American Journal of Food Science and Technology, 2022, Vol. 10, No. 4, 153-161
Available online at http://pubs.sciepub.com/ajfst/10/4/2
Published by Science and Education Publishing
DOI:10.12691/ajfst-10-4-2

A Comparative Study on Food Hygiene and Safety Practices of Local and Contemporary Bread Bakers in the Gambia

Uyamadu Evelyn Anuli[1,*], Haita Ndimballan[2], Alasana Kanteh[2], Modou Lamin Bah[2]

[1]Department of Public and Environmental Health,
School of Medicine and Allied Health Science, The University of the Gambia
[2]Ministry of Health and Social Welfare, The Gambia
*Corresponding author: euyamadu@utg.edu.gm

Received August 11, 2022; Revised September 15, 2022; Accepted September 25, 2022

Abstract Bread is a significant staple food that can be consumed without further processing. However, given that eating contaminated bread could have a negative impact on consumers' health, its safety has become a top concern for the food industry. The aim of the study was to assess the knowledge, attitudes, and practices of bread makers on food safety and hygiene. This was a cross-sectional descriptive study involving 416 bread bakers from the registered local and contemporary bread bakeries in GBA and Brikama. Data was collected using a structured and semi-structured questionnaire which was interviewer-administered and observation checklist. Thirty bread samples each from the bakeries and the retailer shops were analyzed for pathogenic contamination. Data were analyzed using a descriptive statistic, chi-square, and t-test at P=0.05. The majority of the respondents were males 96.4% and in the age range of 25-54 years. Several (88.7%) had good knowledge of food safety and hygiene. The overall attitude scores revealed that about 94% of the respondents had a poor attitude towards food safety and 86.6% of the respondents in two bakeries had fair practice towards food hygiene and safety (70% and 16.8%) respectively. There was a significant relationship between the knowledge (p=0.001), attitude (p=0.002), and practices (p=0.001) of the respondents in local and contemporary bakeries. Bread analysis showed that only a third of the bread sampled from the two bakeries (50% and 40%) were contaminated, while almost all the bread sampled from the bread sellers (40% and 20%) were contaminated. The bread is more likely to be contaminated by pathogenic and non-pathogenic microorganisms due to poor bakery hygiene conditions, bakers' handling of bakery procedures, and vendors' attitudes. Therefore, all bakery employees and bread vendors should be trained on proper handling of bread to prevent outbreaks of food borne illnesses.

Keywords: *knowledge, attitude, practice, bread bakers, food hygiene & safety*

Cite This Article: Uyamadu Evelyn Anuli, Haita Ndimballan, Alasana Kanteh, and Modou Lamin Bah, "A Comparative Study on Food Hygiene and Safety Practices of Local and Contemporary Bread Bakers in the Gambia." *American Journal of Food Science and Technology*, vol. 10, no. 4 (2022): 153-161. doi: 10.12691/ajfst-10-4-2.

1. Introduction

Food hygiene involves a set of basic principles that are undertaken in the systematic control of environmental conditions that may emerge during the production, packaging, delivery/transportation, storage, processing preparation, selling, and serving of food in a manner that ensures the safety of food consumption and to also make sure that it is of good keeping quality [1]. Foodborne illnesses are the leading causes of morbidity and mortality hindering socio-economic development across the globe [2,3]. These diseases are caused by harmful microbes present in food and also other dangerous chemicals. Both developed and developing countries are affected by food-borne diseases and it affects both the young and the elderly. In developing countries, the annual reports regarding the increase in the number of foods borne diseases are a result of poor food hygiene and safety practice [4]. With the increased rates of national and international travel, the demand for food also rises, which also enhances the spread of food-borne diseases. Notwithstanding, proper food handling, and good hygienic practices can prevent most foodborne illnesses.

Access to safe food is a basic human right worldwide. The food sector has a broad spectrum and a great diversity, with various policies guiding practices of stakeholders from small-scale to large-scale sector players. As a result of the rapid rural-urban migration, a lot of people in urban settlements rely on ready-to-eat (RTE) food to meet their food needs. Ready to eat food is a type of food that can

be consumed in the form in which it is bought. It does not require further processing or modifications except reheating or where additional cooking is required, in the case of foods that can be eaten either fully or partially cooked [5].

In most countries and cultures, bakery products are the important staple foods [6]. They are a good source of several necessary nutrients such as carbohydrates, proteins, fats, vitamins, and minerals, and are the most widely consumed food on the planet [6]. However, harmful microbes can enter bakery foods through inappropriate handling and storage, causing sickness in consumers [7].

Because freshly baked products have a low water activity and are baked at a high temperature, they are devoid of germs and do not contain pathogenic microorganisms, making them a safe food from a microbiological standpoint [6,8]. However, different physical, chemical, and microbiological factors, such as slicing machinery, post-baking contamination from the handler, bread coolers, conveyor belts, racks, and high moisture, can all affect bakery product deterioration [6]. The bakery food is also contaminated by the use of unsanitary water and improper handling during the post-baking process, such as slicing, serving, and packing [9].

Bread is a very essential, readily available RTE staple food requiring no further processing before consumption. In Nigeria, the government has done a lot of effort to ensure the production of quality bread for consumption through awareness. This is a result of the numerous routes through which the contamination of bread is enhanced [10]. Bread is made from low protein flour made from wheat or cassava and contains several ingredients that improve its quality. Table salt, sugar, flavor, and at least an efficient oxidizing additive are some of the ingredients added to bread to assist in the raising process and to produce a texture in the finished product that is appealing to the consumers. In the Gambia, it is reported that more than 80% of households consume locally baked bread (Tapalapa) on a daily bases, with more than 35% consuming the modern bread [11].

A study indicated that out of 6 bakeries that were assessed on hygiene and safety in Ile-Ife, south western, Nigeria, only 2 facilities had a good level of hygiene, 1 facility had fair hygiene while the remaining three reported poor hygiene [12]. These results were justified by the fact that over 6% of the respondents had never used head gears before, 30% constantly used head gears, and only 10% used a face mask. Approximately two-thirds (65%) of bakery workers wore aprons and 45% wore hand gloves, regularly [12,13,14].

A study on KAP conducted by [4], revealed that the knowledge and practices of food handlers on food hygiene and safety were very low. The study placed much emphasis on the need to conduct effective food safety training to improve knowledge, hygiene, and handling practices of food handlers [15,16].

Considering that bread is a commonly consumed food in The Gambia, there is a need to assess the knowledge of bakers on the hygienic practices adopted during baking to adopt better ways of improving their hygiene practices.

2. Methodology

The target population for this study comprised all registered local and contemporary bakeries within the greater Banjul Area and Brikama. A comparative cross-sectional study design was employed in this study to collect information on the knowledge, attitudes, and practices of local and modern bread bakers towards food safety and hygiene from the selected bakeries.

2.1. Sample Size Determination

The sample size was computed using single proportion sample size formula by a conchare.

Since there is no record of bread safety and hygiene in The Gambia, a 50% prevalence will be used to calculate the sample for this study [17]:

$$n = \frac{p(1-p)(z_{\propto}/2)^2}{e^2}$$

Where;
n = Total Sample Size
p = Proportions of the samples from the population (50%)
Z_{α} = Confidence interval (95% I.C = 1.96)
e = Margin of error (5% or 0.05)
z= 1.96, P= 0.5, q= (1-p) and d= 0.05
$n = [1.96^2 * 0.5* (1-0.5)]/0.05^2$
n = 384 + 10% non-response rate

With an attrition rate of 10%, n = 400.

2.2. Sampling Selection Technique

A two-stage sampling procedure was adopted for the study.

2.2.1. Stage 1: Selection of Bakeries

Information on the number of registered bakeries was obtained from Food Safety and Quality Authority. Presently there are 29 registered bakeries in Brikama and 55 in GBA making a total of 84 bakeries in the two study areas. Sixty-four are local bakeries while 20 are contemporary or modern bakeries. All the registered bakeries in GBA and Brikama were selected

2.2.2. Stage two: Selection of the Study Participants (the Bakers)

Simple random sampling was used to select 5 bakers from each of the bakeries based on the interest to participate in the study.

2.3. Data Collection Instruments and Methods

Three instruments were used for data collection.

2.3.1. Questionnaire

Semi-structured interviewer-administered questionnaire was adopted from a previous similar study [18] which assessed the knowledge, attitude, and practices of food handlers towards food hygiene and safety in Kenya and

then slightly modified to suit this study. The questionnaire was used to collect data on the knowledge, attitude, and practice of the respondents towards food safety and hygiene. Research assistants were trained to collect the data from selected bakers within the community using face-to-face interviews. The questions were read out to the respondents and explanations were provided whenever it is necessary. The interview was conducted in Mandinka, Serere, and Wolof being the major language spoken by most of the residents of the study site. The data collection was supervised by the researcher. The questionnaire was divided into five sections: Section A featured the socio-demographic information such as, age, gender, tribe, educational status, etc; section B was used to collect information about the bakery; section C was used to collect information on the knowledge towards food safety and hygiene; section D featured attitudes towards food safety and hygiene and section E: showed practices of bakers on food hygiene and safety

2.3.2. Observational Checklist

An observational checklist adapted from the "WHO (1996) essential requirement for the safety of street-vended foods" was used to assess the environmental and personal hygiene of bread bakers.

2.3.3. Standard Operating Procedures for Microbial Identification from Bread Sample

2.3.3.1. SAMPLE COLLECTION

A total of 60 bread samples were collected from bakery houses and baked bread selling shops at KMC.

1. Ten bread samples were collected from 10 local bakeries and 10 samples from each of the two retail shops that get bread from the same bakeries making a total of 30 local bread samples. Similarly, ten bread samples were collected from 10 modern bakeries and 10 samples from each of the two retail shops that get bread from the same bakeries making a total of 30 modern bread samples.
2. The bread samples were added into a labeled sterile polythene bag by bread sellers and transported to the NPHL Bacteriology Laboratory for analysis.
3. Microbial analysis was conducted within one to three hours of collection.
4. The samples were kept in the refrigerator at 4°C until microbial analysis was conducted.

NB; (if not analyzed within 1 to 3 hrs).

2.3.3.2. LABORATORY ANALYSIS

1. 25g of bread sample was suspended in 225ml of distilled water or Buffered peptone water.
2. The mixture was homogenized using shaker at 160rpm for 5min
3. 1ml of the homogenized sample was transferred into 9ml of distilled water/BPW for serial dilution
4. One milliliter of the solution was serially diluted in a set of 5 test tubes containing 9ml of distilled water/BPW
5. 0.1ml of appropriate dilution was aseptically transferred on Mueller Hinton, Deoxycholate citrate agar (DCA)or MacConkey, Blood Agar.
6. This was Incubated at 37°C for 24hrs
7. After incubation, colonies were counted using colony counting and expressed as colony-forming unit per milligram (CFU/mg) per plate
8. Samples that have greater than 10^2-10^3cfu/mg are considered to be contaminated.

NB; International Microbiological standards recommended units of bacterial contamination for foods is in the range 10^2-10^3cfu/mg of food coliforms and less than 10^3cfu/mg of food for total bacterial plate counts

2.4. Measurement and Scoring of Knowledge, Attitude and Practice on Food Safety and Hygiene

2.4.1. Knowledge

Twenty-four questions were used to score for knowledge as Good, Fair, and Poor. Based on the overall score for the individual respondent, 17-24 points were scored as good, 9-16 points were scored as fair and 0-8 was scored as poor

2.4.2. Practice

For practice, fifty questions were used to score as Good, Fair, and Poor. Based on the overall score, 33-50 points were scored as good,17-32 as fair, and <17 as poor.

2.4.3. Attitude

For attitude, seventeen questions were used to score as good and fair. Based on the overall score, >8 is cored as good and 0-8 scored as poor

2.5. Data Processing and Analysis

SPSS software version 22 and Stata13.0 were employed to process and analyze the data and presented using tables and charts as appropriate.

3. Results

3.1. Socio-demographic Characteristics of the Respondents

Table 1 shows the sociodemographic features of the respondents. The result revealed that 71.2% of the bakery workers age ranges between 25-54 years out of which 53.4% were from local bakeries while 17.8% were from contemporary bakeries, 96.4% of them were males and majority of the bakers (48.7%) completed at least primary schools' education. The majority 53.3% of the respondents were married (38.9% and 14.4%) respectively. Interestingly, majority of the bakery workers were non-Gambians.

3.2. Knowledge of the Respondent on Food Safety and Hygiene

Table 2 shows the knowledge of the respondent on food safety and hygiene. The majority (59.4%and 17.8%) of

bakers in local and contemporary bakeries admitted that the food we eat is capable of transmitting diseases to us, Preparation of food disregarding hygiene rules causes food-borne illnesses, (66.8% and 21.4%), Food borne diseases are transmitted by food contamination (68% and 21.4%), Improper reheating of food causes food-borne illnesses (50.2% and 20). Covering hair is necessary before and during food preparation (70.7% and 21.6%), washing hands before food preparation reduces the risk of food contamination (76.2% and 22.4%), Trimming fingernails is necessary before food preparation (75% and 22.1%), Using gloves while handling food reduces the risk of food contamination (44.7% and 17.5%), Proper cleaning and sanitization of equipment reduces the risk of food contamination(75.5% and 22.1%), Pieces of jewelry and artificial nails should be removed during bread mixing (76% and 21.9%), food cannot be prepared on dirty surfaces/equipment (76.4% and 22.4%),. raw food and processed food should be kept separate (73.6% and 21.9%) and temperature control is important in the storage and processing of safe food (49% and 19%).

3.3. Food Safety and Hygienic Practices among the Respondents

Table 3 shows the practice of the respondents to food hygiene and safety. Most of the respondents said that they never put on jewelry and a watch while working (61.9% and 16.6%, 3%), use hand gloves touching or distributing unwrapped bread (37.5 % and 15.1%), wear an apron/PPE while working (50.2% and 9.4%), clean their working area before baking (57.7% and 14.9%), clean your bread before selling to customers (51.2% and 12%), Check the shelf life of the ingredients at the time of delivery (54.1% and 15.9%), Properly clean the bread storage area before storing new products(47.6% and 13.9%), Washing hands before, during and after bread preparation (45.5% and 11.8%), Washing bread preparation utensils before and after food preparation (54.1 % and 15.6%), Taking a bath and put on clean cloths before, during and after bread preparation (37% and 12%), trimming finger nails before bread preparation (48.8% and 14.4%), Covering hair before and during bread preparation (31% and 13.7%).

Table 1. Participants' socio-demographic characteristics

Variable	n (%)	Type of Bakery	
		Local (77.4%)	Modern (22.6%)
Age of participants			
15 - 24	116(27.9)	23.3	4.6
25 - 54	296(71.2)	53.4	17.8
55 - 64	3(0.7)	0.7	0
above 64	1(0.2)	0.0	0.2
Gender			
Male	401(96.4)	77.2	19.2
Female	15(3.6)	0.2	3.4
Educational level			
Never been to school	144(35.9)	32.2	3.7
Madarasa	30(7.2)	6.7	0.5
Primary	195(48.7)	38.2	10.5
Secondary	41(10.2)	3	7.2
Tertiary	6(1.5)	0.0	1.5
Marital status			
Single	179(43.0)	35.8	7.2
Married	222(53.3)	38.9	14.4
Widow	5(1.2)	0.7	0.5
Separated/Divorce	10(2.4)	1.9	0.5
Ethnicity			
Mandinka	38(9.1)	3.1	6
Fula	318(76.4)	67.3	9.1
Jola	14(3.4)	1.7	1.7
Wollof	26(6.2)	2.6	3.6
Others	20(4.8)	2.6	2.2
Nationality			
Gambian	170(40.9)	23.8	17.1
Non Gambia	246(59.1)	53.6	5.5

Table 2. Knowledge of the respondent on food safety and hygiene

Variable	n (%)	Type of Bakery	
		Local (77.4%)	Modern (22.6%)
Is the food we eat capable of transmitting diseases to us?			
Yes	321(77.2)	59.4	17.8
No	95(22.8)	18	4.8
Preparation of food disregarding hygiene rules causes food-borne illnesses			
Yes	367(88.2)	66.8	21.4
No	49(11.8)	10.6	1.2
Food borne diseases are transmitted by food contamination			
Yes	371(89.4)	68	21.4
No	44(10.6)	9.4	1.2
Improper heating of food causes food-borne illnesses			
Yes	292(70.2)	50.2	20
No	124(29.8)	27.2	2.6
Washing hands before work reduces the risk of food contamination			
Yes	410(98.6)	76.2	22.4
No	6(1.4)	1.2	0.2
Covering hair is necessary before and during food preparation			
Yes	384(92.3)	70.7	21.6
No	32(7.7)	6.7	1
Trimming finger nails is necessary before food preparation			
Yes	404(97.1)	75	22.1
No	12(2.9)	2.4	0.5
Using gloves while handling food reduces the risk of food contamination			
Yes	259(62.2)	44.7	17.5
No	157(37.7)	32.7	5
Proper cleaning and sanitization of equipment reduces the risk of food contamination			
Yes	406(97.6)	75.5	22.1
No	10(2.4)	1.9	0.5
Jewelries and artificial nails should be removed during bread mixing			
Yes	407(97.9)	76	21.9
No	9(2.1)	1.4	0.7
Food cannot be prepared on dirty surfaces/equipment			
Yes	411(98.8)	76.4	22.4
No	5(1.2)	1	0.2
Raw food and processed food should be kept separate			
Yes	397(95.5)	73.6	21.9
No	19(4.5)	3.8	0.7
Temperature control is important in storage and processing of safe food			
Yes	238(68)	49	19
No	133(32.0)	28.4	3.6

Table 3. Respondents' Practices to Food hygiene and Safety

Variable		n (%)	Type of Bakery	
			Local (77.4%)	Modern (22.6%)
Do you practice any of the following				
Put on jewelry and a watch while working				
	Never	326(78.6)	61.9	16.6
	Sometimes	88(21.2)	15.2	6
	Always	1(0.2)	0.2	0
Use of hand gloves				
	Never	174(41.8)	37	4.8
	Sometimes	219(52.6)	37.5	15.1
	Always	23(5.5)	2.9	2.6
wear an apron/PPE while working				
	Never	56(13.5)	12.3	1.2
	Sometimes	248(59.6)	50.2	9.4
	Always	112(26.9)	14.9	12
Clean your working area before baking?				
	Never	5(1.2)	1.2	0
	Sometimes	109(26.2)	18.5	7.7
	Always	302(72.6)	57.7	14.9
Do you clean your bread before selling to customers?				
	Never	20(4.8)	2.4	2.4
	Sometimes	133(32.0)	23.8	8.2
	Always	263(63.2)	51.2	12
Check shelf life of the ingredients at the time of delivery?				
	Never	9(2.2)	2.2	0
	Sometimes	116(27.9)	21.2	6.7
	Always	291(70.0)	54.1	15.9
Properly clean the bread storage area before storing new products?				
	Never	11(2.7)	2.2	0.5
	Sometimes	149(35.8)	27.6	8.2
	Always	256(61.5)	47.6	13.9
Washing hands before, during and after bread preparation				
	Never	3(0.7)	0.5	0.2
	Sometimes	175(42.1)	31.5	10.6
	Always	238(57.2)	45.4	11.8
Washing bread preparation utensils before and after food preparation				
	Never	1(0.2)	0.2	0
	Sometimes	125(30.0)	23.1	7
	Always	290(69.7)	54.1	15.6
Taking bath and put on clean cloths before, during and after bread preparation				
	Never	9(2.2)	1.2	1
	Sometimes	203(48.8)	39.2	9.6
	Always	204(49.0)	37	12
Trimming finger nails before bread preparation				
	Never	11(2.6)	1.7	1
	Sometimes	142(34.1)	26.9	7.2
	Always	263(63.2)	48.8	14.4
Wear hair covering	Never	51(12.3)	8.7	3.6
	Sometimes	179(43.0)	37.7	5.3
	Always	186(44.7)	31	13.7

3.4. Comparison of Knowledge, Attitude and Practices of Food Safety

The comparison of the knowledge, attitude, and practice scores of the respondents is shown in Table 4. Regarding knowledge, the Majority (88.7%) of the respondents which accounted for 66.6% and 22.1% for local and contemporary bakeries respectively had good knowledge of food hygiene and safety. A comparison of the knowledge of the respondents in local and contemporary bakeries was significant (p=0.001).

Conversely, both the respondents in local and contemporary bakeries showed poor attitudes to food hygiene and safety 94.0% which accounted for 71.3% for local and 22.7% for contemporary bakeries. Also, a comparison of the attitude of the respondents in local and contemporary bakeries was significant (p=0.002).

Concerning Practice of food hygiene and safety, several (86.6%) of the respondents in two bakeries had fair practice towards food hygiene and safety (70% and 16.8%) respectively. Also, a comparison of the practices of the respondents in local and contemporary bakeries was significant.

Table 4. Correlation of food safety knowledge, Attitude, and practices among bakers

Variable	n (%)	Type of Bakery		P-value
		Local (77.4%)	Modern (22.6%)	
Overall knowledge score				
Poor	0	0	0	
Fair	47(11.3)	10.8	0.5	0.001*
Good	369(88.7)	66.6	22.1	
Overall Attitude score				
Poor	390(94.0)	71.3	22.7	0.002*
Good	25(6.0)	6	0	
Overall Practice score				<0.001*
Poor	1(0.2)	0.2	0	
Fair	361(86.6)	70	16.8	
Good	54(13)	7.2	5.8	

3.5. Results of the Bread Sample Analysis for Pathogenic Contamination

The results showed that 50% of bread samples from the local bakeries were contaminated with coliform organisms compared to contemporary bakeries where only 40% showed contamination Table 5.

Table 5. Local bakery Bread sample analysis

Sample Source	Colony Count cfu/mg	n	%
Local Bakeries			
Contaminated	4080	5	50
Uncontaminated	280	5	50
Retail Local Bakeries			
Contaminated	2775	8	40
Uncontaminated	258	12	60
Total		30	

Colony count<10^3 =uncontaminated
Colony count >10^{2}-10^3=contaminated.

Also, 40% of local bread samples collected from the retailer's shops were contaminated with coliform organisms whereas only 20% of bread samples from contemporary bakeries showed signs of contamination. Table 6.

Table 6. Contemporary bakery bread sample analysis

Sample Source	Colony Count cfu/mg	N	%
Modern Bakeries			
Contaminated	5750	4	40
Uncontaminated	0.00	6	60
Retail Modern Bakeries			
Contaminated	3025	4	20
Uncontaminated	95.00	16	80
Total		30	

Colony count<10^3 =uncontaminated
Colony count >10^{2}-10^3= contaminated.

4. Discussion

Food safety is essential to preserve the wholesomeness of sustenance for human consumption since living creatures in this environment are always looking for food to stay alive. Poor food handling practices, according to studies, are the leading cause of food borne disease [19]. Bread is a very essential, readily available Ready -to-eat staple food requiring no further processing before consumption and this makes it a good source of food borne illness if improperly handled

4.1. Sociodemographic Features of the Respondents

In terms of gender and age, the majority of respondents (96.4%) were men between the ages of 25 and 54years. This is similar to the findings by Afolabi and his colleagues where 65% of the bakery workers were between the ages of 18-31 years with 24 years as the median age and 70% of them were males [12]. Most of them had primary school as their highest level of education 48.7% which is in contrast with others studies where most of the respondents (67.5%) attained secondary education and about 53.3% of them were married [12]. Several 59.1% of the respondents were non Gambians and 76.4% were from fulas tribe.

4.2. Knowledge of Food Safety and Hygiene

Majority of the respondent (88.7%) had good knowledge on food safety and hygiene. This is in contrast with the study by [4,20,21] which reported that most food handlers lack adequate food safety knowledge, personal and hand washing hygiene, and thus, result to food contamination. Another study by [22] in Brazil found that a large number of food workers lack enough knowledge of food safety and practices. According to a similar study, food handlers' lack of food safety education and inappropriate food handling procedures are the leading causes of food quality degradation and the occurrence of foodborne diseases [23,24]. However, studies conducted

by [4,24] reveal that male respondents had a higher knowledge score towards food safety than females. This is likely to be the case in this study as almost all the respondents (96.4%) are males. Majority 84.8% of the respondents did not receive any formal training on food safety. This is however on the contrary to the cross-sectional KAP study by [25] in Northern Kuching City, Sarawak with a sample size of 361 street food vendors which discovered that indicators such as age, education level, employment period and training in food safety also increase food safety knowledge scores. His study was backed by [26,27].

4.3. Attitude towards Food Safety and Hygiene

The overall attitude scores revealed that about 94% of the respondents had poor attitude towards food safety. This may be because of their low level of education coupled with the fact that majority of the respondents are males. It could also be as a result of socio-cultural practices with regards to food hygiene and safety practices which is mostly attributed to females than male. This disagrees with the study by [4] in Kenya where Food handlers' attitude towards food safety was positive, with females having higher attitude scores than male respondents. The same findings were obtained by [24,28]. However, several studies on KAP highlighted that as age increases, coupled with good educational level, length of employment, and food safety training, there is a high chance that positive food safety behaviors and practices will be exhibited [4,15,26,29].

4.4. Food Safety and Hygienic Practices

Concerning Practice, several (86.6%) of the respondents in two bakeries had fair practice towards food hygiene and safety (70% and 16.8%) respectively. A study on KAP conducted by [4] revealed that the knowledge and practices on food hygiene and safety displayed by food handlers was very low. The study placed much emphasis on the need to conduct an effective food safety training in order to improve knowledge, hygiene and handling practices of food handlers [15,16].

This study shows that about 12.3% of the respondents had never use hair coverings while only 44.7% always wear it. This is similar to the study by [12] which shows that 6% of the bakery workers had never use head gear while only 30% always wear it. In this study, very few 26.9% of the respondents wear apron always while working. [12] reported that about two-thirds (65%) of bakery workers wear aprons regularly. Among the bakery workers only 5.5% wear hand gloves regularly, 52.6% wear it sometimes while 41.8% never use hand gloves while working. [12] reported that about 45% wear hand gloves regularly, 15% uses it occasionally and 45% do not see any reason why they should use it. This is also similar to findings by [13] where 47% of bakers uses bare hands while working in bakeries, against the standard practice but much higher than the 16.7% reported by [14]. None of the bread sellers and 65% of the bakery employees reported wearing an apron, which is consistent with findings from research by [30].

Majority 63.2% of the respondents clean bread with foam or rags before selling to the customers and 31% always touch money with bare hands while 44.2% does that occasionally .The unwholesome practice of cleaning bread with foam has never been reported in literature and is a major mechanism for contamination of bread as it provides ample opportunity to expose the bread to handling with hands that are rarely ever washed before handling bread; the hands that are used to receive money in between transactions which has been reported in a study by [30].

Observation showed that the toilet facilities of the bakeries are in good condition. the toilet facility is not close to the food preparation site, or their source of water used in the bakeries. This is in contrast with the finding by [14] where Toilet facilities of both male and female workers were also not highly satisfactory level as only 33% of the respondents were given good comments about toilet facilities. The bakeries roofs and floor were in good condition as opposed to that by [14] which showed that all the factories' roofs were not well enough. The practice of covering hair and wearing of aprons were not satisfactory enough as only half of the respondents (51.7%) put on hair coverings while very few 39.7% put on apron. This concur with the findings by [14] which reported that the practice of wearing aprons & caps by personnel of the considered factories were not at satisfactory level.

The sanitary conditions of the bakeries are not very satisfactory as cross contamination is not controlled, no adequate facilities to wash hands, food preparation utensils and surfaces and no effective and properly functioning waste management system which is similar to findings by [14,30] in Bangladesh. Hygiene of bakeries assessed was poor as only a third of bakeries assessed had good hygiene which is similar to findings by [14] in Bangladesh.

4.5. Correlation of Food Safety Knowledge, Attitude and Practices among Bakers

A comparison of the knowledge of the respondents in local and contemporary bakeries was significant ($p=0.001$). Similarly, a comparison of the attitude of the respondents in local and contemporary bakeries was significant ($p=0.002$). Also, a comparison of the practices of the respondents in local and contemporary bakeries was significant ($p=0.001$). This is similar to findings from several studies that knowledge, attitude and practices have a positive correlation, indicating that as food safety knowledge increases, attitude increases as well as practices [4,31] and [32]. This is contrary to the study conducted by [1] who reported that there exists a positive correlation between food safety knowledge and attitude but a negative correlation between food safety knowledge and practices as well as attitude and practices [15,16].

4.6. Bread Sample Analysis

Laboratory analysis of bread samples showed more coliform contamination in the samples from the local bakeries compared to contemporary bakeries. Similarly, more contamination was seen in local bread samples from the retailer's shop compared to contemporary bread samples (50% and 40%) and (40% and 20%), respectively.

This might be attributed to the frequent handling of bread sellers with unwashed hands. This backs up research from the Hazard Analysis and Critical Control Points (HACCP) program, which shows that most foods are contaminated somewhere along the processing chain [33,34].

International Microbiological standards recommended units of bacterial contamination for foods is in the range 10^2-10^3cfu/mg of food coliforms and less than 10^3cfu/mg of food for total bacterial plate counts. In this study, coliform count exceeded the recommended contamination limits. The majority of coliform food contamination is caused by poor handling resulting from contact with handlers, their feces, or fecal orally infected objects, which is a relatively prevalent occurrence among local bakers and shops. (>10^3)cfu/g. [34] also recorded high coliform count which ranged from 1.19 x10^4-2.05x10^6 cfu/g. [9] recorded that among the three commodities analyzed, bread was found to be highly contaminated by micro-organisms.

5. Conclusion

The study showed that the knowledge of the local and contemporary bread bakers towards food safety and hygiene was good, attitude poor and fair practice. Also, the bread samples from the retail shops showed more pathogenic contamination than those from the bakeries. Therefore, all bakery workers and bread vendors should receive training in food hygiene and handling.

Acknowledgements

The authors acknowledged the University of the Gambia Research Directorate for sponsoring this research. We also acknowledge the technical assistance of Abdoulie Secka and Batou Saidy during the data collection and also Mr Bakary Sanneh and Abou Kebbeh of the Public health laboratory unit of the Ministry of Health, Kotu, the Gambia. We also acknowledge Mr Mansour Badjie for his assistance in data analysis.

References

[1] Ansari-Lari M, Soodbakhsh S, Lakzadeh L. (2010). Knowledge, attitudes and practices of workers on food hygienic practices in meat processing plants in Fars, Iran. *Food Control*, 260-263.

[2] Hassan Ali N, Farooqui A, Khan A, Khan AY, Kazmi SU. (2010). Microbial contamination of raw meat and its environment in retail shops in Karachi, Pakistan. *Journal of Infection in Developing Countries, 4*, 382-388.

[3] WHO. (2015). Estimates of the Global burden of foodborne diseases. *foodborne diseases burden epidemiology reference group 2007-2015*.

[4] Malavi, D.N.; Abong, G.O.; Muzhingi, T. 2017. Food safety knowledge, attitude and practices of orange fleshed sweetpotato puree handlers in Kenya. Food Science and Quality Management. ISSN 2224-6088. 67: 54-63.

[5] Singh S, Rana T, Kaur N, Parihar R, Kumar R, Kumar S, Kumar R (2014). Studies on Microbiological Quality of Ready to Eat Food from Solan City of Himachal Pradesh. *Int. J. Univ. Pharm. BioSci, 3*(3): 181-189.

[6] Saranraj, P. and Geetha, M. (2012). Microbial Spoilage of Bakery Products and Its Control by Preservatives. *International Journal of Pharmaceutical and Biological Archives*, 3(1), 38-48.

[7] Das, K.K., Sarkar, A. and Hossain, A. (2020). Isolation of pathogenic microorganisms and determination of their antibiotic resistance patterns collected from different bakery products of Dhaka city. *Food Research* 4 (4): 1312-1316 (August 2020) Journal homepage: http://www.myfoodresearch.com.

[8] Khanom, A., Shammi T. and Kabir, M.S. (2016). Determination of microbiological quality of packed and unpacked bread. *Stamford Journal of Microbiology*, 6(1), 24-29.

[9] Gill, A.., John, A. ., Iqbal, N. ., Faridi, T. A. ., & Noor, S.. (2020). Assessment of biochemical profile among patients of Microbiological Quality Assessment of Bakery Products Available in Lahore, Pakistan: Microbiological Quality Assessment of Bakery Products Available in Lahore, Pakistan. *DIET FACTOR (Journal of Nutritional &Amp; Food Sciences), 1*(01), 29-34.

[10] Emeje, O. S. (2010). Assessment of bread safety in Nigeria: Quantitative determination of potassium bromated and lead. *Afr. J. Food Sc, 4*(6), 394-397.

[11] Gambia National Micronutrient survey (2019). Gambia Annual Country Report 2019 Country Strategic Plan, 2019-2021. World Food Programme.

[12] Afolabi, T.O, Aluko, O.O, Olaniran, O, Olusola Ajao,O., Ojumu, B.K, and Olawande, O. (2015). Safety of bread for human consumption in an urban community in Southwestern Nigeria. *African journal of food science, 9*(5), 272-277.

[13] Chukuezi C.O. (2010). Food safety and hygiene practices of street food vendors in Owerri, Nigeria. *Stud. Sociol. Sci.*, 50-57.

[14] Huq AKO, Uddin JM, Haque KMF, Roy P, Hossain MB. (2013). Health, hygiene practices and safety measures of selected baking factories in Tangail region, Bangladesh. *Int. J. Curr. Microbiol. Appl. Sci. 2(10):68-75.*, 68-75.

[15] Soon, J.M., and Baines, R.N. (2012). Food safety training and evaluation of handwashing intention among fresh produce farm workers. *Food Control, 23*(2), 437-448.

[16] Kassa, H., Silverman, G. S., & Baroudi, K. (2010). Effect of a Manager Training and Certification Program on Food Safety and Hygiene in Food Service Operations. *Environmental Health Insights, 4*, 13-20.

[17] Naing, L., Winn, T., & Rusli, B. N. (2006). Practical issues in calculating the sample size for prevalence studies. *Archives of Orofacial Sciences, 1*, 9-14.

[18] Wandolo, M.A. (2016). Food safety and hygiene practices: a comparative study of selected technical and vocational education and training and university hospitality schools in Kenya.

[19] Augustin JC, Kooh P, Bayeux T, Guillier L, Meyer T, Jourdan-Da Silva N, Villena I, Sanaa M, Cerf O, (2020). On Behalf Of The Anses Working Group On Consumer Information On Foodborne Biological Risks. Contribution of Foods and Poor Food-Handling Practices to the Burden of Foodborne Infectious Diseases in France. Foods. 2020 Nov 11; 9(11): 1644.

[20] Baluka SA, Miller R, Kaneene JB (2015). Hygiene practices and food contamination in managed food service facilities in Uganda. *African Journal of Food Science*, 31-42.

[21] Tolulope OA, Zuwaira IH, Danjuma AB, Yetunde OT, Chundung AM, Ayuba IZ, (2014). Training: a vital tool for improving the knowledge and practice of food safety and hygiene among food handlers in boarding schools in Plateau state. *Journal of Tropical Medicine*, 87-92.

[22] Soares, L.S., Almeida, R.C.C., Cerqueira, S.E., Carvalho, J.S., and Nunes, L.I (2012). Knowledge, attitudes and practices in food safety and the presence of coagulase- positive staphylococci on hands of food handlers in the schools of Camacari, Brazil. *Food Control*, 206-213.

[23] Aluko, O.O, Ojeremi T.T, Olaleke, D.A., Ajidagba, E.B. (2015). Evaluation of food safety and sanitary practices among food vendors at car parks in Ile Ife, southwestern Nigeria. *Food Control*, 165-71.

[24] Sharif, L., Obaidat M.M, Dalalah, M. (2013). Food Hygiene Knowledge, Attitudes and Practices of the Food Handlers in the Military Hospitals. *Food and Nutrition Sciences, 4*, 245-251.

[25] Rahman M, Arif MT, Bakar K, bt Tambi Z. (2012). Food safety knowledge, attitude and hygiene practices among the street food vendors in Northern Kuching city, Sarawak. *Borneo Science*, 35-103.

[26] Park SH, Kwak TK, Chang HJ. (2010). Evaluation of the food safety training for food handlers in restaurant operations. *Nutrition Research and Practice*, 58-68.

[27] Talaei, M., Holakouie-Naienib, K., Foroushanib, R.A., and Aslc, M.H. (2015). Knowledge, attitude and practice of people about foodborne outbreak in Isfahan city, Iran. *Journal of Food Safety and Hygiene*, 1-7.

[28] Sanlier, N. and Konaklioglu, E. (2012). Food safety knowledge, attitude and food handling practices of students. *British Food Journal*, 469-480.

[29] Nik Rosmawati, N.H., Muda, W.M.W., Jamil, N.I.N., Hanafi, N.N.N., and Rahman, R.A.. (2016). Effect of food safety training on food handlers' knowledge and practices A randomized controlled trial. *British Food Journal, 118*(4).

[30] Nurudeen AA, Lawal AO, Ajayi SA. (2014). A survey of hygiene and sanitary practices of street food vendors in the Central State of Northern Nigeria. *J. Public Health Epidemio*, 174-181.

[31] Mendagudali RR, Akka KD, Swati IA,Shedole DT, Bendigeri NAD. (2016). Knowledge, attitude, and practices of food safety among women of Khaza bazar, the urban field practice area of KBN Institute of Medical Sciences, Kalaburagi, Karnataka. *International Journal of Medical Science and Public Health*, *5*(3), 516-20.

[32] Bendigeri, N. A. D. (2016). Knowledge, attitude, and practices of food safety among women of Khaza bazar, the urban field practice area of KBN Institute of Medical Sciences. *International Journal of Medical Science and Public Health*, 5 (3), 516-20.

[33] Adesetan TO, Ilusanya OAF, Sobowale AA, Jumani UP (2013) Bacteria commonly associated with bakery equipments in selected areas around Olabisi Onabanjo University environ, Ago-Iwoye, Nigeria. Adv. *Adv. Environ. Biol, 7*(1), 77-181.

[34] Daniyan, S.Y and Nwokwu, O.E. (2011). Enumeration of microorganisms associated with the different stages of bread production in FUTMIN bakery, Nigeria. *Int. Res. J. Pharm*, 88-91.