

**Assessment of The Hygienic Condition of Food Canteens
at The University of Abuja**

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Abstract

This research reports bacteriological evaluation of food contact surfaces at the Mini and Main campuses of the University of Abuja food canteens. 390 samples were collected from 43 canteens and bacterial isolation was done using Nutrient agar (HI MEDIA), Mannitol Salt Agar (HI MEDIA), Eosin Methylene Blue (TM MEDIA), and MacConkey Agar (TM MEDIA) by streak inoculation method. Ninety-five (95) questionnaires were distributed to forty-three (43) canteen owners and fifty-two (52) workers. In the face of adequate knowledge on food safety among participants, the results revealed that majority had unsafe hygiene practice, as most vendors do not wear apron, cover hair when serving or preparing food or clean food contact surfaces before and after preparing food to sell. Thus, vendors need education on safety hygiene practices knowing that knowledge without practice is vain. The percentage prevalence of bacteria organisms isolated from this study as confirmed using conventional biochemical characterization are as follows: *Staphylococcus* thirty (30) (22.9%), *Streptococcus* fifteen (15) (11.5%), *Bacillus* twenty-seven (27) (20.6%), *Klebsiella* ten (10) (7.6%), *Escherichia coli* forty (41) (31.3%) and *Proteus* eight (8) (6.1%) from both campuses. This study shows the occurrence of pathogenic bacteria organisms isolated from the food canteens in the mini and main campuses of the University of Abuja, hence the need to create awareness and enlightenment so as to eliminate or extremely decrease the prevalence of bacterial food borne Diseases around the campuses and its environs.

Key words: Hygiene, Canteen, Bacteria, Prevalence, Knowledge

1. INTRODUCTION

1.1 Background of the Study

Food is defined by the World Health Organization as any processed, semi-processed, or raw substance that is meant for either animal or human consumption (WHO, 2022). Food is a crucial tool for meeting the body's demands on a regular basis (Kesari and Noel, 2022) and people should be concerned about improving food safety and hygiene standards since it will help avoid the spread of food-borne illnesses. Akande (2002) adopts a similar perspective when defining food as any material that individuals prepare and consume in order to meet their physiological demands. Additionally, food is defined by Wachukwu *et al.*, 2020 as any liquid or solid substance that can nourish the body when consumed and digested. Food includes any consumed item that can meet a person's nutritional needs and must be wholesome and secure before adequate and healthy food can support wellbeing, but unacceptable and contaminated food components pose a risk to animal and human health (Akintaro, 2012; Enunwaonye *et al.*, 2020). Bacteriological contaminants are important cause of food-borne illness, which may differ in severity from a mild disturbance to a chronic or critical illness (Rahman *et al.*, 2015).

Food-borne illnesses such as botulism, listeriosis, cholera, camphylobacter enteritis, colibacillosis, salmonellosis, shigellosis, leptospirosis, toxoplasmosis, amoebiasis, and yersiniosis are caused by pathogenic bacteria organisms in developing nations (Edema *et al.*, 2005). Food-borne infections are significant sources of production loss and pose serious dangers to animal and human health in Nigeria (Ajao and Atere, 2009). The presence of high bacterial loads on surfaces, plates, equipment's, cooking utensils, that comes in contact with food serves as sources of contamination which also presents a major threat to animal and human health. (Bala *et al.*, 2015). Globally, an enormous community of animal/humans will be impacted if food contamination by bacterial organisms happens within a canteen as a result of inadequate hygienic practices (Zemichael, 2019).

Hygiene is defined as any measures taken to ensure a healthy environment and prevent disease or associated health risks (Kamboj *et al.*, 2020). Thus, maintaining one's environment to avert illness and diseases is a relevant part of hygiene for a wholesome living in society. Satish *et al.*, (2020), referred to hygiene as steps taken to uphold health and stop the spread of disease. Unhygienic behaviors have been found to expose people to infections that include clinical symptoms such as fever, nausea, abdominal pain, retching, vomiting, diarrhea, dehydration, fatigue and other environmental health problem (Thomas, 2017).

Good quality food when consumed, is thought to have an influential impact on the state of health of every community, hence University institutional catering services should receive more awareness and enlightenment (Brimblecombe *et al.*, 2014), as it is most likely that staffs and students will have their primary meals away from their houses and lodging houses (Tóth and Koller, 2017). This present investigation focused on the hygiene standard of food canteen in University of Abuja.

1.2 Statement of the Problem and aim of the study

The University of Abuja is one of the leading public universities in Nigeria, with a population of over 40,000. The food vendors at the University of Abuja have been observed to have unkept hairs,

dirty foot wears, cough without the use of handkerchief, and usage of dirty water to wash utensil in an unhygienic environment. This type of scenario can lead to food contamination that may result to infection within the university community.

There is very little data available on food-borne illnesses caused by micro-organism among students and staff patronizing food canteens within the University of Abuja community.

There is low level of awareness and enlightenment of the food vendors and students on the types of bacteria organisms that can be acquired from consuming unhygienically prepared food at the University of Abuja.

This study aimed to determine the occurrence of bacteria organisms from food preparation surfaces in food canteens at University of Abuja.

1.3 Review of Related Literature

Bittsánszky *et al.*, 2015 studied the hygienic conditions of canteens by means of surface microbial analysis. The kitchen surfaces of 11 different canteens were surveyed, the results showed an increase in microbial load over the regulations of Decree 4/1998 despite regular food handler's training.

Reports on the assessment of sanitary status of food and drinks catering establishments which was a descriptive observational study in south east Asmara, Eritrea. The results of the investigation of 139 different foods and beverages revealed that the sanitary state was unacceptable, and recommendations were put forward to enforce rules and regulations within the community Idris *et al.*, 2019. In 2018 Elechi and Gladys findings revealed that, there is a significant positive correlation between knowledge, attitude and practice of food hygiene among food handlers.

Ajao and Atere (2009) randomly selected six canteens to conduct a bacteriological assessment and hygiene standard of food canteens in Kwara State Polytechnic, Ilorin, and the result of their study indicated that clean plates, walls, tables and serving counters have high hygiene quality indices of 75%, 91%, 62% and 65% respectively. While floor, hand towels, apron, money and hand swabs have low hygiene quality indices of 53%, 36%, 56%, 46% and 40% respectively. (Todd, 2023). In addition, they discovered that the dessert and stew samples had lower levels of microorganisms than the water and vegetable samples, with the exception of the *Enterobacter* species (10.3%) and *Bacillus* species (12.5%) that predominated during their sampling period. Faremi *et al.*, 2018 studied food safety and hygiene practices among food vendors in a tertiary educational institution in south western Nigeria using a structured questionnaire. They found that 67.2% of the respondents had inadequate knowledge on how food-borne illnesses spread. Similar to this, researchers conducted 102 interviews, and their results, along with observations of the university canteen's surroundings, revealed that food servers rarely wash their hands and this may serve as a source of food contamination Okojie *et al.*, 2005.

2. MATERIALS AND METHODOLOGY

2.1 Study Area

The research work was carried out in Gwagwalada area council, federal capital territory (FCT) Abuja, Nigeria. Gwagwalada Area council is located between 8°25¹¹ and 9°25¹¹ North of the equator and longitudes of 6° 45¹¹ and 7° and 45¹¹ East of the Greenwich. The territory covers an area of 2,700 square kilometres. Gwagwalada is lying close to the centre of the country, and is situated wholly within the region generally referred to as the “Middle Belt” Dawn *et al.*, 2000. It shared boundaries with Kuje to the East, Abuja Municipal Area Council to the North, Abaji to the South and Zuba to the West. The federal capital territory was formed in 1976 shares boundary with Kogi, Kaduna, Niger and Nassarawa lying between latitude 8.25°N and 9.20°N of the equator and longitude 6.45°E and 7.39°E east of Greenwich Meridian.

2.2 Research Design and Sampling Technique

This study is a cross sectional study of the 43 canteens in university of Abuja main and mini campuses using convenience sampling technique.

2.3 Sample Size Determination

Sample size was determined using the formula as described by Thrusfield 2005, using 50% prevalence rate (Ajao, 2009), approximately 390 samples was selected for the microbial data collection.

$$N = \frac{Z^2 pq}{d^2}$$

Where:

N= Sample size

q=1-p

Z= 1.96 (normal distribution) from table

P= Prevalence rate from the average of previous studies

D=Desired absolute precision of 5% with 95% Confidence Interval

2.4 Sample Collection and Sample processing

Three hundred and ninety (390) swab samples were collected from table tops, plates and refrigerator handle using commercial sterile swab sticks from the 43 canteens/maishai stalls in main and mini campus, University of Abuja from January to March, 2023. 270 swab samples were obtained from main campus at convocation ground, market, hostels and faculty canteens while 120 swab samples were obtained from mini campus at different canteen location such as Mini campus gate, hostels, school field area. The swab samples were transported, packed on ice to the Microbiology laboratory of the Department of Veterinary Microbiology, University of Abuja for processing and Bacteriological analysis.

Table 1 Sources of samples and Locations

S/N	Source	Main campus	Mini campus	Total
1.0	Plate (A)	93	36	129
2.0	Refrigerator handle(B)	70	12	82
3.0	Table Top (C)	107	72	179
4.0	Total	270	120	390

2.5. Media Preparation

All media and reagent were prepared according to the manufacturer's instructions (Difco laboratories, USA, Paisley, Scotland, UK; Antec, London, UK and Oxiod, London, UK).

2.6. Laboratory Culture and Identification

2.6.1 Non-selective pre-enrichment

The swab sample obtained was inoculated into the already prepared peptone water and then incubated at 37 degrees Celsius for about 24 hours.

2.6.2 Selective Plating

A loopfull of inoculum from the incubated peptone water was taken and streaked on MacConkey, Eosine methylene blue and Manitol salt agar simultaneously across the surface of a whole agar plate in a quadrant streak pattern (avoiding the edges of the plate). The plates were incubated at 37°C for 24 hours. Suspected colonies were sub-cultured into nutrient agar slant at 37°C for 24 hours to obtain a pure culture. Colonies were observed and taken for preliminary identification.

2.6.3 Non selective plating

The samples were inoculated on nutrient agar directly from the enrichment medium (peptone water) by streaking with a wire loop across the surface of a whole agar plate in a quadrant streak pattern (avoiding the edges of the plate). The plate was incubated at 37°C for 24 hours and the growths were differentiated based on morphology.

2.7 Preliminary Identification

Preliminary screening and identification of the organism were conducted using Gram staining, oxidase and catalase test.

2.8 Biochemical Characterization of Isolates

Conventional Biochemical Characterization

Biochemical test such as indole test, methyl red test, citrate test, urease test, Voges proskauer test, sugars (glucose, inositol and manitol), was performed (Cheesbrough, 2006).

2.9 Questionnaire Administration

A total number of ninety-five (95) questionnaires were distributed between January and February 2023 to 43 canteen owners and 52 workers from the 43-canteen sampled to ascertain the level knowledge and analysis of risk factors that are concerned with both personal and general hygiene practices towards food consumption. Questionnaire data were analyzed using descriptive tables and graphical analysis method with the use of Statistical Package for Social Science (SPSS v.21) software.

3. RESULTS

Table 2: Number of Growth of microorganisms on different media

Media	Growth	No Growth	Total
Nutrient agar	381 (97%)	9 (2.3%)	390
Eosine methylene blue agar	85 (21.8%)	305 (78.2%)	390
MacConkey agar	266 (68.2%)	124 (31.8%)	390
Mannitol salt agar	37 (9.5%)	353 (90.5%)	390

Table 3: Biochemical reactions of the suspected bacterial isolate

S/N	Organism	BIOCHEMICAL REACTION						
		Number of Positive						
		Oxidase	Catalase	Indole	MR	VP	Citrate	Urease
1	<i>Staphylococcus</i>	0	30	0	30	30	30	30
2	<i>Streptococcus</i>	0	0	0	15	0	15	0
3	<i>E.coli</i>	0	41	41	41	0	0	0
4	<i>Bacillus</i>	0	27	0	20	27	27	0
5	<i>Proteus</i>	0	8	0	8	0	8	8
6	<i>Klebsiella</i>	0	10	0	0	10	10	10
		Number of Negative						
1	<i>Staphylococcus</i>	30	0	30	0	0	0	0
2	<i>Streptococcus</i>	15	15	15	0	15	0	15
3	<i>E.coli</i>	41	0	0	0	41	41	41
4	<i>Bacillus</i>	27	0	27	27	0	0	27
5	<i>Proteus</i>	8	0	8	0	8	0	0
6	<i>Klebsiella</i>	10	0	10	10	0	0	0

Table 4: Biochemical reaction of the bacteria suspected isolates.

S/N	Biochemical Reaction	Organisms					
		<i>Staphylococcus</i>	<i>Streptococcus</i>	<i>E. coli</i>	<i>Bacillus</i>	<i>Proteus</i>	<i>Klebsiella</i>
1	Gram reaction	+	+	-	+	-	-
2	Catalase	+	-	+	+	+	+
3	Oxidase	-	-	-	Variabl e	-	-
4	Indole production	-	-	+	-	-	-
5	VP	+	-	-	+	-	+
6	MR	+	+	+	-	+	-
7	Urease	+	-	-	-	+	+
8	Motility	-	-	+	+	+	-
9	Citrate	+	+	-	+	+	+
10	Shape	Cocci	Cocci	Rod	Rod	Rod	Rod
11	Gas	-	-	+	-	+	+
12	H ₂ S	-	+	-	-	+	-
	Total						

Key: + positive, – negative

Table 7: Demographic Information

	Frequency	Percentage (%)
• Age		
< 20 years	2	2.1
21-30 years	50	52.6
31-40 years	24	25.3
41-50 years	16	16.8
51-60 years	3	3.2
Total	95	100.0
• Educational Qualification canteen owners and staff		
No Education	11	11.6
Primary Level	16	16.8
Secondary Level	46	48.4
Tertiary Level	22	23.2
Total	95	100.0
• Type of duty Performed in Canteen		
Worker	52	54.7
Canteen Owner	43	45.3
Total	95	100.0
• Canteen Respondent Location		
Main Campus Uni-Abuja	74	77.9
Mini Campus Uni-Abuja	21	22.1
Total	95	100.0

Table 5: Micro -organisms isolated in various swab samples from canteens at University of Abuja

Bacteria	Plates	Refrigerator handle	Table top
<i>Staphylococcus</i> species	+	+	+
<i>Streptococcus</i> species	+	+	+
<i>Escherichia coli</i>	+	+	+
<i>Bacillus</i> species	-	+	+
<i>Proteus</i> species	-	+	-
<i>Klebsiella</i> species	+	-	-

Key +; present; - not present

Table 6: Distribution of bacterial isolates and their percentage prevalence from the study.

Bacterial isolate	Frequency	Plates	Refrigerator handles	Table tops	Percentage prevalence (%)
<i>Staphylococcus</i> species	30	7	8	15	22.9
<i>Streptococcus</i> species	15	4	6	5	11.5
<i>E. coli</i>	41	10	22	9	31.3
<i>Bacillus</i> species	27	8	7	12	20.6
<i>Proteus</i> species	8	3	2	3	6.1
<i>Klebsiella</i> species	10	5	3	2	7.6
TOTAL	131			TOTAL	100

Table 7: Demographic Information

	Frequency	Percentage (%)
• Age		
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21-30 years	50	52.6
31-40 years	24	25.3
41-50 years	16	16.8
51-60 years	3	3.2
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Total	95	100.0
• Canteen Respondent Location		
Main Campus Uni-Abuja	74	77.9
Mini Campus Uni-Abuja	21	22.1
Total	95	100.0

Table 8: Comparison between main and mini campus

				Count	Column N %
If they use disinfectants to clean serving tables					
Canteen	Main Campus	Canteens Clean serving	No	60	63.2%
Respondent	UniAbuja	Tables with Disinfectants	Yes	14	14.7%
Location		on regular basis	Total	74	77.9%
	Mini Campus	Canteens Clean serving	No	18	18.9%
	UniAbuja	Tables with Disinfectants	Yes	3	3.2%
		on regular basis	Total	21	21.1%
If operators often clean food contact surfaces before and after preparing food to sell					
Canteen Respondent	Main Campus	Operators often clean Food	No	60	63.2%
Location	UniAbuja	Contact Surfaces before & after preparing Food to Sell			
	Mini Campus	Operators often clean Food	Yes	14	14.7%
	UniAbuja	Contact Surfaces before & after preparing Food to Sell	Total	74	77.9%
			No	14	14.7%
			Yes	7	7.4%
			Total	21	22.1%

Figure 1: Histogram of canteen staff who has had previous training on food safety skills

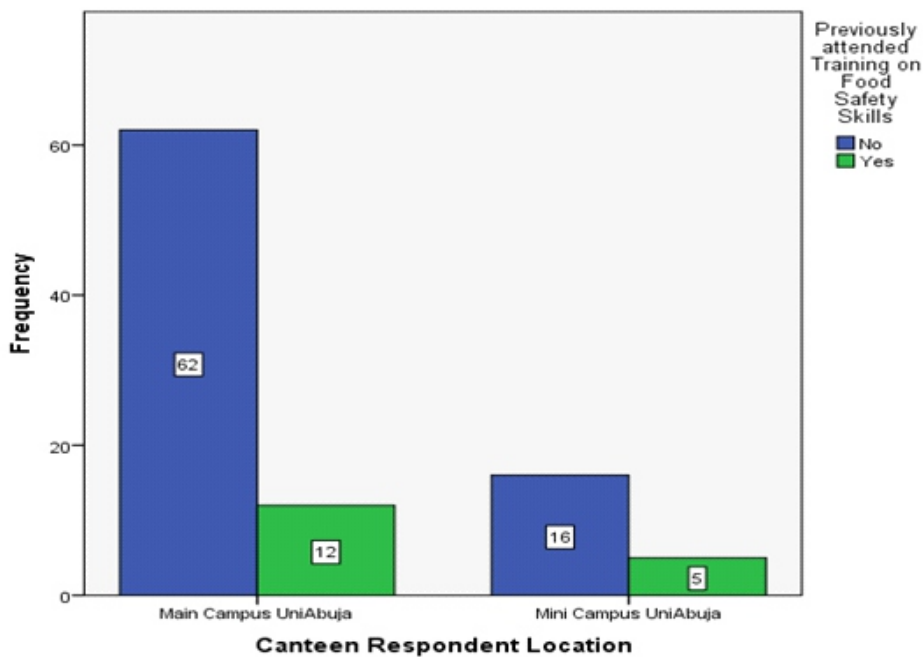


Figure 2: Canteen operators accept that improper food handling is the major cause of food contamination in Uniabuja Canteens

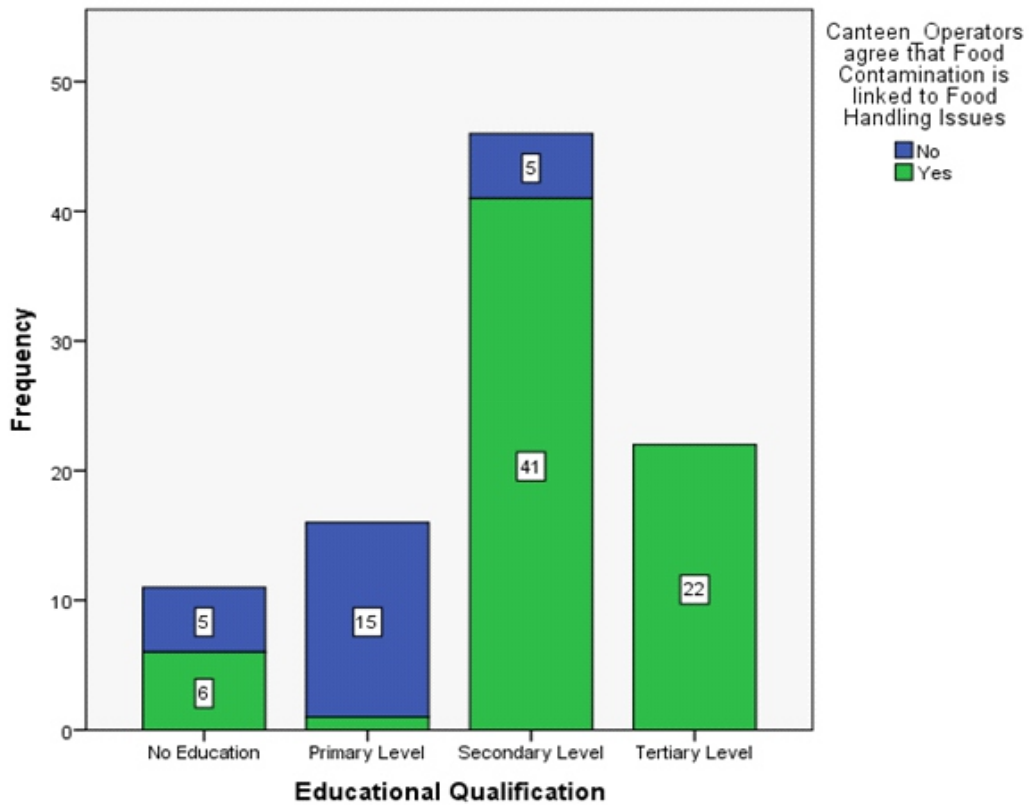


Figure 3: Canteen operators disagree that hand washing with soap/water is a personal hygiene practice they observed after using Bathroom

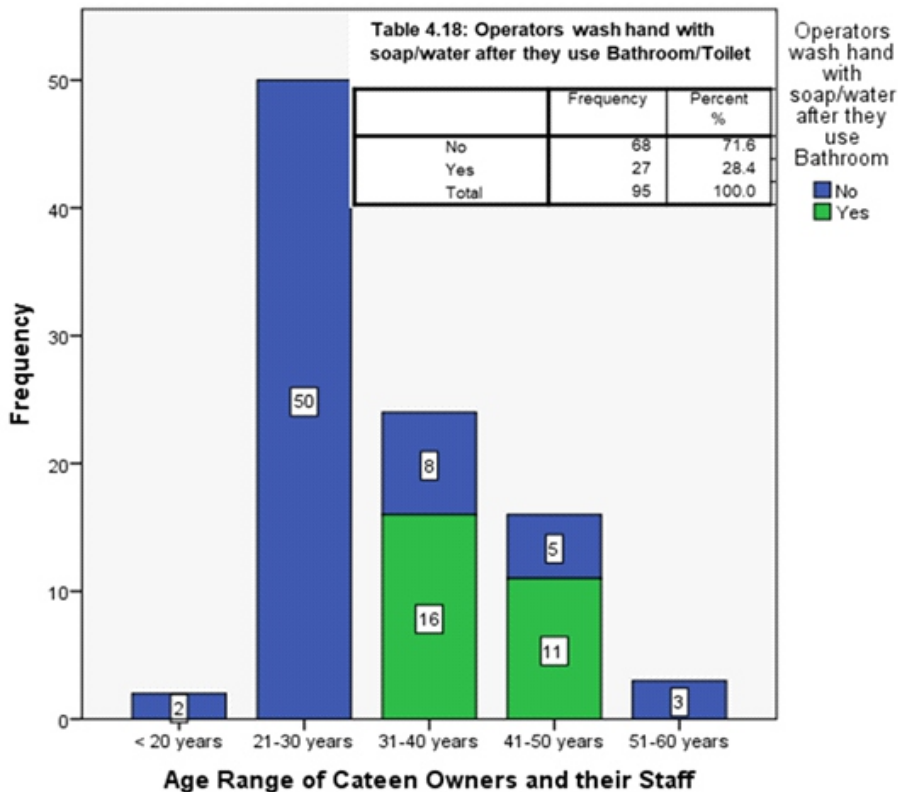
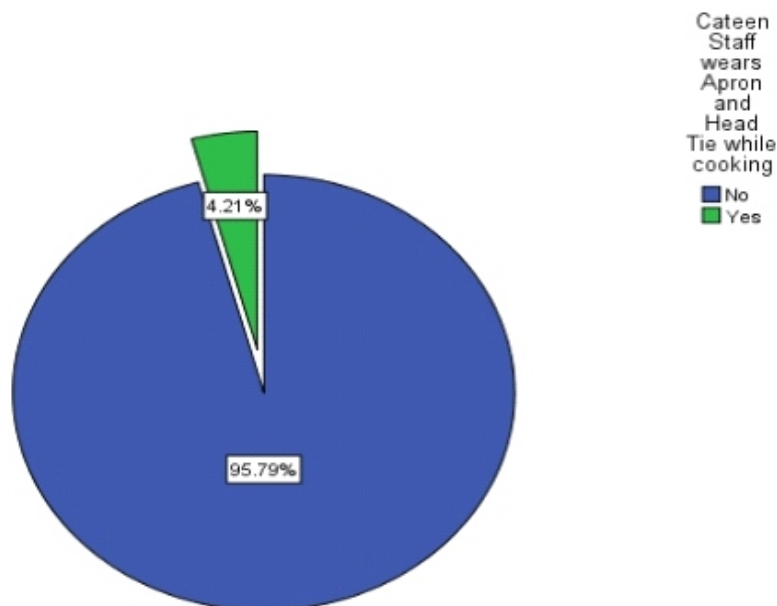


Figure 4: Uniabuja canteen staff confirmed head Tie and Apron are not used regularly while cooking



4. DISCUSSION

From the 390 samples analyzed, six (6) bacteria organisms were isolated as shown on Table 6. 30 were positive for *Staphylococcus*, fifteen (15) positive for *Streptococcus* species, forty-one (41) positive for *E.coli*, twenty-seven (27) positive for *Bacillus* species, eight (8) positive for *Proteus* species, ten (10) positive for *Klebsiella* species which shows the prevalence of 22.9%, 11.5%, 31.3%, 20.6%, 6.1%, 7.6% respectively. However the pathogen isolated in this present study are similar to microorganism reported by (Okonko *et al.*, 2008). The result obtained shows that *E. coli* has the highest prevalence in both main and mini campus which was higher than the prevalence found by (Ajao and Atere, 2009). The microbes could have contaminated the food from variety of sources including animal skin, feces, utensil and raw food product. The prevalence of *Staphylococcus* species was higher than that of (Ajao and Atere, 2009) who had 17.5% prevalence of *Staphylococcus* species from apron, hand towel sample, money, and palm swab. The coliform isolated from the surface sample could probably have come from the raw materials, water, dust, and palm of the food handlers. *Streptococcus*, *Proteus*, and *Staphylococcus* isolated from refrigerator handle, table tops and plates is evidence of cross contamination

The diversity in sociodemographic and socioeconomic position, timing of the study, and study tool utilized could all be contributing factors to the discrepancy in food hygiene practice level. More than half of the study participants practiced poor food hygiene, which could have a significant impact on the pathogenesis of disease. Foodborne illnesses are largely caused by improper food handling, according to the Codex Alimentarius Commission's 2003 report. Several other studies conducted among food handlers at universities in Ethiopia also revealed that food handlers were vehicles of disease-causing microorganisms such as *Shigella* and *Salmonella* (Dagnew *et al.* ,2013). Research among Arba Minch University food handlers also found that 6.9% of *Salmonella* and 3% of *Shigella* isolates were found in stool cultures (Mama and Alemu 2016). To ensure proper food handling and to develop rules for food safety and hygiene, a culture of food safety is necessary (De Andrade *et al.*, 2020). Experienced food handlers had reported better food hygiene practice. This association is consistent with earlier studies conducted regarding food hygiene practice and

determinant factors (Legesse *et al.*, 2017; Meleko., 2015; Sharif *et al.*, 2013). However other studies reported that work experience has no association with level of food safety practice (Baluka *et al.*, 2015). Work experience is crucial to improving food hygiene practices since it gives employees more opportunities to receive orientation and training in this area.

It has been observed that Knowledge, attitude and practice of food safety play a basic role in preventing and controlling food poisoning outbreaks (Sani *et al.*, 2014).

From Figure 1, the grouping of canteen operators' response by location (Main and Mini Campus). 62 or 84% canteen personnel out of seventy-four (74) workforce surveys in main campus have never been trained on food safety skills, compared to only twelve (12) personnel with previous training experience. Also, for canteen group in mini campus, 76% or sixteen (16) personnel out of twenty-one (21) respondents have not had any form of training on food safety management skills.

Figure 2 shows that the higher the level of educational qualification obtained by canteen owners or workers, the higher the acceptance rate (73.7% or 70 yes responses) that incorrect handling of food prepared and served in their canteen domain can cause food contamination by microorganism.

Figure 3 combined with result in Table 9 suggest that, regardless of the age factor of the canteen owner or workers, 71.6% or 68 personnel out of 95 respondents do not wash their hands with soap after making use of toilet and bathroom.

In Figure 4, 95.8% of the canteen personnel confirmed that head covering and apron are not used regularly while cooking.

The questionnaire survey conducted during the research reveals the extent of awareness. Despite this, canteen operators and workers have not ensured proper hygiene to prevent potential transmission of pathogenic organisms to students and staff of the institution, highlighting a gap in understanding contaminants effects on humans. In the present study, the respondents were mainly within the ages of 20 - 60 years old, female with either a secondary or tertiary level of education and operating in university of Abuja which is an urban area. This trend is similarly observed in previous studies where the food vendors are predominantly female (Monney, *et al.*, 2013; Nurudeen, *et al.*, 2014; Musa and Akande, 2003; Afolaranmi, *et al.*, 2015; Tessema, *et al.*, 2014; Okojie and Isah, 2014) within the ages of 20 - 40 years old (Chukuezi, 2010; Musa and Akande, 2003) and have either a secondary or tertiary level of education (Okojie and Isah, 2014). On the contrary, some studies have observed that food vendors were predominantly male (Muinde and Kuria 2005; Duse, 2003) with no education or primary education as the highest level of education attained (Nurudeen, *et al.*, 2014; Afolaranmi, *et al.*, 2015; Musa and Akande, 2003; Bamidele, *et al.*, 2015).

In the present study, it was found that the majority of respondents had good understanding of the food vendors' knowledge of food hygiene. This finding was comparable to several previous studies conducted in Nigeria (Afolaranmi, *et al.*, 2015; Bamidele, *et al.*, 2015). The majority of food vendors, however, were found to have poor knowledge of food hygiene, according to studies from Ethiopia, Malaysia, Iran, Korea, and Thailand (Tessema *et al.*, 2014; Rahman *et al.*, 2012).

It is tempting to suggest that the majority of respondents in the current study had either a secondary or tertiary level of education, which may have served as a foundation for increased comprehension of information about food hygiene and consequently improved knowledge. This would explain

why the majority of food vendors in the study had a high level of knowledge. According to Kalua (2001), knowledge positively influences the development of attitudes; in other words, attitudes can be viewed as a reflection of knowledge, which is connected to personal beliefs and prior experiences. This explanation may help to explain the findings of the current study, which showed that the majority of respondents had good knowledge of food hygiene and an attitude toward it that was congruent with this knowledge.

This pattern was also seen in a study conducted in Malaysia (Rahman, *et al.*, 2012), where the majority of respondents had poor knowledge and attitude, and in earlier studies conducted in Nigeria (Bamidele, *et al.*, 2015), where the majority of respondents had good knowledge and attitude. Thus, the level of personal and environmental hygiene in the present study appears to be fairly high, which is comparable to some other studies (Martins, 2006; Von and Makhoane, 2006) whose authors contend that because food vendors must rely on repeat business from customers to maintain and sustain their livelihood, they are more likely inclined to produce relatively safe food by maintaining the minimum required level of hygiene standard.

According to Chukueze, (2010) it is not necessary to require food vendors to undergo medical examinations before they do business operations or at regular intervals thereafter, because doing so does not appreciably increase food safety. Nevertheless, there is always a chance that food vendors could be healthy carriers of disease and infect customers; as a result, it is in the consumer's best interest for all food vendors to be scrutinized.

Further analysis revealed that the level of knowledge, attitude and formal training were significantly associated with food hygienic practices of the respondents. This was consistent with a number of studies; in Malaysia by Rahman *et al.*, (2012), where knowledge, attitude and training were significantly associated with practice, in Nigeria by Afolaranmi *et al.*, (2015), where knowledge and training were significantly associated with practice, in Ethiopia and Thailand by Tessema *et al.*, (2014) respectively, where both studies reported that, knowledge was significantly associated with practice. On the other hand, a study in Nigeria by Out, (2014) reported that attitude was not significantly related to practice, and a study in Ghana by Rheinländer *et al.*, (2008) reported that knowledge was not significantly related to practice. These findings were attributed to the existing socio-cultural context, which most likely had a greater impact on safe food practices. The World Health Organization (WHO) has stated that the use of aprons and hair covers by food vendors has more to do with aesthetics and consumer assurances than food safety, despite the low level of food hygienic practice observed in the present study as shown by their practices like 4.1% of wearing apron and head ties as an indication of low level of hygiene (World Health Organization 1996).

5 Conclusion

The hygienic condition of foods canteens at both campuses of the University of Abuja was analyzed by means of cultural methods, well-structured questionnaire, and standard biochemical test. The prevalence of pathogenic bacteria on food preparation surfaces was also determined in this research. With regards to the findings of the current research, it can be inferred that there is high occurrence of *E. coli* that can be isolated from food contact surfaces in both campuses of the university of Abuja due to the unfavorable hygiene condition of food handlers as shown in the questionnaire survey carried out in this research

Conflict of Interest

The researchers and mentors declare no conflict of interest.

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