Investigation Of Microbial Load Of Some Food Vendors In Ibadan

Agboola OA[2], Umezurike ET[2*] Akinpelu AO[1]

[1] Health Management and Information Science, Lead City University, Ibadan, Oyo, Nigeria.
[2] Microbiology, Lead City University Ibadan, Ibadan, Oyo, Nigeria.
* Corresponding Author umezurikee@yahoo.com
+2348135939991

Abstract: Food is an essential instrument for health promotion and disease prevention and cannot be toyed with. Poorly prepared and packaged street vended foods had been identified in many countries as causes of food borne disease according to relevant health authorities. This study assessed and evaluated the microbial quality of some of these street foods sold in eateries and canteens with Ibadan Metropolis while comparing the results obtained with prescribed standards. The study took place within Ibadan Metropolis located in the southwestern part of Nigeria and predominantly occupied by Yoruba speaking people. Samples for this study were collected from five locations. These included three eateries and two local canteens (Locally referred to as Buka). Samples included rice, Amala (Yam Flour), Fish, Meat etc. All samples were kept in a cool box, transported to the laboratory and analyzed within 12 hours. About 28 different types of microorganisms were isolated from the environment of study. Total microbial load for all the (food) outlets was 1509cfu (colony forming unit), out of which 86% (1302) were bacterial. This study implicated a wide range of microorganisms and the microbial load and content within the studied food samples were quite high. Researchers posit that *In-vitro* study and evaluation of environment of servicing ready-to-eat food should be encouraged. This will allow thorough qualitative monitoring of the Good manufacturing practices (GMP) of the environment.

Introduction

Food is an essential instrument for health promotion and disease prevention and cannot be toyed with. Poorly prepared and packaged street vended foods had been identified in many countries as causes of food borne disease according to relevant health authorities (FAO, 1997). Studies have revealed the frequent contamination of street food in many developing world including Nigeria. (Madueke et al, 2014)

Although street foods belong to the informal sector of the Nigerian economy, it is rapidly expanding especially in the urban cities. It plays a significant role in the feeding of urban population with cheap accessible and nutritious foods. Street foods are ready-to-eat (RTE) foods and beverages either prepared on the street and sold along the streets by vendors and hawkers or prepared at home, transported from home and consumed on the streets without further processing (Muinde and Kurria, 2005).

There is an increase in the consumption of ready-to-eat fast food because of a change in social patterns, which is characterized by increased mobility, large numbers of itinerary workers and less family centered activities. The fast pace of life in urban centers has affected the way people seek and find food to eat. Thus, good manufacturing practices of foods taken outside the home such as good sanitation or sanitary measure and proper food handling have been transferred from individuals/families to the food vendor who rarely enforces such practice. (Musa and Akande, 2002).

Unfortunately, increasing numbers of local foodborne diseases continue to be implicated with food service institutions that prepare and sell to the public. Steps to improve local surveillance of quality and safety of RTE foods are needed to help ensure public health. The benefits in cost and convenience derived from RTE foods should always be coupled with safety assurance. Street vended and restaurant food can contribute to food security of those involved in its production, particularly, suppliers of raw produce, food processors, and consumers. (Khater et al, 2013).

Several microorganisms of public health concern have been implicated in street foods sold in some African countries such as fecalcoliform bacteria, Salmonella species (Achinewhu and Amadi, 1996). These may be found in vegetable salad, egg burger, packaged fried rice, meat/fish pies, roasted plantain/yam/fish, beans cake, pancake and many others.

Many of these street foods may have a high degree of hand contact in the process of preparation

and vending which predisposes; these foods to various level of bacterial contamination especially those of human origin (Mepba et al., 2007).

This study assessed and evaluated the microbial quality of some of these street foods sold in eateries and canteens with Ibadan Metropolis while comparing the results obtained with prescribed standards.

Materials and Methods
Study Area and Sample collection
The study took place within Ibadan Metropolis. Ibadan is the largest cosmopolitan city in West Africa and it is the capital city of Oyo State, Nigeria. It is the third most populous city after Lagos and Kano in Nigeria. It is located in the southwestern area of Nigeria and predominantly occupied by Yoruba speaking people. Samples for this study were collected from five locations. These included three eateries and two local canteens (locally referred to as Buka). Samples included rice, Amala, Fish, Meat etc. All samples were kept in a cool box, transported to the laboratory and analyzed within 12 hours.

Sample Processing
Ten grams of the food samples were homogenized in 90ml of sterile distilled water and stomached using a stomacher at 360rpm for 1min, after which the homogenized samples were serially diluted to 105 (Clarence *et al.,* 2009).

Isolation and enumeration of microorganisms
One milliliter of 10-5 dilution of each food sample was inoculated on Nutrient agar (for total Viable bacteria), MacConkey agar (for coliform) and Potato dextrose agar containing 0.1% streptomycin (for fungi) using pour-plate technique. The plates were prepared in duplicates and incubated under aerobic condition at 37°C for 24 - 48 hours, with the exception of Potato dextrose agar plates which was incubated at $25^{O}C$ for 3-5 day. The number of colonies in each plate were counted using the Quebec colony counter (Reichert, USA) and expressed as colony forming unit per ml of sample homogenate (cfu/ml) (Clarence *et al*., 2009).

Identification of isolates
The isolates were purified by sub culturing and characterized based on colonial morphology, cellular morphology, staining and biochemical reactions and identified using Bergey's Manual ofdeterminative bacteriology (Holt *et al*., 1994). The fungi were characterized based on colonial morphology and cellular morphology was identified as described by Cooper (1995).

Results
About 28 different types of microorganisms were isolated from the environment of study. Total microbial load for all the (food) outlets was 1509cfu (colony forming unit), out of which 86% (1302) were bacterial.

Table 1: The fungal and bacterial isolates.

Bacterial Isolates	Fungal/Yeast Isolates
Staphylococcus aureus	*Aspergillus niger*
Staphylococcus epidermis	*Aspergillus flavus*
Staphylococcus citreus	*Aspergillus ochraceous*
Bacillus subtilis	*Aspergillus fumigates*
Acinetobacter species	*Fusariumoxysporum*
Norcadia species	*Curvularia species*
Kurthia species	*Penicilliumcamemberti*
Lactobacillus species	*Penicilliumcasei*
Streptococcus species	*Verticillum species*
Proteus valgularis	*Trichothecium species*
Micrococcus liteus	*Botrytis species*
Pseudomonas aeruginosa	*Rhizopusstolonifer*
Morexellaspp	*Saccharomyces cerevisae*
Aeromonasspp	*Endomyces species*

Table 1 shows the total number of bacteria and fungi isolated from the samples. There were a total of fourteen bacterial isolates as well as fungal isolates. Of the different fungi, *Aspergillus species* were four (4), and *Penicillium species,* two (2). Of the fourteen different bacteria, *Staphylococcus species* were three (3).

Table 2 shows the number of colony forming units, cfu, and their corresponding percentages for the different locations. The two local canteens (*Amala* joints) were observed to have higher microbial load in the environment where the foodis served, covering 58% for both, and 42% for the other three food outlets. Of the local canteens, the one closest to the garage and the largely uneducated drivers and touts had the higher percentage of 30, and the other, closer to the University campus had 28%. The other three outlets are comparatively neater, nicer and more civilized in outlook, thus recorded far lower percentages with the highest being 21.

Table 2: Number of colony forming unit and percentage according to location.

Location	Colony Forming Unit (CFU)	Percentage (%)
Amala Joint (Orita)	397	30
Amala Joint (School 2)	381	28
Tantalizer	286	21
KFC	153	11
Chicken Republic	129	10

Table: 3 Microbial Load in The Sampled Eateries In Ibadan.

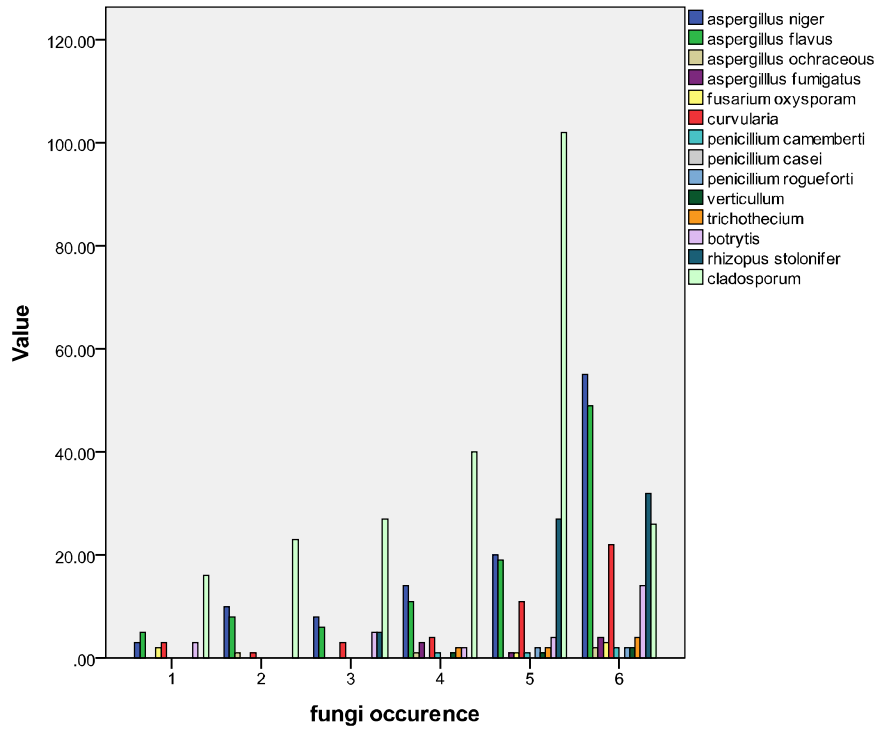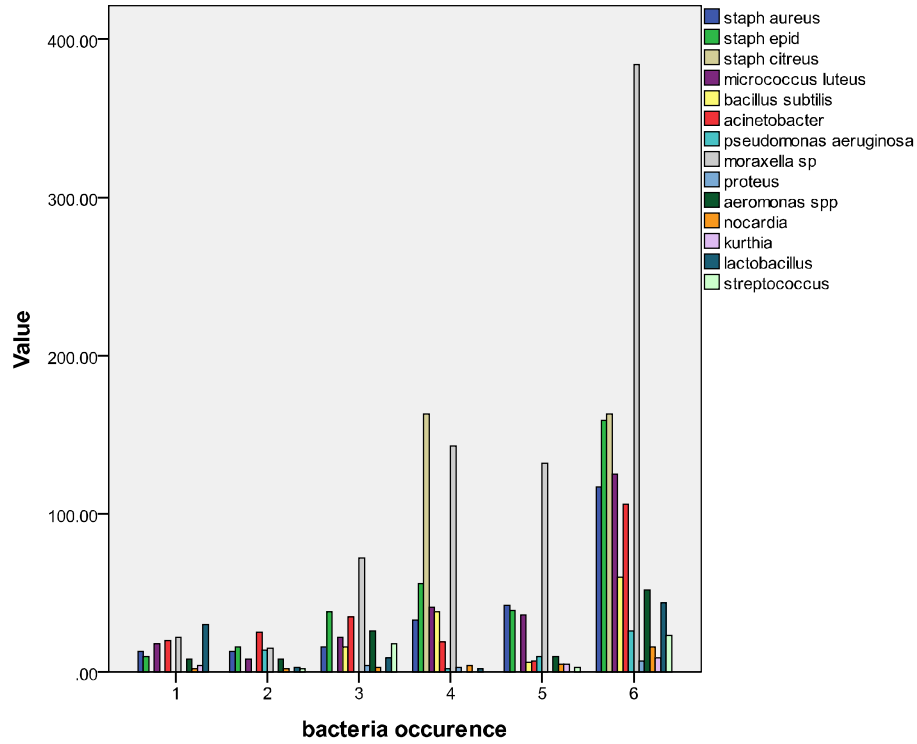| S-No	Trade Name	Address	Date of sample	MacConkey Agar (for the coliform)	Nutrient Agar for total bacteria count	Potatoes Dextrose Agar for yeast and Mould	Total microbial load per visit.
1	KFC	Opposite PHCN zonal office, Ring Road, Ibadan.	4-3-13	-	25	6	31
			15-3-13	-	41	4	45
			25-4-13	-	17	3	20
			15-4-13	-	54	3	57
2	Chicken Republic	Beside Glo Building Challenge Bus-Stop Ibadan	4-3-13	-	45	4	49
			15-3-13	-	13	5	18
			25-4-13	-	30	8	38
			15-4-13	-	18	6	24
3	Tantalizer	Iwo road Ibadan	4-3-13	-	96	11	107
			15-3-13	-	74	9	83
			25-4-13	-	63	4	67
			15-4-13	-	126	3	129
4	*Amalajoint* right next to the campus.	Behind Therfem filling station, LCU-gate Ibadan	4-3-13	-	115	8	123
			15-3-13	-	295	9	304
			25-4-13	-	43	1	54
			15-4-13	-	151	12	163
5	Amala joint, orita	Orita-New garage road, by the round about	4-3-13	-	87	31	118
			15-3-13	-	110	18	128
			25-4-13	-	85	29	114
			15-4-13	-	12	24	36
Total					**1301**	**208**	**1509**

Table 3 shows the number of colonies observed as per sampling dates and growth media. The MacConkey agar plates on all sampling occasions did not yield any growth or colony. In comparison, the Nutrient Agar plates yielded far more growth colonies than Potato Dextrose Agar on all occasions except one, that is, the last sampling day at the *Amala* joint 1. In essence, bacterial growth had 86.22% while fungal/yeast growth had 13.78%.

Table 4: Percentage occurrence of microorganism in the sampled eateries in Ibadan (in CFU/ml and represented the number of colonies formed)

S/No		KFC		Chicken Republic		Tantalizer		Amala joint right next to LCU campus		Amala Orita		
		Occurrencee	%	Occurrence	%	Occurrence	%	Occurrence	%	Occurrence	Total	%
	Bacterial											
1	*Staphylococcus aureus*	13		13		16		33		42	117	1.29
2	*Staphylococcus epidermidis*	10		16		38		56		39	159	1.20
3	*Staphylococcus citreus*							163			163	1.18
4	*Micrococcus luteus*	18		8		22		41		36	125	1.25
5	*Bacillus subtilis*					16		38		6	60	1.25
6	*Acinetobacterspp*	20		25		35		19		7	106	1.42
7	*Pseudomonas aeruginosa*			14				2		10	26	2.00
8	*Moraxella Spp.*	22		15		72		143		132	384	1.15
9	*Proteus valgularis*					4		3			7	1.00
10	*Aeromonas Spp.*	8		8		26				10	52	1.33
11	*Nocardia Spp.*	2		2		3		4		5	16	1.00
12	*Kurthia Spp.*	4								5	9	1.00
13	*Lactobacillus Spp.*	30		3		9		2			44	1.50
14	*Streptococcus Spp.*			2		18				3	23	2.00
	(1301)=86%	137	1.22	106	1.14	259	1.18	504	1.15	295		
	Fungi/Yeast											
1	*Aspergillus Niger*	3		10		8		14		20	55	8.6
2	*Aspergillus flavus*	5		8		6		11		19	49	8.0
3	*Aspergillus ochraceous*			1				1		=	2	0.01
4	*Aspergillus fumigatus*							3		1	4	0.01
5	*Fusariumoxysporam*	2								1	3	0.01
6	*Curvularia Spp.*			1				1		2	4	0.01
7	*Penicilliumcamemberti*	3		1		3		4		11	22	11.0
8	*Penicilliumcasei*							1		1	2	0.01
9	*Verticulumspp*									2	2	0.01
10	*Trichothecium*							1		1	2	0.01
11	*Botrytisspp*							2		2	4	0.01
12	*Rhizopusstolonifer*	3				5		2		4	14	7.01
13	*Saccharonycescerevisae (yeast)*					5				27	32	7.50
14	*Endomycesspp*			2							11	42.19
	Total	16	8.0	23	5.5	27	6.5	40	6.3	102		

This table shows the total percentage occurrence of microorganism in the sampled area

bacteria occurence

Legend:
- staph aureus
- staph epid
- staph citreus
- micrococcus luteus
- bacillus subtilis
- acinetobacter
- pseudomonas aeruginosa
- moraxella sp
- proteus
- aeromonas spp
- nocardia
- kurthia
- lactobacillus
- streptococcus

fungi occurence

Legend:
- aspergillus niger
- aspergillus flavus
- aspergillus ochraceous
- aspergilllus fumigatus
- fusarium oxysporam
- curvularia
- penicillium camemberti
- penicillium casei
- penicillium rogueforti
- verticullum
- trichothecium
- botrytis
- rhizopus stolonifer
- cladosporum

Key
1. Kfc
2. Chicken Republic
3. Tantilizer
4. Amala Joint Right Next To The Leadcity University Campus
5. Amala Joint At Orita Challenge
6. Total Number Of Occurence

Discussion

In this study, ready to be-served food, prepared in an environment which ideally according to government regulations should be hygienic was the focus. The researchers studied microbial load of food which should have been prepared by standard procedures. The effect of the microbial contents of the environment did play a big role, and this study focuses on how it affects the health of the consuming public.

It was observed that the presence of these microorganisms cut across all the food outlets. Traditionally the eateries catered for the middle class and high income individuals while the canteens took care of the lower income populace.

Effect of bacterial and fungi isolated in the environment being studied cannot be over emphasized. Most of the microorganisms isolated are not harmful but serve as contaminant. Among these are *Staphylococcus citreus, Moraxella, Acinetobacter, Streptococcus, Curvularia* and others (Harrigan and McCance, 1986 and Satish Guptee, 2001).

However, few of the isolated microorganisms have been found associated with diseases. For instance, *Aspergillus flavus, Aspergillus nigeri, Aspergilusfumigatus and Penicillium specie*has been found associated with various respiratory diseases like Aspergillosis and Penicillosis in human and domestic farm animals. It is also on record that *Aspergillus flavus* produces mycotoxins called aflatoxin; an exotoxin that is very fatal to animal and human (Alexopoulous 1983; Harrigan and McCane, 1986; Fawole and Osho, 1989 and Satish Guptee, 2001).

Staphylococcus aureus and *Staphylococcus epidermidis* have been fingered to have caused various skin diseases like; acne and impedigo (Nand et al, 2012). *Proteus vulgaris* as the name implies grew and swarm "profusely" on laboratory media. They are commensal's in intestinal track of human and other animals. Although they are never pathogenic in chicken and guinea pigs but when found in urine sample they hydrolyze urea to produce ammonia, the characteristic of alkalinity of urine. Increased alkalinity can lead to the formation of struvite, calcium carbonate, and or apatile which can Turk in the kidney stone to make it grow very large enough to cause obstruction and renal failure if left for long untreated. They are also implicated in wound infection, septicemia and pneumonia in most hospitalized patients. However, they are susceptible to most anti-biotic apart from tetracycline and their derivatives (Ryan and Ray, 2004, Nanda, 2005 andFrenod and Emmanuel, 2006).

Pseudomonas Aeruginosa a well-known soil microbe and anopportunistic human pathogen is known for its ability to utilize a wide variety of organic materials as food. It can attack damage tissues of people with reduced immunity causing generalized inflammation and sepsis on organs like lungs, urinary tracts and kidneys which can be fatal. Pseudomonas is code named "Nosocomial bacterial" as they are commonly found on hospital equipment (like catheters, scissors, etc). they are studied to have ability of growing in diesel and jet fuel causing corrosion and make them to be called "Hum bug" (Hydrocarbon utilizing microorganism) seen as dark gellish or "algae" mats (Ryan and Ray 2004; Amai, 2006, Biopharma, 2007; *Cooper et al,* 2003 and Williams *et al*, 2007).

Lactobacillus species and Streptococcus species are lactic acid producing bacterial. They are normal floral on human found in oral, respiratory, urinary and genital tracts. Their presence on the skin and dermal layers is to keep away the pathogenic microorganism (Schlegel, 2002).

Conclusion And Recommendation

This study implicated a wide range of microorganisms and the microbial load and content within the studied food samples were quite high. Researchers posit that *In-vitro* study and evaluation of environment of servicing ready-to-eat food should be encouraged. This will allow thorough qualitative monitoring of the Good manufacturing practices (GMP) of the environment. It will also assure the consuming public of their health knowing fully well that the food being consumed is hygienically okay right from the production level till the consumption state.

Government agencies should have an in-home quality control department where *in-vitro* analysis should be carried out on such food providers; the result which should always be their guide of operation and visitation. The existing routine examination of physical structures, equipment and personnel hygiene monitoring should be an addendum. *In-vitro* analysis will speak better about the quality of the environment than the physical quantity (GMP).

1. Studies have shown that only few microorganisms will survive and metabolize in a cold environments and that microbial load of a given environment increases as the temperature increase. Therefore, it is recommended that government should promulgate an enabling law that would enforce food vendors to install A.C. cooling unit to environment where-so-ever these ready-to-eat foods are to be served. This will drastically reduce the microbial level of such environment.

2. Government in Nigeria must also expedite action on the power problems bedeviling the country as inability to store perishables such as meat, fish and

vegetables by these vendors' leads to food spoilage and increase in microbial population.

3. The formation and empowerment of food sanitary inspectors like what is obtainable in developed nations, is being recommended by researchers within this study. These inspectors will be saddled with the responsibility of monitoring, enforcing and prosecuting any licensed food vendor that operates outside the rules and guiding lines of food handling and production.

References

1. Achinewhu SC, Amadi EN (1996). Bacterial Flora of Some Street Foods in Port Harcourt, Nigeria. Niger Delta Biol., 1: 59-61.
2. Amai, R.K. (2006. "Phylogenetic affiliation of the pseudomonads based on 16s RNA sequence". Int Journal Evolution microbiology. Vol. 50(4) 1563-89. PMID 109 39664.a.
3. Biopharma, A.V (2007). "Antisense antibacterial Method and compound", World Intellectual property organization http://www.wipo-int/pctdb/en/wo.jsp?1A=US2006027522 & display =Desc retrieved 2008-10-18.
4. Cooper, M., Tavamker, G.R and Williams, H.D (2003). "Regulation of expression of the cyanide-insensitive terminal oxidase in *pseudomonas aeryginesa microbiology* Vol 149(5) pp. 1275-84.
5. Falola, A.O., Olatidoye, O.P., Balogun, I.O and Opeifa, A.O. (2011). Microbiological Quality Analysis of Meat Pies Sold by Street Hawkers: A Case Study Of Mainland Local Government Area of Lagos, Nigeria. Journal of Medical and Applied Biosciences 2: 1- 8.
6. FAO (1997). Street Foods. Food and Agriculture Organization of the United Nations, Rome, Italy, 1 - 4.
7. Fawole, M.O. and Osho, B.A. (1989). Laboratory Manual of microbiology. Spectrum publisher, Ibadan ISBN-978-246-032-N.
8. Frenod and Emmanuel (2006) "Existence result for a model of proteus mirabilis swarm" Differential and integral equations. Vol19(6)697-720.http://arxiv.org/abs/math.FA/0702761.
9. Harrigan, w.f and McCane, M.F (1986). Laboratory methods in foods and Dairy microbiology. Academic Press Inc. London 3rd Edition ISBN 0-12-326040x.
10. Madueke, S. N.; Awe, S.; Jonah, A. I. Microbiological analysis of street foods along Lokoja-Abuja Express Way, Lokoja. American Journal of Research Communication, 2014, 2(1): 196-211} www.usa-journals.com, ISSN: 2325-4076.
11. Mbah, M., Ogban, G. I., Konlack, G.D., Useh, M. F., Asuquo, A.E. (2012).The Bacteriological Status of Five Selected Street Vended Cooked Foods in Calabar, Nigeria. Journal of Pharmacy and Biological Sciences, 2 (4): 25-29.
12. Mepba HD, Achinewhu SC, Aso SM, Wachukwu CK (2007). Microbiological quality of selected street foods in Port Harcourt. J. of Food Safety, 27(12), 1202-1211.
13. Muinde OK, Kuria E (2005). Hygienic and sanitary practices of vendors of street foods in Nairobi, Kenya. Afr. J. of Food, Agric. and Nutr. Dev., 5: 1-14.
14. Musa, O.L. Akande, T.M. 2002: Effect of Health Education Intervention or Food Safety Practice among Food Vendors in Ilorin. J. Med. 5:120 – 124.
15. Nand, P., Drabu S., and Gupta, R.K. Insignificant anti-acne activity of *Azadirachtaindica* leaves and bark. *Journal of Pharmaceutical Negative Results*. Vol. (3) Pp 29-33.
16. Nanda, M. (2005). Clinical Microbiology for DMLT Students. 1st edition. Jaypee Brothers Medical Publisher (P) Ltd. ISBN 81-8061-569-3.
17. Oranusi, S. and Braide, W. A. (2012). Study of Microbial Safety of Ready-To-Eat Foods Vended On Highways: Onitsha-Owerri, South East Nigeria. International Research Journal of Microbiology. 3 (2) 66-71.
18. Ossai, O. S. (2012). Bacteriological Quality and Safety of Street Vended Foods in Delta State. Nigeria Journal of Biology, Agriculture and Healthcare. 2 (5): 114- 118.
19. Ryan, K.J and Ray, C.G (2004). Sherris Medical *Microbiology* (4th edition) Mc.Graw Hill Pp. 362-8 ISBN 0-8385-8529-9.
20. Satish Guptee. (2001). Practical Microbiology. Jaypee Brothers Medical Publishers (p) Limited. 2nd Edition Jammu, New Delhi, India.
21. Schlegel, H.G. (2002). General microbiology low price 7th Edition Cambridge University Press ISBN 0-521-49850-3.
22. Williams, H.D., Zlosnik, J.E. and Ryall, B. (2007). "Oxygen, Cyanide and energy generation in the cystia fibrosis pathogen *Pseudomonas aeruginosa* Adumicrob. Physiol. 52 pp 1-71. Doi:10,1016/500652911(06)52001-6, PMID 17027370.

8/25/2018