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BACTERIOLOGICAL QUALITY ASSESSMENT OF SOME READY TO EAT FOOD SOLD IN KUST WUDIL CAMPUS

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ABSTRACT
Food borne illness as a result of microbial contamination of foods is an important public health problem that needs to be addressed. Studies on bacteriological quality of some ready to eat foods sold in Kano University of Science and Technology, Wudil campus was carried out. A total of ten (10) samples of ready to eat foods (Jollof rice, Moi-moi, rice and stew, Dumplings and Massa) were randomly collected from different food vendors and restaurants in KUST, Wudil campus. Bacteriological analysis were carried out to determine the aerobic plate count, total coliform count as well as isolation and identification of bacteria of public health importance using standard microbiological methods. The viable mesophilic bacterial counts of the food samples were ranged from $3.7x10^3$ to $7.6X10^4$cfu/g. Escherichia coli, Klebsiella species, Salmonella species, Pseudomonas aeruginosa and Shigella species were isolated across all the food samples. Microbiological quality control programs and aseptic techniques of the food handling for food vendors and food safety practices should be encouraged, local processors of foods should be enlightened on hygienic methods of processing, preservation and storage of the foods.
Keywords; Ready to eat foods, foodborne pathogens microbiological quality, food safety.

INTRODUCTION

Bacterial food spoilage is any sensory change (tactile, visual, olfactory or flavour) which makes food to be unacceptable for consumption. Spoilage may occur if there is improper handling, cooking, cooling, unhygienic preparation and consumption (Saba *et al.*, 2012). Symptoms of food borne illnesses include: diarrhoea, vomiting, abdominal cramp and nausea (Nweze, 2010); most of which are caused by *Staphylococcus aureus, Salmonella* species*, Clostridium perfringens, Clostridium botulinum, Campylobacter, Vibrio parahaemolyticus, Bacillus cereus and* Entropathogenic *Escherichia coli.* Food safety depends on conditions necessary during the production, processing, storage, and preparation of food to ensure that it is safe, sound, wholesome, and fit for human consumption (FAO/WHO, 2003).

In Nigeria, the unhygienic handling of foodstuff, health status of food vendors, poor sanitary conditions of markets, absence of adequate waste disposal facilities, use of contaminated water and kitchen equipment and poor storage affect food safety (WHO, 2007). However, because there is limited information on the bacteriological assessment of some ready to eat food in Kano University of Science and Technology Wudil campus, this study assessed the bacteriological status of some commonly consumed food in Kano University of Science and Technology Wudil campus.

Ready-to-eat foods sold in food service centres are conveniently consumed by diverse group of people including students, workers and other staffs. This is mainly due to lack of time for home cooking of meals. However, when food poisoning out breaks are investigated, it has been shown that small and medium food service centres are often important locations in the transmission of food-borne illness (Walker *et al.,* 2003; Birgen *et al.,* 2020) In fact, food-borne diseases are the most widespread health problems in the contemporary world and an important cause of reduced economic productivity. Research studies have clearly indicated that biological contaminants are the major cause of food-borne diseases (WHO, 1992). In the developing world including Nigeria, health risks are associated with initial contamination of raw foods with pathogenic bacteria and subsequent contamination by food handlers during preparation from cross-contamination, survival of pathogens during preparation and microbial proliferation after cooking of food, as well as during holding of cooked foods (Bryan, 2002).

The use of bare hands to feel the adequacy of cooking increases level of contamination as enteropathogens can survive on the hands for three hours or longer (Mensah *et al.* 2002).The container in which foods are served is an important risk factor, similarly, use of polythene bags, papers and leaves in wrapping ready-to-eat foods also increase risk of contamination. The papers used for packaging some ready to eat foods are usually newsprint of questionable origin. Leaves are usually wiped with a piece of cloth without washing or disinfecting. Moreover, micro-flora on leaves and microbes acquired through poor handling of foods could be transferred to ready-to-eat foods (Mensah *et al.,* 2002). Handling of food at ground level also increases risks of contamination because dust could easily get into cooked foods. There is also a risk of contamination associated with exposure of food to flies (Birgen *et al.,* 2020). The preparation of pounded yam involves pounding the staple after cooking by means of a mortar and pestle and turning the stiff dough with bare hands (Mensah *et al* 2002). The fact cannot be overemphasized that ready-to-eat foods sold in food service centres pose a direct health hazard to consumers if they contain an infective dose of pathogens or toxic levels of their toxins (Adesetan *et al*., 1995).

Due to food spoilage, one-third of the world's food produced for the consumption of humans is lost every year. Bacteria and various fungi are the cause of spoilage and can create serious consequences for the consumers, but there are preventive measures that can be taken hence the need of this research in the area.

MATERIALS AND METHODS

Sample collection

The method described by Fawole and Oso (2001) was adopted, in this method about 100g portion of Jollof rice, Beans dumpling, Massa and Vegetable soup from different vendors at KUST Wudil campus were carefully transfer into the sterile sample containers which were covered tightly, labelled and transported on ice to prevent bacterial multiplication during samples transportation to Microbiology Laboratory, Kano University of science and Technology, Wudil and immediately.

Sample Preparation

Ten (10) grams portion of each food sample were homogenized by blending in 100mL of peptone water to make a stock solution. Further, this was labelled as 1:10 dilution which is also the stock or homogenate. This was further serially diluted to $1:10^5$. By taking 1ml of the homogenate and transferred to the next test tube ($1:10^2$). It was then continued serially up to ($1:10^5$). Approximately, 1ml of the appropriate dilution from each tube was seeded in plate count agar using pour plate method, and then incubated at 37°C for 24h under aerobic atmosphere for total aerobic plate count as described by Adesetan *et al.* (2013).

Pure culture of isolate were obtained by repeated subculture on some selective media (i.e MacConkey, CLED, blood agar and SSA agar) and characterized based on colonial morphology, microscopy (Gram staining), and biochemical tests as described by Cheesbough, (2012).

RESULTS AND DISCUSSION

Bacteriological analysis of ready to eat food samples collected from KUST Wudil campus revealed the samples to have high bacterial and coliform count (MPN). From table one, the highest bacterial count was obtained in sample one of rice ad stew (R1) ($7.6x10^4$cfu/ml) while moi-moi sample (M2) has the lowest counts of ($3.7x10^3$cfu/ml). Furthermore, the result of total coliform count of the food samples through which jollof rice (sample 2) has the highest coliform count of 17 while rice and stew (sample 1), beans dumpling (sample 2) and jellof rice (sample 1) had the lowest coliform count which is within the normal range.

Table 1. Bacterial Plate Count Table and Coliform Count Using MPN

S/N	SAMPLES	BACTERIAL COUNT(cfu/ml)	TOTAL COLIFORM COUNT
1	R1	$7.6x10^4$	2
	R2	$4.0x10^4$	6
2	B1	$5.7x10^3$	4
	B2	$4.3x10^3$	2
3	M1	$9.1x10^3$	6
	M2	$3.7x10^3$	7
4	J1	$3.2x10^4$	2
	J2	$6.5x10^4$	17
5	MS1	$1.4x10^4$	7
	MS2	$8.8x10^3$	6
	NAFDAC AND WHO STANDARD	**(1 $x10^2$ cfu/ml)**	**0 (ZERO)**

KEYs; J_1=Jellof rice 1 , J_2= Jellof rice 2, Ms_1=Massa 1, Ms_2=Massa 2, B_1= Beans dumpling 1, B_2= Beans dumpling 2, M_1= Moi-moi 1, M_2= Moi-moi 2, R_1= Rice and stew 1, R_2= Rice and stew 2.

In comparison; WHO/NAFDAC (2008) water standard stated that all eatable substances directly intended for eating or drinking, *E. coli* and thermotolerant coliform bacteria must not be detectable in any 100 ml of sample. NAFDAC/WHO; total bacterial count standard for food was given as **(**1 $x10^2$ cfu/ml**)** for food to became safe for consumption.

This contamination might be from the exposure of these foods to the environment, since microorganisms are widely distributed in the soil and atmosphere. Since micro-organisms are widely distributed in the soil and the atmosphere, contamination of these products during processing and handling is expected. In this study the high count of bacterial count given range of $7.6x10^4$ CFU/ml to $3.7x10^3$ CFU/ml, in study done earlier Similar high counts of 2.4 x 10^6 to 1.7 x 10^7cfu/ml were observed in food condiments sold in a local market (Ogbadu *et al* 2002). The presence of bacterial such as *Escherichia coli, Klebsiella* species, *Salmonella* spp., *Pseudomonas aeruginosa* and *Shigella* spp. from 'Jollof rice', 'Moi-moi, 'beans dumpling, 'Rice & stew and 'Massa' was high and is in agreement with other studies earlier described (Zeru and Kumie, 2007). The presence of *E. coli* in this study might be attributed to the heat processing failure or post-processing contamination, faecal contamination and poor hygienic practice of food handlers.

Table 2. Frequency of Occurrence of Bacterial species

SAMPLE	*Salmonella spp*	*E. coli*	*Shigella spp*	*K. pneumoniae*	*Ps. aeruginosa*
R1	_	+	+	+	-
R2	+	+	-	+	-
B1	-	+	+	+	+
B2	-	-	+	+	+
MS1	-	+	+	-	+
MS2	+	+	-	-	+
J1	-	+	-	+	+
J2	+	-	+	+	-
M1	-	+	+	-	+
MS2	+	-	+	-	+
Total	4	7	7	6	7
Percentage (%)	12.90%	22.58%	22.58%	19.35%	22.58%

KEYS; + means= presence and – means = Absence.

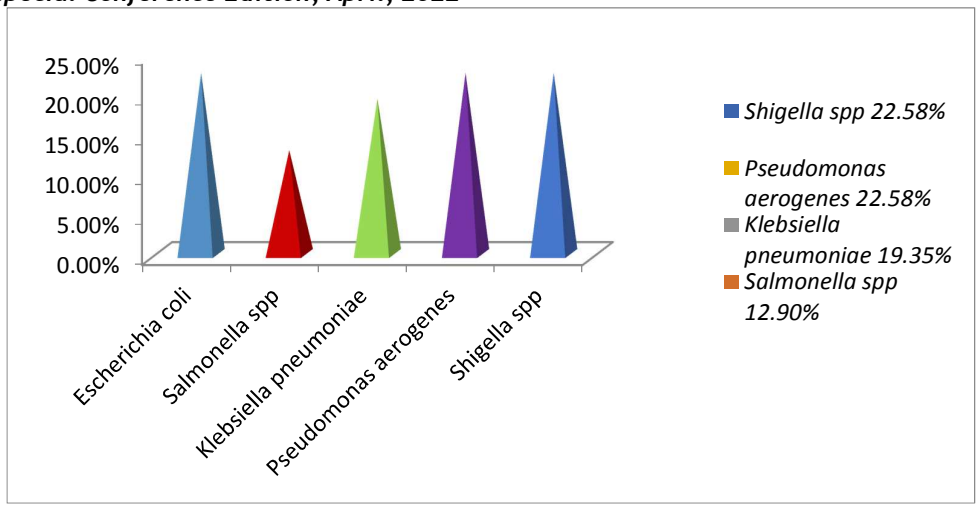

Figure 1: Percentage occurrence of bacterial isolate found on each food sample

The presence of total coliform in street-vended foods can be linked to contamination resulting from inappropriate processing, incomplete heating, used of contaminated water during preparation and washing or secondary contamination via contact with contaminated equipment such as chopping boards, knives, and serving wares (Weil *et al*., 2006). In this study the total coliform count ranges from 17 to 2/100ml which does not correspond to the standard total coliform count of 0/100ml. This contamination can be introduced into the foods during handling, processing or vending (Sandel and McKillip, 2004). In this study Salmonella and Shigella species were also detected. This is not consistent with previous work done on 'Sambusa' and 'Macaroni' in Ethiopia (Muleta and Ashenafi, 2001). Usually, it is difficult to predict the association of Salmonella Shigella species with specific food products. But in some situations the *S. enteritidis*, can be associated with beef, meat, milk poultry and eggs or egg products. The presence of *Salmonella* and *Shigella* species might be due to the ingredients used in the foods during preparation. In this study *E. coli*, *Shigella* spp. and *Pseudomonas* spp. contamination were confirmed in 22.58% samples of Massa, Moi-moi, Beans dumpling, jollof rice and Rice & stew. These results were higher that than obtained by (Hamid 2008) who revealed that *E. coli* contamination were found in 14.2% and 12.6% of examined samples respectively. Tessi *et al*. (2002) reported *E. coli* contamination in 6.34% of ready-to-eat cooked food samples. Observational studies have shown that Kano University of Science and Technology, Wudil campus is overcrowded and the mobility of people is high, because it is the area where commercial internet café and cafeteria place are found. There are a number of food vendors and consumers at Kano University of Science and Technology, Wudil campus. But the foods are displayed and sold openly at very dirty surrounding. This can easily be contaminated by dust, insects, and hands of intending consumers. The contamination levels of coliform and *E. coli* were higher in food samples. This could be the use of unhygienic water for cleaning utensils and cooking of foods. Observational study, a continuous supply of tap water is not steady around consumers in Kano University of Science and Technology, Wudil campus. Therefore food vendors typically do not have clean water supply for drinking, cleaning and cooking. They are obliged to store water, often using for this purpose wide mouth storage vessels that permit the introduction of hands and utensils. In addition, they use water from unsafe sources such as wells and surface water consequently contaminated by faecal matter.

CONCLUSION

The findings of this study revealed that ready-to eat foods sold at Kano University of Science and Technology, Wudil were contaminated with high bacterial count of $7.6x10^4$ and presence of pathogenic bacteria such as *E. coli, Shigella* sp., *Pseudomonas aeruginosa,* and *Klebsiella* sp. The possible sources of these contaminants are due to the unhygienic manner of handling food in the restaurant. This implies that these ready-to-eat foods are viable source of various diseases. Some of these diseases could spread and acquire epidemic status which poses serious health hazards. Irrespective of the presence of these gram negative and gram positive bacteria in ready-to-eat foods analyzed, it is believed that cooking processes and hygiene could greatly reduce the microbial load to harmless level.

Conclusively, the presence of these microorganisms in food courses food spoilage and food poisoning. Food should not only be nutritionally balanced, but should be microbiologically safe as well. From the result gotten, it was indicated that these ready to eat food samples did not meet the bacteriological quality standard (WHO, 2007). More closely, supervision should be made on these restaurants around the Kano University of Science and Technology, Wudil community by relevant authorities, and further studies should be carried out on other food samples sold in the community, to ensure proper food quality standard.

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