws frozen food in the refrigerator or other cool place	98 (26.8)	125 (34.2)	66 (18.0)	39 (10.7)	38 (10.4)
Stores left-overs in a cool place for within two hours of cooking	80 (21.9)	142 (38.8)	89 (24.3)	36 (9.8)	19 (5.2)
Cook when sick	49 (13.4)	142 (38.8)	91 (24.9)	41 (11.2)	43 (11.7)

Variables	Always	Most times	Sometimes	Not often	Never
	n (%)	n (%)	n (%)	n (%)	n (%)
Key 5: Use safe water and raw materials					
Checks and throws away food beyond its expiry date	3 (0.8)	11 (3.0)	64 (17.5)	56 (15.3)	232 (63.4)
Wash fruit and vegetables with wholesome water	38 (10.4)	140 (38.3)	74 (20.2)	59 (16.1)	55 (15.0)

4. DISCUSSION

This study assessed the WHO's knowledge of five keys to safer food handling among food handlers in Sokoto metropolis. Almost all the respondents knew that it was important to wash hands before handling food and the importance of using soap. This finding is encouraging because maintaining hand hygiene is an essential step in preventing contamination of food [10]. The finding in this study is similar to what was reported in a study in India, where all the study subjects knew the importance of washing hands with soap and water before handling food [15].

Less than half of the respondents knew it was unhygienic to sneeze into the hands. This finding is worrisome as food handlers who do not know this will easily contaminate food with the potential to causing foodborne disease outbreak. Similarly, only a few of the respondents knew it was unhygienic to keep nails long. This is a source of worry as microorganisms that cause foodborne diseases can be harboured under the nails and transported to food [19]. Almost three-quarters of the respondents knew that food should be kept very hot before serving. This is encouraging because the food handlers knowing that keeping food very hot will prevent the growth of organisms or the production of toxins that can lead to foodborne disease.

A worrisome finding in this study is that less than one-quarter of the respondents knew that food cooked on the outside is not necessarily cooked on the inside. This can be present a public health problem, especially among those that dispense animal food products that, if not properly cooked, can transmit various forms of foodborne diseases.

Another worrisome finding is that less than one-fifth of the respondents did not know that only the looks of water do not determine the safety of the water. The implication is that the food handlers could be using contaminated water for

commercial food production that can lead to foodborne disease outbreak. This is even more troubling as Sokoto is a state known for the frequent cholera outbreak.

Another disturbing finding is that less than one-fifth of the respondents did not know that only looks o water does not determine the safety of the water. The implication is that the food handlers could be using contaminated water for commercial food production that can lead to foodborne disease outbreak. This is even more troubling as Sokoto is a state known for the frequent cholera outbreak [20].

Overall, less than one-quarter of the respondents had good knowledge. This finding is not surprising as less than 40% of the respondents have never had any form of food hygiene training. This finding indicates that generally, the knowledge of the various areas of the five keys to safer food is lacking. This is a public health concern as a significant portion of the community is served by commercial food handlers. The finding in this study is similar to what was reported in other studies in the southern part of Nigeria [13,16], Ethiopia [21] and Thailand [18]. However, a contrary finding was reported in Northcentral Nigeria [12], Ethiopia [22] and Malaysia [14] where a high proportion of the respondents had good knowledge of food hygiene.

This study showed that those with formal education were more likely to have good knowledge of food hygiene. This finding was not surprising as basic personal hygiene is one of the basics that is taught in the formal education arena. Different factors have been found to predict knowledge in different studies. For example, Anuradha found in their research in India that only educational status was associated with knowledge [6]. In another study, although education was associated with knowledge, those with no formal education had better knowledge than those who had primary education [23].

Almost all the respondents knew that it was important to wash hands before handling food; however, only about 16 % reported they always washed their hands before and during food preparation. This is not surprising as it has been shown that food handlers do not always put knowledge into practice [24]. Studies in Nigeria, Ethiopia and Thailand have also found that knowledge was associated with good food hygiene practice [12,18,25]. The finding in this study is worrisome as food handlers' poor personal hygiene is an essential contributor to FBD outbreaks [26].

Similarly, more than half of the respondents knew that raw food should be sorted separately from cooked food; however, only 15% percent of the respondents always separate raw and cooked food during storage. This is a source of concern as contact of uncooked food such as raw meat with ready-to-consume food like salad can be a source of foodborne disease. The majority of the respondents knew that fruits and vegetables should always be washed before consumption; however, only about 10% of them wash their fruits and vegetables. The findings indicate that there is a disconnect between the knowledge of the respondents and their practices. Several reasons could be responsible for this. For example, in the study area, there is hardly any pipe born water supply; therefore, it will be difficult for food handlers to always wash their hands.

5. LIMITATIONS AND OPPORTUNITIES FOR FUTURE RESEARCHES

The findings from this study are prone to social desirability bias because the information used was self-reported. Future studies could employ mixed methods of both qualitative and quantitative methods, which may produce more comprehensive findings that would validate our results. Future studies may also segregate food handlers that cook and those that wash or serve food in order to guide the development of targeted interventions.

6. CONCLUSION AND RECOMMENDATION

We found that there was poor knowledge of the five keys to safer food. We also found that most of the practices were below the required for food safety. We found that age, gender and educational status were significant predictors of knowledge. Based on our findings, we

recommend that Sokoto state ministry of health collaborate with the ministry of environment and non-governmental organizations to coordinate training interventions, incorporating the WHO five keys to safer food for the food handlers. Special attention should be given to food handlers older than 40 years and those without formal education.

CONSENT AND ETHICAL APPROVAL

Ethical approval with reference number SKHREC/050/017) was obtained from the research ethics committee of the Sokoto state ministry of health. We obtained the ethical approval for this study from the Sokoto State research ethics committee. Permission was received from the administration of the LGAs and district heads of the community. Permission was also received from restaurant owners. Written informed consent was obtained from the study participants before the commencement of data collection. We maintained confidentiality by excluding the names of respondents.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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