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MICROBIOLOGICAL ASSESSMENT OF READY TO EAT FOOD FROM SELECTED STREET VENDING FOOD LOCATIONS IN IKPOBA-OKHA LOCAL GOVERNMENT AREA OF EDO STATE

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ABSTRACT

This study was conducted to analyse the microbial quality and public health effect of ready to eat food from different street food vending locations in Ikpoba-okha Local Government Area (LGA). The mean total viable plate counts (TVC) for bacteria and fungi were ascertained with the spread plate methods using nutrient agar and potato dextrose agar media respectively. The results indicated a mean TVC ranging from 5.41 x 10^4 to 2.80 x 10^3 and 3.57 x 10^5 to 3.18 x 10^3 for bacteria and fungi respectively. The highest bacterial counts of 5.41 x 10^4 was obtained in food samples collected from Street Vending location (SFL) 7 while the highest fungal counts of 3.57 x 10^5 was obtained from food samples collected from SFL 4. The characterization and identification of microbes showed the presence of nine (9) bacteria. The bacteria and their percentage of occurrence are: *E. coli* (40%), *Streptococcus* spp (50%), *Staphylococcus aureus* (60%), *Pseudomonas aeroginosa* (90%), *Salmonella* spp (30%), *Enterobacter* spp (50%), *Bacillus cereus* (40%), *Micrococcus* spp (30%), *Alcaligenes faecalis* (10%). It also showed the presence of Four (4) fungi. The fungi and percentage of occurrence are: *Rhizopus* spp (50%), *Aspergillus flavus* (40%), *Aspergillus niger* (40%) and *Mucor* spp (60%). The data obtained showed that *Pseudomonas aeroginosa* and *Mucor* spp were dominant in foods obtained from all the locations. The findings of this study shows that most of the ready to eat food samples examined did not meet microbiological quality standards. Hence, it is recommended that adequate and proper measures to ensure good quality of ready to eat foods from street food vending locations in Ikpoba-okha should be put in place by relevant authorities.

Keywords: Street foods, Public health, Food quality, Microbiological assessment, Hygiene, Contamination

INTRODUCTION

In Nigeria and all over the world, ready to eat foods sold by different food vendors, are consumed daily by numerous consumers. The ready to eat foods play an important socio-economic role in meeting food and nutritional requirements of city consumers at affordable prices to the lower and middle income groups and are appreciated for their unique flavours and convenience (**Muzaffar *et al*., 2009**). Asides provision of ready-made instant meals at relatively low prices, teeming urban dwellers are attached to street foods because of it gustatory attributes. These attributes are linked to the culinary prowess of the vendors (**Alimi *et al*., 2016; Choudhury *et al*., 2011**). In contrast to these potential benefits, it is also recognized that ready to eat food are often highly contaminated by microbes as a result of food vendors who are often poor, uneducated, and lack knowledge in safe food handling, and hygiene, mode of food display, food service and hand washing, sources of raw materials, and use of potable water. Consequently, ready to eat food are perceived to be a major public health risk (**Bhowmik, 2010**). Contamination of ready to eat food is as a result of so many factors such as preparation methods, poor packaging, indiscriminate waste disposal, poor sanitation, poor hygiene of food handlers, exposure of food to open air, contaminated kitchen equipment and utensils, contaminated water used in washing kitchen equipment and utensils and used for preparing food, contaminated food vending surfaces and too many people clustering around the food vending area (**Omemu and Aderoju, 2008**). In cases of people clustering around food vending area, microbes, dust particles and even spittle can be introduced into the open food as consumers struggle to be attended to.
There has also been an observed increase in the patronage of ready to eat food vendors within Benin-City, Edo State, Nigeria (**Wogu *et al*., 2011**) and especially in Ikpoba-okha Local Government Area (LGA) of Edo State (**Okareh *et al*., 2015**) . However, their poorly regulated operations raise serious questions about food safety and hygiene standard, as well as monitoring by relevant authority (**Barro *et al*., 2006; Abdalla *et al*., 2008**). Ikpoba-okha is a fast growing urban centre, expanding rapidly in size and population and is characterised by people on the move; this creates a suitable environment for ready to eat food trade which unfortunately operates under unsanitary conditions. This study is aimed at analysing the public health risk of ready to eat food by carrying out a microbiological assessment of the ready-to-eat food in selected street food vendors in Ikpoba-okha LGA.

MATERIALS AND METHODS

Study Area

This study was carried out in Ikpoba-Okha local government area of Edo State, located in the South-South geopolitical zone of Nigeria. Ikpoba-Okha is a densely populated town with a total population of 372,080 according to the 2006 population census conducted by the National Population Commission of Nigeria, and with an increase to 487,400 estimated projection for 2016. Ikpoba-Okha is the second LGA with the highest population in Edo State (NPC 2006). The inhabitants of the area are mainly small to medium scale business owners, farmers, artisans, civil servants, bankers, and students. The people are a combination of Christians, Muslims, and traditionalists. Major languages spoken are English, Pidgin English and Edo. Ten (10) street food vending location coded as SFL 1-10 (Upper mission extension, Aduwawa road, Agbor road, M.M Way, Upper sakponba road, Third east circular axis, Sapele road, Ologbo, Idogbo and Urora respectively), which are mostly patronised by consumers in LGA were selected for this study.

Sample collection

Three (3) different food samples were collected from each street food vending location, particularly Rice (White rice and stew, jollof and fried rice), soup (vegetable, okra and Egusi soup), and beans (with and without oil). Making a total of thirty (30) food samples. The food samples were collected with the dishing spoons used by the food vendors, packaged into sterile containers and were immediately transported to the laboratory for microbiological analysis.

Viable colony count and Isolation of Microbes

10g of each food sample was weighed and ground in a sterile mortar. 90ml of distilled water was poured into the mortar, the mixture was homogenized and used as stock followed by serial dilutions. Serial dilutions of up to 10^{-6} were made. A 0.1ml of serial dilutions 10^{-3}, 10^{-4} and 10^{-5} were cultured on Nutrient Agar (bacterial plate count) and Potato Dextrose Agar (fungal plate count) using the spread plate technique with a sterile glass rod. The petri dishes for the bacterial plate count were incubated at 37^{0}C for 24h. The number of colonies seen were counted using a colony counter and recorded as colony forming unit per gram (cfu/g). The petri dishes for the fungal plate count were incubated at room temperature for 4 days and then examined for fungal growth.

Characterization and identification of microbes

Macroscopic examination and biochemical analysis of different isolates obtained from the different plates were accessed to identify the organism to the species level, using Bergey's manual of determinative bacteriology. The growth portion of the fungal mycelia on the Potato Dextrose Agar medium was cut and placed on grease free microscopic slide containing few drops of Lacto phenol cotton blue, and covered with a cover slip. The mycelium was then examined under the microscope at a magnification of x10.

RESULTS

The frequency and percentage of thirty street vended food samples collected from ten (10) street food vending location mostly patronised by consumers in Ikpoba-Okha LGA is shown in the table 1 below. Some of the food samples collected and analysed were beans (without oil) (26.7%), Jollof rice (20%), Egusi soup (13.3%)

Table 1 Frequency and percentage food analysed

Food samples	Frequency	Percentage (%)
White rice and stew	3	10
Jollof rice	6	20
Fried rice	1	3.3
Beans (with oil)	2	6.7
Beans (without oil)	8	26.7
Egusi soup	4	13.3
Vegetable soup	3	10
Okro soup	3	10
Total	30	100

There was microbial growth in many of the food samples analysed. The total viable count of bacteria for SFL 7 had the highest count of 5.41 x 10^4 while the lowest count of 2.80 x 10^3 was found in SFL 3 (Table 2). The highest total viable count of fungi was 3.57 x 10^5 for SFL 4 while the lowest was 3.18 x 10^3 SFL 6 (Table 3).

Table 2 Total viable count for bacteria isolates from the foods analysed

Sample location	Mean TVC for bacteria (cfu/g)
SFL 1	4.21 ± 0.32 x 10^3
SFL 2	4.50 ± 0.21 x 10^3
SFL 3	2.80 ± 0.13 x 10^3
SFL 4	1.25 ± 0.02 x 10^4
SFL 5	1.98 ± 0.03 x 10^4
SFL 6	3.72 ± 0.35 x 10^3
SFL 7	5.41 ± 0.15 x 10^4
SFL 8	5.01 ± 0.13 x 10^4
SFL 9	1.09 ± 0.12 x 10^4
SFL 10	3.59 ± 0.29 x 10^3

TVC: Total viable counts; Mean ± SE (Standard error); cfu: colony forming units; SFL: Street food location

Table 3 Total viable count for fungi isolates from the foods analysed

Sample location	Mean TVC for fungi (cfu/g)
SFL 1	0.00 ± 0.00
SFL 2	1.50 ± 0.01 x 10^4
SFL 3	3.95 ± 0.35 x 10^3
SFL 4	3.57 ± 0.03 x 10^5
SFL 5	0.00 ± 0.00
SFL 6	3.18 ± 0.31 x 10^3
SFL 7	0.00 ± 0.00
SFL 8	1.29 ± 0.16 x 10^4
SFL 9	4.19 ± 0.22 x 10^3
SFL 10	2.40 ± 0.09 x 10^4

TVC: Total viable counts; Mean ± SE (Standard error); cfu: colony forming units;

Table 4 shows the cultural and biochemical characteristic of the bacteria isolates while table 5 shows the morphological and microscopic characteristics of the fungi isolate. Nine (9) bacteria were isolated: *E. coli* (40%), *Streptococcus* spp (50%), *Staphylococcus aureus* (60%), *Pseudomonas aeroginosa* (90%), *Salmonella* spp (30%), *Enterobacter* spp (50%), *Bacillus cereus* (40%), *Micrococcus* spp (30%), *Alcaligenes faecalis* (10%). It was observed that *Pseudomonas aeroginosa* was isolated in food samples from all street food vending locations except SFL 3, while *Alcaligenes faecalis* was only isolated from food sample from SFL 10 (Table 6). Four (4) fungi were also isolated: *Rhizopus* spp (50%), *Aspergillus flavus* (40%), *Aspergillus niger* (40%) and *Mucor* spp (60%). It was observed that *Mucor* spp were more isolated in ready to eat food from six (6) of the ten (10) street food vending locations while *Aspergillus flavus and Aspergillus niger* were isolated from four (4) of the ten (10) street food vending locations (Table 7).

Table 4 Cultural and biochemical characteristics of bacterial isolates

Organism Code	Gram Reaction/colony characteristics	Motility	Biochemical reaction							Sugar fermentation								Probable organism
			Oxidase	Citrate	Starch hydrolysis	Catalase	Indole	Methyl red	Vorges proskauer	Glucose	Mannitol	Maltose	Lactose	Sucrose	Dulcitol	Xylose	Sorbitol	
B1	Gram negative single rod/ moist grayish white colony	+	–	–	–	+	+	+	–	+	+	–	+	–	–	+	+	*Escherichia coli*
B2	Gram positive cocci in chains/ whitish gray colony	–	–	–	+	–	–	+	+	+	–	+	+	+	–	–	–	*Streptococcus* spp.
B3	Gram negative single rod/ green colony	+	+	+	–	+	–	–	–	–	+	–	–	–	–	+	–	*Pseudomonas aeroginosa*

B4	Gram positive cocci in clusters/ golden yellow colony	–	–	+	–	+	–	+	+	+	+	+	+	+	–	–	–	*Staphylococcus aureus*
B5	Gram negative rod/ gray colony	+	–	–	–	+	–	+	–	+	+	+	–	–	–	+	+	*Salmonella* spp.
B6	Gram positive cocci/ bright yellow colony	–	+	+	–	+	–	–	–	–	–	–	–	–	+	–	–	*Micrococcus* spp.
B7	Gram negative rod/ grayish white colony	+	+	+	–	+	–	–	–	–	–	–	–	–	–	–	–	*Alcaligenes faecalis*
B8	Gram positive rod with endospore/ grayish white colony	+	+	+	+	+	–	–	+	+	+	+	–	+	+	+	–	*Bacillus cereus*
B9	Gram negative single rod/ moist gray colony	+	–	+	–	+	–	–	+	+	+	+	+	+	–			*Enterobacter* spp

KEY**:** + = Positive; – = Negative

Table 5 Morphological and microscopic characteristics of fungi isolates

Isolate Code	Morphological Characteristics	Microscopic Characteristics	Probable Isolates
F1	Colonies are flat whitish and fluffy which turns yellowish-brown as culture gets old.	Finely roughened sporangia. Sporangiophores are long and branched. The basal mycelium produce chlamydospores	*Mucor* spp.
F2	Colonies are fast growing, flat and black in colour with yellow edges which turns full black as culture gets old.	Conidiophore arising from the foot-cell, basipetal conidia on phialides on vesicle	*Aspergillus niger*
F3	Colonies are usually fast growing, with yellow-green colour with white edges and powdery surface	Condiophore terminate in a vesicle covered with phialides	*Aspergillus flavus*
F4	Colonies covers the whole petri dish and are white cotton like which turns grey as the culture gets old. The reverse plate has black colour	Saclike structure that contain sporagiophore are connected one to another by aseptate hyphae	*Rhizopus* spp.

Table 6 Distribution of bacteria isolates in the different sample location

Bacteria found	Sample location										Percentage of occurrence (%)
	SFL 1	SFL 2	SFL 3	SFL 4	SFL 5	SFL 6	SFL 7	SFL 8	SFL 9	SFL 10	
E. coli	+	-	-	-	+	-	-	-	+	+	40
Streptococcus spp.	-	+	+	-	-	+	+	+	-	-	50
Staphylococcus aureus	+	+	+	-	-	-	+	+	-	+	60
Pseudomonas aeroginosa	+	+	-	+	+	+	+	+	+	+	90
Salmonella spp.	-	-	-	-	-	+	+	-	-	+	30
Enterobacter spp	+	+	+	+	-	-	+	-	-	-	50
Bacillus cereus	-	+	+	-	-	-	+	-	-	+	40
Micrococcus spp.	-	-	-	-	+	-	+	+	-	-	30
Alcaligenes faecalis	-	-	-	-	-	-	-	-	-	+	10

Table 7 Distribution of fungi isolates in the different sample location

Fungi found	Sample location										Prercetage of occurrence (%)
	SFL 1	SFL 2	SFL 3	SFL 4	SFL 5	SFL 6	SFL 7	SFL 8	SFL 9	SFL 10	
Rhizopus spp.	-	+	+	-	-	+	-	+	+	-	50
Aspergillus flavus	-	-	+	+	-	-	-	-	+	+	40
Aspergillus niger	-	-	-	+	-	+	-	+	+	-	40
Mucor spp.	-	+	+	+	-	+	-	-	+	+	60

DISCUSSION

The results shows that there was microbial growth in many of the food samples analysed (Table 2 and 3), this may be as a result of poor hygiene practises of the food handlers, inadequate heating, secondary contamination via contact with contaminated equipment, utensils or surfaces and inappropriate processing (**Gopal *et al*., 2015**). It may also be due to microbial contamination of water used to wash equipment and utensils, large number of people crowding serving space or food sale point and long periods between preparation time and consumption time.

The bacteria isolates with high occurrence from all food samples collected were *Pseudomonas aeroginosa* (90%), *Staphylococcus aureus* (60%), *Streptococcus* spp (50%), *Enterobacter* spp (50%) (Table 6). This finding is similar to the reports of **Okareh *et al*., 2015; Akpoka *et al*., 2019** and **Wogu *et al*., 2011**.

Pseudomonas aeroginosa can be found nearly everywhere as long as there is enough water. Common habitats are moist soils and lakes as well as toilets, sinks, swimming pools, soap dishes and dishwashers (**Zottola *et al*., 1994**). *Pseudomonas* biofilm formation is been reported to be problematic and a serious public health risk (**Meliani and Bensoltane, 2015; Burmolle *et al*., 2010**). *Pseudomonas* biofilm can grow on abiotic surfaces of different equipment and processing surfaces in food industry food. It is also reported that when organisms like pseudomonas form biofilm, they became more resistant to the chemicals and antibiotics. Such a biofilm is a potential source of contamination of foods that may lead to spoilage, foodborne diseases and transmission of foodborne pathogens (**Gunduz and Tuncel, 2006; Joseph *et al*., 2001**).

Staphylococcus is very common on the human skin, armpit, nose, throats, groins etc. the strains which are virulent can produce toxins (enterotoxins) which can cause food poisoning, after ingestion the toxins in contaminated food (**CDC, 2018**). *Streptococcus* spp. has been reported in many food poisonings with symptoms like vomiting, nausea, sore throat, rash, stuffy nose and fever. *Enterobacter* spp. can be found on soil, water, the human skin, sewage, plants, some dairy products and intestinal tracts of humans and animals. Its detection from food samples indicates faecal contamination or a confirmation of poor hygiene practice (**WHO, 2010**).

It's also important to note that *E. coli* (40%) and *Alcaligenes faecalis* (10%) were isolated in food samples, is an indication of faecal contamination of food, water or food handlers and poor hygienic processing practices (**Tambekar *et al*., 2007**).

The fungi isoaltes with high occurrence from all food samples collected were Mucor spp. (60%) and *Rhizopus* spp. (50%) (Table7). This finding is similar to the reports of **Paterson and Lima (2017)**.

Mucor is a filamentous fungus found in soil, plants and decaying fruits. *Rhizopus* is also filamentous fungi found in soil and associated with dead and decaying plant material. Both are capable of causing food spoilage. They can contaminate food through unsanitary practices of food handlers which are capable of causing a group of infections referred to as zygomycosis which includes: septic arthritis, mucocutaneous and rhinocerebral infections, renal infections, Respiratory infections, pulmonary infections and gastritis which can be a serious health risk especially for immunocompromised persons (**Actor, 2012; Sydney and Worobo, 2018**). The fact that *Mucor* spp. and *Rhizopus* spp. were isolated from food samples in this study may be as a result of contaminated vegetables used for soups and fried rice, which were not properly washed or cooked. It may also be as a result of use of dried ingredients used for stews and jollof rice which was not properly cooked.

Also, *Aspergillus flavus* and *Aspergillus niger* which were isolated more from the beans samples, occurring at 40% each of all samples collected from the 10 street food vending locations. This report is similar to the report **Al-Abdalall (2009)**. *Apergillus* spp are known to produce mycotoxins which are a serious health risk such as kidney, liver and gastrointestinal health issues to consumers who consume food contaminated by *Aspergillus* spp (**Akande *et al*., 2006, Yiannikouris and Jonany, 2002 Lawlor and Lynch, 2005**).

Food samples collected from SFL 7 in this study had the highest mean total viable count of 5.41 x 10^4 for bacteria compared to the count from the other street food vending locations (Table 2), which is within the acceptable or intermediate limits of microbial load for cooked ready to eat food (**NSW, 2009**). This result agrees with that of **Okareh *et al*., (2015)**, who reported similar bacteria counts from food and hand-swab samples collected from the sixty food handlers in the 3 Local Government Areas (LGA) in Edo State, showing that Ikpoba-okha LGA had the highest bacteria count compared to two other LGA in their study.

The highest total viable count of 3.57 x 10^5 for fungi in this study was from food samples collected from SFL 4 (Table 3). This agrees with a similar report of **Wogu *et al*., (2011)** who reported similar fungi counts from ready to eat rice sold in Benin City.

CONCLUSION

The presence of these microorganisms in food sold in street food vending locations which are highly patronised by consumers in Ikpoba-okha Local Government Area (LGA) of Edo State, is a cause for concern as it could lead to serious public health challenges of the consumers. It is therefore recommended that the Edo State government should enforce strict regulations and supervision on good hygiene practices such as the use of Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Point (HACCP) application in food production and processing, which will mitigate microbial contamination of food and foodborne diseases.

REFERENCES

Abdalla, M.A. Suleiman, S.E., Alien, Y.Y. and Bakheit, O. (2008). Food safety knowledge and practices of street food vendors in Khartoum City. *Sudanese Journal of Veterinary Science & Animal Husbandry*, 47(182), 123–136 https://www.sustech.edu/index.php/college/publication/college_of_veterinary_medicine_/food-safety-knowledge-and-practices-of-street-food-vendors-in-Khartoum-City/?&pubno=280

Actor, J.K. (2012) Immunology and Microbiology 2nd edition pp 139-146 https://doi.org/10.1016/B978-0323-07447-6.00015-6

Akande, K.E., Abubakar, M.M., Adegbola, T.A. and Bogoro, S.E. (2006). Nutritional and health implications of mycotoxins in animal feeds: A Review. *Journal of Nutrition*, 5, 398-403 https://doi.org/10.3923/pjn.2006.398.403

Akpoka, A.O., Okwu, M.U., Imade, O.S., Enaigbe, A.A., Solanke, E.O., Erifeta, G.O. and Izevbuwa, E.O. (2019). Microbial Assessment of Ready-to-Eat Food and Food Contact Surfaces in Selected Restaurants in Okada, South-South Nigeria. *Bacteria Empire*, 2(3), 58-63 https://doi.org/10.36547/be.2019.2.3.58-63

Al-Abdalall, A. (2009). Production of aflotoxins by *Aspergillus flavus* and *Apergillus niger* isolated from seeds of pulses. *Journal of food, Agriculture and environment*, 7(2), 33-39 https://www.researchgate.net/publication/267791913

Alimi, B.A., Oyeyika, A.T., Olohungbebe, L.O. (2016). Socio-economic characteristics and willingness of consumers to pay for the safety of fura de nunu in Ilorin, Nigeria. *Quality Assurance Safety of Crops and Foods* 8, 81-86 https://doi.org/10.3920/QAS2014.0494

Barro, N. Bello, A.R. and Itsiembou, Y. (2007). Street-vended foods improvement: contamination mechanisms and application of food safety objective strategy: critical review. *Pakistan Journal of Nutrition*, 6(1), 1–10 https://doi.org/10.3923/pjn.2007.1.10

Bhowmik, S. (2010). Street Vendors in the Global Urban Economy, Routledge: Taylor & Francis, New Delhi, India, https://doi.org/10.4324/9780203150542

Burmolle, M., Thomsen, T.R., Fazli, M., Dige, I. and Christensen, L. (2010). Biofilms in chronic infections-A matter of opportunity monospecies biofilms in multispecies infections. *FEMS Immunology and Medical Microbiology*, 59, 324-336 https://doi.org/10.1111/j.1574-695x.2010.000714.x

CDC (2018). Staphylococcal Food Poisoning. Retrieved from https://www.cdc.gov/foodsafety/diseases/staphylococcal.html

Choudhury, M., Mahanta, L., Goswami, J., Mazumder, M., Pegoo, B. (2011). Socio-economic profile and food safety knowledge and practice of street food vendors in the city of Guwahati, Assam, India. *Food control* **22**:196-203 https://doi.org/10.1016/j.foodcont.2010.06.020

Correa, C.M.C. Tibana, A. and Gontijo Filho, P.P. (1991). Vegetables as a source of infection with *Pseudomonas aeruginosa* in a university and Oncology hospital of Rio de Janeiro. *Journal of Hospital Infection*, 18(4), 301-306 https://doi.org/10.1016/0195-6701(91)90187-D

Gopal, N., Colin, H., Ross, P. R., Beresford, T. P., Fenelon, M. A. & Cotter, P. D. (2015). The Prevalence and Control of Bacillus and Related Spore-Forming Bacteria in the Dairy Industry. *Frontiers in Microbiology*, 6, 1418. https://doi:10.3389/fmicb.2015.01418

Gunduz, G.T. and Tuncel, G. (2006) Biofilm formation in an ice cream plant. *Antonie van Leeuwenhoek* 89, 329-336 https://doi.org/10.1007/s10482-005-9035-9

Joseph, B., Otta, S.K., Karunasagar, I. and Karunasagar, I. (2001). Biofilm formation by *Salmonella* spp. on food contact surfaces and their sensitivity to sanitizers. *International Journal of Food Microbiology* 64, 367-372 https://doi.org/10.1016/s0168-1605(00)00466-9

Lawlor, P.G. and Lynch, P.B. (2005). Mycotoxin management. *African Farming and Food Processing* 46, 12-13 https://www.researchgate.net/publication/289098732_mycotoxin_management

Meliani, A. and Bensoltane, A. (2015). Review of Pseudomonas Attachment and Biofilm Formation in Food Industry. *Poultry, Fisheries and Wildlife Sciences*, 3(1), 1-7 https://doi.org/10.4172/2375-446X.1000126

Muzaffar, A.T., Huq, I. and Mallik, B.A. (2009). Entrepreneurs of the streets: an analytical work on the street food vendors of Dhaka city. *International Journal of Business and Management* **4**(2), 80–88

National Population Commission (2006). The population development in Edo State as well as related information and services. https://www.citypopulation.de/php/nigeria-amin.php?adm1id=nga012

NSW Food Authority (2009). Microbiological quality guide for ready-to-eat foods, 1-9 https://www.foodauthority.nsw.gov.au/sites/default/files/_Documents/scienceandtechnical/microbiological_quality_guide_for_RTE_food.pdf

Okareh, O.T. and Erhahon O.O. (2015). Microbiological Assessment of Food and Hand-Swabs Samples of School Food Vendors in Benin City, Nigeria. *Food and Public Health* 5(1), 23-28 https://doi:10.5923/j.fph.20150501.04

Omemu, A.M. and Aderoju, S.T. (2008). Food safety knowledge and practices of street food vendors in the city of Abeokuta, Nigeria. *Food Control* 19, 396–402 https://doi.org/10.1016/j.foodcont.2007.04.021

Paterson, R. and Lima, N. (2017). Filamentous fungal human pathogens from food emphasising *Apergillus, Fusarium* and *Mucor*. *Microorganisms*, 5(3):1-9 https://doi.org/10.3390/microorganisms5030044

Sydney, A.B. and Worobo, R.W. (2018). Risk mitigation for immunocompromised consumers of mucormycete spoiled and fermented foods: Germane guidance and remaining needs. *Microorganisms*, 6(45), 1-9 https://doi.org/10.3390/microorganisms6020045

Tambekar, D. H., Shirsat, S. D., Suradkar, S. B., Rajankar, P. N. & Bangin-War, Y. S. (2007). Prevention of transmission of infectious disease: Studies on hand hygiene in healthcare among students. *Continental Journal of Biomedical Sciences*, 1, 6 -10. https://doi.org/10.1007/s11947-010-0365-x

WHO (2010). Prevention of foodborne disease: Five keys to safer food World Health Organization. Retrieved from https://www.who.int/foodsafety/consumer/5keys/en/

Wogu, M.D., Omoruyi, M.I., Odeh, H.O. and Guobadia, J.N. (2011). Microbial load in ready-to-eat rice sold in Benin City. *Journal of Microbiology and Antimicrobials* 3(2), 29-33 https://www.researchgate.net/publication/280291409

Yiannikouris, A. and Jonany, J. 2002. Mycotoxins in feeds and their fate in animals: A review. *Animal Research*, 51:81-99 https://doi.org/10.1051/animres:2002012

Zottola, E.A. (1994). Scientific status summary "Microbial attachment and biofilm formation: a new problem for the food industry?" *Food Technology*, 48, 107-114

NSW Food Authority (2009). Microbiological quality guide for ready-to-eat foods, 1-9 https://www.foodauthority.nsw.gov.au/sites/default/files/_Documents/scienceandtechnical/microbiological_quality_guide_for_RTE_food.pdf