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Knowledge and Practices Related to Food Hygiene among Food Handlers in Sokoto, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors AZE and KJA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MOO, MAM, BGA and IAR managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Unsafe food poses global health threats, endangering everyone Vended foods are considered to be a public health hazard because the food handlers are often poor, have poor schooling and lack appreciation for food hygiene practices (particularly in developing countries). However, the restaurants have a large clientele base ranging from the rich to the poor who are exposed to these hazards and thus any outbreak of food borne illnesses could be disastrous. This study aimed to determine the knowledge and practice related to food hygiene among food handlers in Sokoto, Nigeria.
Methods: A cross-sectional study was conducted among 263 food handlers selected by a multistage sampling technique. Data were collected with a set of pre-tested interviewer-administered, semi-structured questionnaire, and observer's checklist. Data were analyzed using IBM SPSS version 20 statistical package.
Results: The mean age of the respondents was 27.14 ± 8.84.years. Most of the respondents were females (82.9%), and a majority of respondents were single (52.5%), and had at least primary

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education (51.3%). Most, 198 (75.3%) of the 263 respondents had good knowledge of food hygiene, and close to two-thirds 152 (57.8%) had good knowledge of food borne illness. Although a majority of respondents consistently observe food hygiene practices such as covering their nose and mouth while sneezing (86.3%) and cooking food thoroughly (66.5%), compliance with the other food hygiene practices was poor (ranged from 1.1 to 35.4%). The sanitary condition in a substantial proportion of the restaurants was also poor.

Conclusion: Despite good knowledge of food hygiene and food borne illnesses among the respondents in this study, they showed poor compliance with food hygiene practices; and the sanitary condition of a substantial proportion of the restaurants was poor. Promotion of good sanitary practices among food handlers and regulation of their practices by the government agencies concerned to ensure compliance with basic sanitary standards were suggested.

Keywords: Knowledge; practices; food hygiene; food handlers; Nigeria.

1. INTRODUCTION

Food safety is growing in importance as a public health concern for health practitioners and the general public [1]. Vended foods are considered to be a public health hazard because the food handlers are often poor, have poor schooling and lack appreciation for food hygiene practices. The restaurants have a large clientele base ranging from the rich to the poor who are exposed to these hazards and thus any outbreak of food borne illnesses could be disastrous. According to the World Health Organization (WHO), food borne illnesses are prevalent in both developing and developed countries [2]; and climate change is also predicted to impact food safety, where temperature changes modify food safety risks associated with food production, storage and distribution [3]. However, the problem is exacerbated in developing countries due to economic reasons, lack of adequate healthcare, poverty and scarcity of data regarding food borne diseases [4].

Unsafe food poses global health threats, endangering everyone. Infants, young children, pregnant women, the elderly and those with an underlying illness are particularly vulnerable [5]. WHO estimates indicated that 2.1 million deaths from diarrhea worldwide were mainly caused by contaminated food and/or water. It also estimated that, annually up to one-third of the population, even in the developed countries, suffer from food borne diseases [6].

Serious food borne disease outbreaks have occurred on every continent in the past decade, often amplified by globalized trade [3]. The World Health Organization estimated that in the developed countries, up to 30% of the population suffer from food borne diseases each year, and in the developing countries up to 2 million deaths per year are recorded [2,7]. Food borne diseases place an enormous burden on the economy, and impede socioeconomic development by straining health care systems, and harming national economies, tourism and trade [3]. Consumer costs include medical, legal and other expenses as well as absenteeism from work and school. For many consumers who live at the subsistence level, the loss of income due to food borne illness can perpetuate the cycle of poverty [8].

The incidence of food-borne diseases has been on the increase; it is often associated with outbreaks, threatens global public health security and raises international concern. This is believed to be related to the prevalent poor knowledge of food hygiene and unhygienic food preparation and mishandling in homes, food service establishments or markets across the globe. A study by Frosythe et al in UK on food handlers' hygiene knowledge in small food businesses reported lack of basic hygiene knowledge and understanding; the study submitted that this could prove to be a major barrier to the effective implementation of hazard analysis critical control point in small food businesses [9].

In Malaysia, a study among food handlers reported that while the respondents' knowledge on personal hygiene and food borne diseases was good, their knowledge on food storage and preparation temperatures was poor [10]. Similarly, in another study in Jordan, while the respondents showed excellent knowledge of food borne diseases, food storage temperatures and sources of food contamination, they lacked knowledge of proper method of thawing frozen food [11].

A study conducted among food handlers in Turkey reported lack of basic knowledge of food hygiene [12], and another study in Portugal

showed that many food handlers did not seem to be aware of basic safety and health requirements to work with. Only 40.5% of food handlers identified skin disease, gastrointestinal disturbances, and eye/ear and throat disease, as conditions that are not acceptable in food handling [13].

In a study carried out in India to assess the food hygiene practices of street food vendors and determine the critical control points for safe street food in Allahabad city, found that 73.3% of the vendors continue food preparation during illness episodes, and only 30% washed their hands after using the toilets and handling garbage [14].

Studies conducted among food handlers across Nigeria reported poor knowledge of food hygiene and high prevalence of unhygienic practices. A study among food handlers in Lagos, Nigeria [15], found that more than a third (36%) of the food handlers were not aware that food contaminated by germs can cause serious damage to health, 38.3% did not know that they should wash their hands after using the toilet, while 25% did not know that they should wash their hands after handling money. A study done in Ilorin, Nigeria, to assess food hygiene practices among food vendors in secondary schools found high prevalence of unhygienic practices including poor care of utensils (54%), use of previously used water for washing and cleaning, lack of covering apron (69%), unkempt fingernails, open skin lesions (19%) and lack of protection of food from flies [16]. A study conducted in Kaduna, Nigeria, to survey the hygiene and sanitary practices of street food vendors, reported that the study subjects lacked training on hygiene and only 2.7% of them had received formal training on hygienic preparation of food, while 60% of them cooked in unclean environment with flies all over the place [17].

Since food handlers in restaurants cater for a large number of people, they are epidemiologically more important than domestic food handlers in the transmission food borne diseases. Eating outside the home is becoming a common practice in Sokoto metropolis as commercial activities are on the increase, thus creating a greater potential for the spread of food borne diseases. Information regarding food handlers' knowledge and practice is key to addressing the increasing trend of food borne illnesses [2]. There is a dearth of literature on the knowledge, perception and practices related to food hygiene among food handlers in Sokoto, Nigeria. This study was conducted with the view that the findings would provide evidence based information that is useful for strategic interventions and policy formulation. This invariably, will facilitate best practices in food hygiene, prevent outbreaks and reduce the burden of food borne diseases in Sokoto, Nigeria; and in populations with similar characteristics across the world.

2. MATERIALS AND METHODS

2.1 Study Design, Area and Population

This was a cross-sectional study among food handlers working in restaurants in Sokoto metropolis, the capital of Sokoto State, in North-western Nigeria, between June and August 2015. Sokoto State has twenty-three Local Government Areas (four of which are within the metropolis) with a land mass of 25,972km^2, and an estimated population of 4,802,298 projected for 2015 [18]. Farmers form the greater percentage of the population, and they majorly reside in the rural areas, while the rest are civil servants, traders, artisans and people of other occupations like tanning and dyeing (and these are mainly concentrated in the metropolis, being the center of commercial activities in the State). There has been an upsurge in the number of restaurants in Sokoto metropolis concomitantly with the upsurge in commercial activities in the metropolis in recent years. Food handlers who have worked in the selected restaurants for at least 1 month and consented to participate in the study were considered eligible for this study. Restaurant staff solely involved in administrative activities and mobile food handlers without permanent structures were excluded.

2.2 Ethical Consideration

Institutional ethical clearance was obtained from the Ethical Committee of Sokoto State Ministry of Health, Sokoto, Nigeria. Permission to administer copies of the questionnaires was obtained from the Management of the respective restaurants selected for the study. Informed consent was also obtained from the participants before questionnaire administration.

2.3 Sample Size Estimation and Sampling Technique

The sample size was estimated at 263 using the Fisher's formula for calculating sample size for

cross-sectional descriptive studies [19], a 20.5% prevalence of food hygiene practice from a previous study [20], a precision level of 5% and an anticipated participant response rate of 95%.

The eligible participants were selected by a multistage sampling technique. At the first stage, 2 of 4 Local Government Areas (LGAs) were selected by simple random sampling using the ballot option. At the second stage, 2 political wards were selected in each of the selected LGAs by simple random sampling using the ballot option. At the third stage, selection of restaurants was done in the selected wards. The restaurants were stratified into registered and unregistered. A list of the registered restaurants was obtained from the Ministry of Commerce and Tourism, Sokoto State, Nigeria, and line listing of the unregistered restaurants was done. A census of the food handlers working in the respective restaurants was also conducted to provide a guide for selection of study centers and the appropriate sampling technique to be used. Seven of 11 registered restaurants and 14 of 24 unregistered restaurants were selected by simple random sampling using computed generated random numbers. At the fourth stage, all the food handlers that met the inclusion criteria in the selected restaurants were enrolled in the study.

2.4 Data Collection

A standardized, semi-structured, interviewer-administered questionnaire was developed and used to obtain information on participants' socio-demographic characteristics, knowledge of food hygiene and food borne illnesses, perception and practice on food hygiene (Appendix 1). The questions in the questionnaire were adapted from the instrument used in previous surveys and WHO guideline on food safety [21,22]. It was reviewed by researchers in the Department of Community Health, Usmanu Danfodiyo University, Sokoto, Nigeria. Corrections were made based on their inputs on content validity. The questionnaire was pretested on 20 food handlers working in restaurants in one of the two LGAs that were not selected for the study. Some questions were rephrased for clarity after the pre-testing. An observer checklist was used to assess the food hygiene practices of the participants and the sanitary condition of the restaurants. Eight resident doctors assisted in questionnaire administration after being trained on the conduct of survey research, the objectives of the study and administration of survey instrument.

2.5 Data Analysis

Data were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) Version 20 statistical computer software package. Respondents' knowledge of food hygiene was scored and graded on a 17-point scale. One point was awarded for a correct response, while a wrong response or a non-response received no points. This gives a minimum score of '0' and a maximum score of '17' points. Those that scored $\geq$ 10 of 17 points were considered as having 'good' knowledge, while those that scored < 10 of 17 points were graded as having 'poor' knowledge. Knowledge of food borne illnesses was scored and graded on a 12-point scale. One point was awarded for a correct response, while a wrong response or a non-response received no points. This gives a minimum score of '0' and a maximum score of '12' points. Those that scored $\geq$ 7 of 12 points were considered as having 'good' knowledge, while those that scored < 7 of 12 points were graded as having 'poor' knowledge. Frequency distribution tables were constructed; and cross tabulations were done to examine the relationship between categorical variables. The chi-square test was used to compare differences between proportions. All levels of significance were set at $p < 0.05$.

3. RESULTS

3.1 Socio-demographic Characteristics of Respondents

The ages of the 263 respondents ranged from 15 to 52 years (mean = 27.14 $\pm$ 8.84), and a larger proportion (43.3%) were aged less than 25 years. There was a preponderance of females (82.9%), and a majority of the respondents (52.5%) were single. The most predominant religion was Islam (79.1%), a majority of the respondents had formal education (51.3%), have worked for less than 5 years (68.1%), and a larger proportion were involved in serving food (45.6%) as shown in Table 1.

3.2 Respondents' Knowledge of Food Hygiene

A majority, 198 (75.3%) of the 263 respondents had good knowledge of food hygiene. Almost all the respondents knew that hand washing before cooking (99.6%), after using the toilet (98.9%), and use of soap for hand washing, were food hygiene practices. Majority of the respondents

also correctly responded that leaving hair uncovered while cooking (84.0%), keeping fingernails uncut (83.7%), sneezing into hands (76.8%), cooking without wearing apron (58.9%), and wearing jewelleries while cooking (71.9%), were not hygienic. Close to half (44.5%) of the respondents knew that food could get contaminated during preparation. Majority of respondents also knew that raw and cooked foods should be separated (85.9%), one should not cook when sick (87.8%), and wounds should be covered with waterproof dressing (80.2%) as shown in Table 2. There was no significant association ($p > 0.05$) between good knowledge of food hygiene and any of the socio-demographic variables of respondents (Table 3).

3.3 Respondents' Knowledge of Food Borne Illness

More than half 152 (57.8%) of the 263 respondents had good knowledge of food borne illness. A small proportion of respondents (14.8%) associated food borne illness with dirty plates. However, more than half (54.8%) associated it with contaminated food, and 35% knew the food vendor as a likely source of infection. Although a large proportion of respondents (65%) knew that food borne illness can cause serious illness, only 27.8% were aware that it could be serious enough to cause death. About one-third (36.9%) of the respondents knew that fever is a clinical feature of food borne illness and about two-thirds knew that diarrhea (65.8%) and vomiting (63.9%) are also clinical features. While majority of the respondents (73%) knew cholera as a type of food borne disease, only about a quarter (27.8%) knew Ebola Virus Disease as a type of food borne disease, and less than a fifth of respondents (19.7%) knew typhoid fever as a type of food borne disease (Table 4). A significantly higher proportion of respondents with formal education (71.9%) had good knowledge of food borne illness as compared to those with no formal education (43.0%), $\chi^2 = 22.471$, $p < 0.001$ (Table 5).

Table 1. Socio-demographic characteristics of respondents

Variables	Frequency (%) n = 263
Age group (in years)	
Below 25	114 (43.3)
25 -34	99 (37.6)
35 -44	33 (12.5)
45 - 54	15 (5.7)
55 and above	2 (0.8)
Sex	
Male	45 (17.1)
Female	218 (82.9)
Marital status	
Single	138 (52.5)
Married	96 (36.5)
Separated	16 (6.1)
Divorced	9 (3.4)
Widowed	4 (1.5)
Religion	
Islam	208 (79.1)
Christianity	55 (20.9)
Education	
Informal (none and quranic school only)	128 (48.7)
Formal (primary, secondary and tertiary)	135 (51.3)
Working experience (in years)	
Below 5 years	179 (68.1)
5 years and above	84 (31.9)
Job description	
Cooking	91 (34.6)
Serving	120 (45.6)
Dish washing	52 (19.8)

Table 2. Respondents' knowledge of food hygiene

Components of food hygiene	Correct response Frequency (%) n = 263
Hand washing before cooking	262 (99.6)
Hand washing after using toilet	259 (98.9)
Use of soap for hand washing	252 (95.8)
Leave hair uncovered while cooking	221 (84.0)
Keep finger nails uncut	220 (83.7)
Sneeze into hands	202 (76.8)
Cook without wearing apron	155 (58.9)
Wear jewelries while cooking	189 (71.9)
Contamination of food during preparation	117 (44.5)
Separation of raw and cooked foods	226 (85.9)
Cook when sick	231 (87.8)
Cover wounds and sores with waterproof dressing	211 (80.2)
Wash utensils before and after cooking	222 (84.4)
Cook in clean surrounding	204 (77.6)
Clean cooking surfaces as you work	194 (73.8)
Cook food thoroughly	232 (88.2)
Reheat food if it has been kept for greater than 4 hours	172 (65.4)
Knowledge grade	**Frequency (%)**
Good	198 (75.3)
Poor	65 (24.7)

Table 3. Distribution of knowledge of food hygiene by respondents' socio-demographic variables

Variables	Knowledge of food hygiene (n = 263)		Test of significance
	Good frequency (%)	Poor frequency (%)	
Age group (in years)			
< 40	171 (74.0)	60 (26.0)	$\chi^2 = 1.618$,
≥ 40	27 (84.4)	5 (15.6)	p = 0.203
Sex			
Male	32 (71.1)	13 (28.9)	$\chi^2 = 0.508$,
Female	166 (76.0)	52 (29.3)	p = 0.476
Education			
Informal	97 (75.8)	31 (24.2)	$\chi^2 = 0.033$,
Formal	101 (74.8)	34 (25.2)	p = 0.856
Working experience (in years)			
< 5	133 (74.3)	46 (25.7)	$\chi^2 = 0.291$,
≥ 5	65 (77.4)	19 (22.6)	p < 0.589

3.4 Respondents' Self-reported Food Hygiene Practices

Most of the respondents reported observing the various food hygiene practices very often, these include covering their hair while cooking 217 (82.5%), separating raw and cooked food 217 (82.5%), washing utensils before and after cooking 236 (89.7%), and cooking in clean surroundings 232 (88.2%). While majority of respondents reported consistently observing food hygiene practices such as covering their nose and mouth while sneezing 227 (86.3%), and cleaning cooking surfaces as they work 175 (66.5%), only a few respondents reported consistently observing the other food hygiene practices including washing their hands before cooking 10 (3.8%), and after using the toilet 3 (1.1%) as shown in Table 6.

3.5 Food Hygiene Practices of Restaurants' Staff

All the staff were observed to wash their hands before cooking in less than half 9 (42.9%) of the 21 restaurants surveyed. While all the staff were observed to perform hand washing after using the toilet in a majority 12 (54.5%) of the

restaurants, it was observed that none of the staff performed hand washing after using the toilet in 3 (13.6%) of the 21 restaurants surveyed. Other food hygiene practices observed among the staff of the restaurants surveyed are as shown in Table 7.

3.6 Sanitary Condition of Restaurants

Although in most of the 21 restaurants surveyed there were adequate lighting 16 (76.2%) and ventilation 17 (81.0%), only about two-thirds of restaurants had good water supply (61.9%) and functioning deep freezer (66.7%), and a little above half of the restaurants had clean food vending site (57.1%) and sanitary toilet facilities (57.1%). Less than half of the restaurants (47.6%) had clean kitchen, and in a larger proportion of the restaurants, foods were exposed to flies (57.1%), staff work with food at ground level (66.1%) and there were rodents (52.4%) as shown in Table 8.

Table 4. Respondents' knowledge of food borne illness

Variables	Correct response Frequency (%) n = 263
Association of food borne illness with dirty water	39 (14.8)
Association of food borne illness with contaminated food	144 (54.8)
Association of dirty plates and utensils with food borne illness	176 (66.9)
Food vendor as a source of infection	92 (35.0)
Food borne illness as a cause of serious illness	171 (65.0)
Food borne illness as a cause of death	73 (27.8)
Clinical features of food borne illness	
Fever	97 (36.9)
Diarrhea	173 (65.8)
Vomiting	168 (63.9)
Types of food borne illness	
Typhoid fever	51 (19.4)
Ebola	73 (27.8)
Cholera	192 (73.0)
Knowledge grade	**Frequency (%)**
Good	152 (57.8)
Poor	111 (42.2)

Table 5. Distribution of knowledge of food borne illness by respondents' socio-demographic variables

Variables	Knowledge of food borne illness (n = 263)		Test of Significance
	Good frequency (%)	Poor frequency (%)	
Age group (in years)			
< 40	131 (56.7)	100 (43.3)	$\chi^2 = 0.916$,
≥ 40	21 (65.6)	11 (34.4)	p = 0.339
Sex			
Male	24 (53.3)	21 (46.7)	$\chi^2 = 0.443$,
Female	128 (58.7)	90 (41.3)	p = 0.506
Education			
Informal	55 (43.0)	73 (57.0)	$\chi^2 = 22.471$,
Formal	97 (71.9)*	38 (28.1)	p < 0.001
Working experience (in years)			
< 5	102 (57.0)	77 (43.0)	$\chi^2 = 5.105$,
≥ 5	50 (59.5)	34 (40.5)	p < 0.697

**Statistically significant*

Table 6. Respondents' self-reported practices on food hygiene

Self-reported practices on food hygiene	How often			
	Never No (%)	Occasionally No (%)	Very often No (%)	Always No (%)
Hand washing before cooking	2 (0.8)	246 (93.5)	5 (1.9)	10 (3.8)
Hand washing after using the toilet	0 (0)	258 (98.1)	2 (0.8)	3 (1.1)
Use soap for hand washing	0 (0)	228 (86.7)	16 (6.1)	19 (7.2)
Keep fingernails uncut	0 (0)	213 (81)	19 (7.2)	3 (11.8)
Cover nose/ mouth when sneezing	2 (0.8)	18 (6.8)	16 (6.1)	227(86.3)
Wear apron while cooking	92 (35.0)	57 (21.7)	25 (9.5)	89 (33.8)
Cover hair while cooking	19 (7.2)	16 (6.1)	217 (82.5)	11 (4.2)
Wear jwelleries when cooking	13 (51.0)	60 (22.8)	36 (13.7)	33(12.5)
Separate raw and cooked food	12 (4.6)	20 (7.6)	217 (82.5)	14 (5.3)
Cook food when sick	20 (7.6)	207 (78.7)	8 (3.0)	28 (10.6)
Cover wound and sores with waterproof dressing	11(4.2)	219 (83.3)	18 (6.8)	15 (5.7)
Wash the utensils before and after cooking	1 (0.4)	19 (7.2)	236 (89.7)	7 (2.7)
Keep your cooking surroundings clean	10 (3.8)	1 (0.4)	232 (88.2)	20 (7.6)
Clean cooking surfaces as you work	9 (3.4)	39 (14.8)	40 (15.2)	175 (66,5)
Cook food thoroughly	3 (1.1)	40 (15.2)	207 (78.7)	13 (4.9)
Reheat food if it has been cooked and kept for longer than 4 hours	17 (6.5)	113 (43.0)	40 (15.2)	93 (35.4)

Table 7. Food hygiene practices of restaurants' staff

Observed food hygiene practices	Proportion of staff involved				
	All No (%)	Most No (%)	Average No (%)	Few No (%)	None No (%)
Use of head cover at work	7 (36.4)	4 (18.2)	2 (9.1)	4 (18.2)	4 (18.2)
Use of apron or overall when cooking	3 (18.6)	2 (9.1)	3 (13.6)	8 (40.9)	5 (22.7)
Hand washing before cooking	9 (42.9)	7 (33.3)	3 (14.3)	1 (4.8)	1 (4.8)
Hand washing after using the toilet	12 (54.5)	1 (4.5)	4 (18.2)	1 (4.5)	3 (13.6)
Washing of utensils before and after cooking	11 (50.0)	3 (13.6)	3 (13.6)	3 (13.6)	1 (4.5)
Recycle water used for hand washing	8 (40.9)	5 (22.7)	0 (0)	1 (4.5)	7 (31.8)
Recycle water used for washing utensils	12 (54.5)	3 (13.6)	1 (4.5)	1 (4.5)	5 (22.7)
Washing of food items	12 (54.5)	7 (31.8)	2 (9.1)	1 (4.5)	0 (0)
Skin lesions covered with waterproof dressing when cooking	11 (50.0)	2 (9.1)	0 (0)	3 (13.6)	6 (27.3)
Preparation of food far ahead of service	10 (45.5)	1 (4.5)	1 (4.5)	1 (4.5)	9 (40.9)

Table 8. Sanitary condition of restaurants

Variables	Available (observed)	
	Yes frequency (%)	No frequency (%)
Presence of rodents	11 (52.4)	10 (47.6)
Clean food vending site	12(57.1)	9 (42.9)
Clean kitchen surface area	10 (47.6)	11(52.4)
Staff work with food at ground level	14 (66.7)	7 (33.3)
Availability of good water supply	13 (61.9)	8 (38.1)
Availability of sanitary toilet facilities	12 (57.1)	9 (42.9)
Adequate lightening	16 (76.2)	5 (23.8)
Adequate ventilation	17 (81.0)	4 (19.0)
Closeness of garbage to vending site	10 (47.6)	11 (52.4)
Availability of functional deep freezer	14 (66.7)	7 (33.3)
Food exposed to flies	12 (57.1)	9 (42.9)

4. DISCUSSION

The majority of the food handlers in this study were youths in the 15 – 24 years (43.3%) and 25 – 34 years (37.6%) age groups, with a mean age of 27.14 ± 8.84 years. This is similar to a study in Ghana, where half of the respondents were between the ages of 25 and 35 years [23]. This contrasts with studies done in Ilorin [16], where most of the food handlers were older, and within the 30 – 39 years (38.4%) and 40 – 49 years (27%) age groups; and in Brazil [24], where the mean age was 50 years. This could be due to the fact that most of the food handlers in this study were migrant workers, whereas in the other studies, the food handlers were in their native communities.

The preponderance of women in this study with a male to female ratio of 1:5 could be related to the dominant position of women in the food industry, especially in developing countries [25]. This is similar to the finding in a study in Kaduna, Nigeria, where the food handlers were predominantly females with a male to female ratio of 1:4 [17]. However, in Ghana, all the respondents were females [23]. Most of the food handlers had no formal education at all (23.2%), this finding is similar to that obtained in studies in Ghana (26%), and Ilorin (56.9%), where most of the respondents had no formal education [16,26].

About two-thirds of the food handlers (68.1%) had less than 5 years working experience. This is also a reflection of the fact that most of the migrant food handlers were engaged as casual workers in the food establishments and can exit the job at any time whenever a more profitable job is available. This finding contrasts with that of a study in Brazil where the average working experience was about 15 years [24].

In this study, almost all the respondents (98.9%) knew that they should wash their hands after using the toilet. This sharply contrasts with a study done in Lagos, Nigeria, where 38.3% did not know that they should wash their hands after using the toilet [15]. A study in Portugal also showed that many food handlers were unaware of basic safety and health requirements to work with [13].

The knowledge of cross-contamination of food items by most of the respondents in this study (85.6%), contrasts with the finding in a study in Owerri, Nigeria, where only about two-thirds of the respondents (63%) understood the dangers of cross-contamination [27]. In this study, 87.8% of the respondents knew that allowing a sick person to cook is hazardous, but in the Owerri study, 49% of respondents indicated that allowing a sick person to prepare or serve food could not cause people to get food borne illness [27]. In this study, 19.4% of respondents knew typhoid fever and 74% knew cholera as food borne diseases; this is in consonance with the finding in a study in Ghana where knowledge of severe food-borne diseases such as typhoid and cholera and their ways of transmission were also mentioned by all vendors [28].

Only 35% of respondents knew that the food handler can be a source of infection, this is in concordance with the finding in a study in Portugal where a majority of respondents (86.1%) did not know that the food handler can be a source of infection [13]. This contrasts sharply with a study in United Kingdom (UK) where 82.5% of respondents responded that the food handler can be a source of infection [9].

In this study, there was no association between good knowledge of food hygiene and any of the socio-demographic variables ($p > 0.05$). Similar to the findings in this study, a study in Davao's city, found no association between education and knowledge of food hygiene [29].

A large proportion of respondents in this study very often engaged in appropriate food hygiene practices such as covering of hair while cooking (82.5%), and washing utensils before and after cooking (89.7%). This compares well with the findings in studies conducted in Owerri, Nigeria, where 70% of respondents very often engage in appropriate food hygiene practices such as hand washing before cooking [27], and Malaysia where 75.4% of respondents wash their hands after using the toilet [20].

Despite the good knowledge of food hygiene by most of the respondents in this study, only a few consistently observed the various food hygiene practices. Thus knowledge does not necessarily translate into safe practices as seen in studies conducted in Ghana [28], and Malaysia [20], where despite excellent knowledge of food hygiene there was poor practice of food hygiene. Rheinlander et al. [28] also concluded that the wider social, cultural and everyday context seemed to have a greater influence on handling of food risks and hygiene than just knowledge of food safety. The poor compliance with food hygiene practices among the respondents in this

study could be related to the poor sanitary conditions (particularly non-availability of running water and toilet facilities) in a substantial proportion of the restaurants. These findings underscore the need for promotion of good sanitary practices among food handlers, and regulation of their practices by the relevant government agencies concerned to ensure compliance with basic sanitary standards.

5. CONCLUSION

Despite good knowledge of food hygiene and food borne illnesses among the respondents in this study, they showed poor compliance with food hygiene practices; and the sanitary condition of a substantial proportion of the restaurants was poor. Promotion of good sanitary practices among food handlers and regulation of their practices by the government agencies concerned to ensure compliance with basic sanitary standards are hereby suggested.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX 1

Questionnaire on knowledge, perception and practices related to food hygiene among food vendors in Sokoto Metropolis, North-Western Nigeria

SECTION A: SOCIODEMOGRAPHIC CHARACTERISTICS

1. Age: (as at last birthday): _____(in years)
2. Sex: a) Male □ b) Female □
3. Marital Status: a) Single □ b) Married □ c) Separated □ d) Divorced □ e) Widowed
4. Tribe: a) Hausa □ b) Ibo □ c) Yoruba □ d) Fulani □ e) Others_____(please specify)
5. Religion: a) Christianity □ b) Islam □ c) Traditional □ d) Others _____(please specify)
6. Educational Level: a) None □ b) Quranic only □ c) Primary □ d) Secondary □ e) Tertiary □
7. Working experience (in years): _____(please specify)
8. Job description: a) Cooking □ b) Serving □ c) Dish washing □

SECTION B: KNOWLEDGE OF FOOD HYGIENE

9. Is it necessary to wash your hands before cooking? a) Yes □ b) No □ c) I don't know□
10. Is it necessary to wash your hands after using the toilet?
    a) Yes□ b) No□ c) I don't know□

11. Is it necessary to use soap for hand washing? a) Yes□ b) No□ c) I don't know □
12. Is it hygienic to leave your hair uncovered while cooking?
    a) Yes □ b) No□ c) I don't know□
13. Is it hygienic to keep your fingernails uncut? a) Yes□ b) No□ c) I don't know □
14. Is it hygienic to sneeze into your hands? a) Yes□ b) No □c) I don't know □
15. Is it hygienic to cook without wearing an apron?
    a) Yes□ b) No□ c) I don't know□
16. Is it hygienic to wear jewelries when cooking? a) Yes □ b) No □ c) I don't Know□
17. Can food get contaminated during preparation? a) Yes □ b) No□ c) I don't know □
18. Should raw and cooked foods be separated? a) Yes□ b) No□ c) I don't know□
19. Is it safe to cook when you are sick? a) Yes□ b) No□ c) I don't know□
20. Should wounds and sores be covered with waterproof dressing when cooking?
    a) Yes□ b) No□ c) I don't Know□
21. Is it necessary to wash the utensils before and after cooking?
    a) Yes□ b) No□ c) I don't know □
22. Is it hygienic to cook in an unclean surrounding? a) Yes□ b) No□ c)I don't know□
23. Is it necessary to clean cooking surfaces as you work?
    a)Yes□ b) No□ c)I don't know □
24. Is it necessary to cook food thoroughly? a) Yes□ b) No□ c) I don't know□
25. Is it necessary to reheat food if it has been cooked and kept for more than 4 hours?
    a) Yes□ b) No□ c) I don't know □

SECTION C: KNOWLEDGE OF FOOD BORNE ILLNESSES

26. Do you believe that food borne illnesses are not associated with dirty water?
    a) Yes□ b) No□ c) I don't know□
27. Is food borne illness associated with contaminated food?
    a)Yes□ b) No□ c) I don't know□
28. Is food borne illness associated with dirty plates and utensils?
    a)Yes□ b)No□ c) I don't know□
29. Can the food vendor be a source of infection? a) Yes□ b) No□ c) I don't know□
30. Does food borne illness cause serious illness? a) Yes□ b) No□ c) I don't Know□
31. Does food borne illness cause death? a) Yes□ b) No□ c) I don't know □

32. Which of the following do you know to be associated with or caused by food borne illnesses?

i) Fever: a) Yes□ b) No□ c) I don't know□

ii) Diarrhoea: a) Yes □ b) No□ c) I don't know□

iii) Vomiting: a) Yes □b) No□ c) I don't know□

33. Which of the following is a food borne disease?

i) Typhoid fever: a) Yes □ b) No □ c) I don't know □

ii) Ebola: a) Yes □ b) No □ c) I don't know □

iii) Cholera: a) Yes □ b) No □ c) I don't know □

SECTION D: PERCEPTION ON FOOD HYGIENE

34. Do you think it is important to keep yourself clean as you cook?

a) Yes□ b) No□ c) I don't know□

35. Do you think that coughing or sneezing over food is a problem?

a) Yes□ b)No□ c) I don't know□

36. Do you think it is safe to keep cook food long (more than 4 hours) before it is served?

a) Yes□ b)No □c) I don't know□

37. Do you think it is important to wash your hands after blowing your nose?

a) Yes□ b) No□ c) I don't know□

38. Do you think it is important to wash your hand after scratching your skin?

a) Yes□ b) No□ c) I don't know□

39. Do you think it is important to use separate equipment for raw and cooked food?

a) Yes□ b) No □ c) I don't Know□

40. Do you think it is important to treat yourself properly when you have diarrhoea?

a) Yes□ b) No□ c) I don't know□

SECTION E: PRACTICES ON FOOD HYGIENE

41. How often do you observe the following practices?

i) Wash your hands before cooking?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

ii) Wash your hands after using the toilet?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

iii) Use soap for hand washing?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

iv) Keep your fingernails short?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

v) Cover your nose/mouth when sneezing?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

vi) Wear an apron while cooking?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

vii) Cover your hair while cooking?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

viii) Wear jewelries when cooking?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

ix) Separate raw and cooked foods?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

x) Cook when you are sick?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

xi) Cover wounds and sores with waterproof dressing when cooking?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

xii) Wash the utensils before and after cooking?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

xiii) Keep your cooking surroundings clean?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

xiv) Clean cooking surfaces as you work?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

xv) Cook food thoroughly?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

xvi) Reheat food if it has been cooked for and kept for more than 4 hours?

(a) Never □ (b) Occasionally □ (c) Very often □ (d) Always □

42. What is your source of water? a) Water vendor □ b) Borehole □ c) Well□
d) Water reservoir □ e) Stream/river □

43. How do you store your left over food? a) Reheating □ b) Refrigerator □
c) Cool and dry place □ d) Drying □ e) Salting □ f) Smoking □

44. Have you ever been dewormed? a) Yes□ b) No□

45. If your response to question 44 is yes, when last did you deworm yourself?

a) 6 months ago □ b) One year ago □ c) Others _____ (please specify

46. Is this restaurant being used as a sleeping place at night? a) Yes □ b) No □

47. Have you ever attended any training on food hygiene? a) Yes □ b) No □

48. If your response to question 47 is yes, how long ago? _____(please specify)

49. Have you been undergoing periodic medical examination? a) Yes □ b) No □

50. If your response to question 49 is yes, when was the last one you had?

_____(please specify)

51. Do sanitary inspectors routinely come to your restaurant for inspection?

a) Yes □ b) No □

52. If your response to question 51 is yes, when was the last time your restaurant wa inspected?_____ (please specify)

Thank you.

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