

**BACTERIOLOGY OF SUYA MEAT SOLD IN BONNY LOCAL
GOVERNMENT AREA, RIVERS STATE. NIGERIA.**
**KONNE, FELIX EEDEE¹, BARANGO-TARIAH, DIENYE RUTH¹,
TETAM, JACK GBENENEE¹, MONSI, TOMBARI PIUS¹.**

ABSTRACT

Suya Meat is obtained from roasted or smoked beef and other boneless part of an animal. They have good taste and rich in protein, vitamin B12, zinc, selenium, niacin, iron, and phosphorus and are commonly found in most streets as source of food in Nigeria. Processing the meat involves defat and slicing the meat on a table top into smaller portions before it is roasted for few minutes with the addition of spice, like pepper, magi, groundnut and salt. Suja could be contaminated from contaminated air, handlers, equipments, water, papers and some kitchen utensils. Factors affecting the growth of microorganisms on meat could be intrinsic or extrinsic factors. This aim to determine the bacteria contamination of roasted Suja meat sold in Bonny. Culture characteristics of colonies were considered after 24hrs incubation period. The locations were: Tennis Hut, Golf Club, Ama hausa, Hospital Road, (round about), Finima market junction and Akiama respectively. Total of five (5) different Suja sample meat was collected at random, from each of these six Suja location or stand at different time of the day respectively, which sum up the number to total of 30 Suja meat samples assayed. Results shows that the total number of *Bacillus cereus* and *Salmonella species* presence were 10 (34%) and 5(17%) respectively, from the five Suja samples each, across the six Suja stand in Bonny. *Escherichia coli* have no growth. The total of 1(3.4%) and 2 (6.8%) of *Staphylococcus aureus* and *Klebsiella species* respectively were also isolated. Total value of 6(20%) and 5(17%) of *Enterococcus species* and *Proteus species* respectively were also isolated. However, the results also shows that Tennis Hut and Golf club have total of 3(9.6%) and 2(6.4%), of different types of microorganisms isolated. Finima Suja and Akiama have total of 7(22%) and 6(19%) respectively of different type of microorganisms isolation. Finally, the total result from Ama Hausa and Hospital road roundabout were 8(25%) and 5(16%) respectively, shows different type of microorganism associated with Suja meat sold in Bonny local government area of Rivers state.

Keywords: Bacteriology, Suyameat and Bonny.

INTRODUCTION

Suya Meat is obtained from roasted or smoked beef and other boneless animal mostly. They are good, taste and rich in protein, vitamin B12, zinc, selenium and phosphorus. It is also rich in niacin, iron and vitamin (pyridoxine). Suja meat is commonly found in most streets as source of food in Nigeria and sub-Sahara Africa (1).

Based on that Suja meat contamination is associated with the exposure on the street. It is easily contaminated with bacteria, microorganisms and parasite. The meat (Suya meat) is produced from meat part from animals. The meat part from this animal is roasted smoked to dry making it attractive to eat and increasing the shelf life of the Suja meat. Therefore, it is necessary to carried out some microbiological and parasitic quality assessment in order to ascertain their safety for

consumption. Suya could be contaminated from air, handlers, equipments, water, papers, some kitchen utensils for example the spoon, trays, knives and sometimes the contamination could be due to nature of the vendors and the environments (4).



Fig. 1 Picture of Suya meat with spices (6).

Comment [H1]: Not in original manuscript. With reference, did author take permission from the publisher and or author(s) before lifting the picture?

In the abattoirs during slaughtering, there is the chance of contaminating sterile tissue of the meat, with some intestinal flora which is associated with humans, animals and the environment (8).



Fig. 2 Picture of meat abattoir

Comment [H2]: Not in original manuscript, no reference?? Was it original picture, if yes was ethical consideration taken care off

It is believed that raw consumption of uncooked meat could result to food poisoning. This is possible based on the presence of some bacteria in the meat which has the ability to produce some toxins in human resulting to some pathological condition like diarrhea and vomiting. However, the infectious doses of some common contaminations of meat were still under debate or investigations (11).

In spite of some regulatory agencies in Nigeria, for example the National Agency for Food and Drug Administration and Controls (NAFDAC) and the Standard Organization of Nigeria (SON) which function to regulate food productions in Nigeria, but it have been shown and proven that most Suya meat producer do not follow the recommendation of the Food and Drug Agencies, which means that they fall short of the dictates of HACCPs (Hazard Analysis of Critical Control Points) and ISO (International Standard Organization) recommendations (9,13).

Based on the fact that microorganisms could be found everywhere, it's believed that unhygienic preparation of Suya meat, could promote the presence of microorganism on Suya meat sold in Bonny, which could cause contamination to the consumer. It is based on these; my research will ascertain some possibilities towards recommending ways to reduced possible health hazards that could be associated with the consumption of Suya meat sold in Bonny.

This work is aimed at determining the bacteria contamination of roasted Suya meat sold in Bonny local government area.

MATERIALS AND METHODS

Study Area

This study was conducted within the City of Bonny (Ibani) Local Government Area of Rivers state in the month of November to December, 2016. Bonny is geographically located at latitude 40 26¹

N7° 10E, with lengthy raining season and short dry season temperature between 25-28°C. It is situated at the southern edge of Rivers State in the Niger Delta of Nigeria near Port Harcourt. The major occupation of the people is fishing and farming and they speak Ibani language.

The population for this study was drawn from six (6) selected Suya stands namely; Tennis Hut, Golf Club, Finima market Junction, Akiama, Ama-Hausa and Hospital Road (roundabout junction). A total of thirty (30) samples were collected for the study, five from each Suya stand location at different time and day.

Sample Collection

All Suya meat samples from each was aseptically collected into a sterile container, labeled and taking to Bonny General Hospital Medical Laboratory section and department of Medical laboratory Science, Rivers state University, Port Harcourt to analyzed and was cultured into various culture media, strictly following the protocol for media inoculation and organism identification guide for bacteriology culture. The materials used include: Sterile universal containers, B-jou bottles, sterile disposable wire loops, Petri-dishes, Media, Peptone water, Incubator, Autoclave and Test tubes.

The media was prepared according to the manufacturer's instruction. Based on the number of plates, sterilized by autoclaving at 121°C for 15 minutes and dispensed aseptically into disposable Petri-dishes (about 20mls each) after cooling to about 50°C (2).

Bacteriology Determination

The sample was incubated aerobically in the incubator for 24hours. Sub-culture was done the following day into various media. The plates were incubated at 37°C for 12 -24 hours and examined for bacterial growth (2).

Biochemical and gram staining test for proper identifications.

Catalase Test, Coagulase Test, Indole Test, Oxidate Test, Methyl Red Test, Urease Test, Citrate Test and Lactose Fermentation Test (2).

Statistical Analysis

The data were analyzed statistically using Excel, Software.

Comment [H3]: The author(s) should construct the sentences well;

RESULTS

Table. 1: Showing the Total Number of Microorganisms Isolated from Six different Suya Locations in Bonny Local Government Area.

Organisms Isolated	Tennis Hut (%)	Golf Club (%)	Finima (%)	Akiama (%)	Ama hausa (%)	Hospital Road (%)	Total (%)
<i>Bacillus cereus</i>	2(66)	1(50)	3(42)	2(33)	2(25)	2(40)	10(34)
<i>Salmonella species</i>	1(33)	00(00)	2(28)	00(00)	2(25)	00(00)	5(17)
<i>Escherichia coli</i>	00(00)	00(00)	00(00)	00(00)	00(00)	00(00)	00(00)
<i>Staphylococcus aureus</i>	00(00)	00(00)	00(00)	1(16)	00(00)	00(00)	1(3.4)
<i>Klebsiella species</i>	00(00)	00(00)	00(00)	1(16)	00(00)	1(20)	2(6.8)
<i>Enterococcus species</i>	00(00)	1(50)	00(00)	1(16)	2(25)	2(40)	6(20)
<i>Proteus species</i>	00(00)	00(00)	2(28)	1(16)	2(25)	00(00)	5(17)
Total	3(9.6)	2(6.4)	7(22)	6(19)	8(25)	5(16)	
Percentage of Microorganisms Isolated from the Six different Locations; Tennis Hut, Golf Club, Finima, Akiama, Ama hausa and Hospital Road							

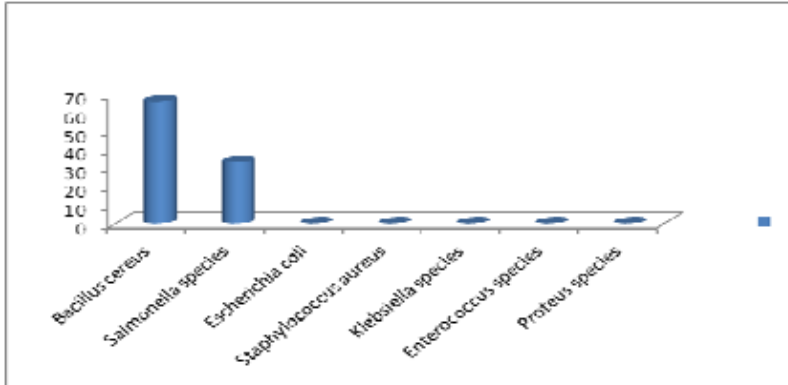


Fig.3: Graph showing the percentage of organisms isolated from **Tenni Hut**.

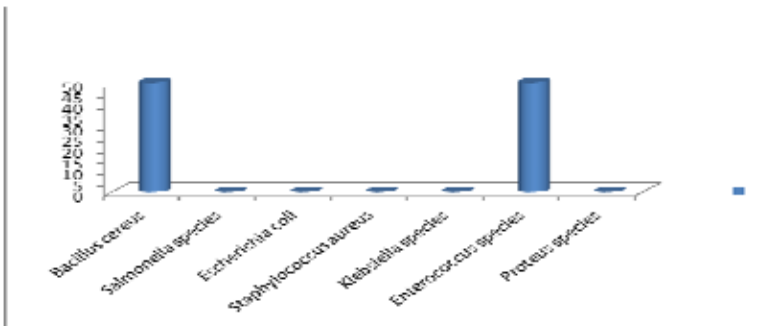


Fig.4: Graph showing the percentage of organisms isolated from **Golf Club**.

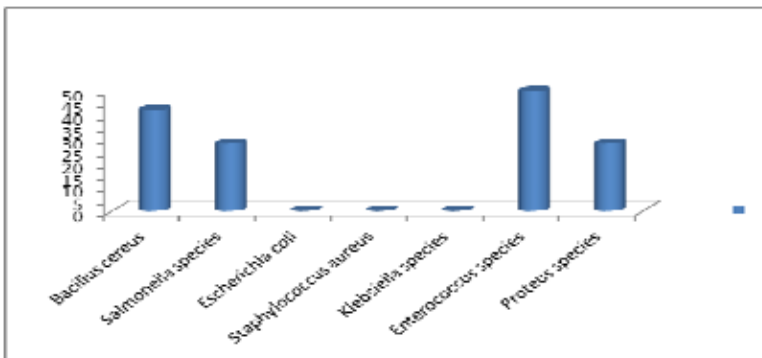


Fig. 5: Graph showing the percentage of organisms isolated from **Finima**.

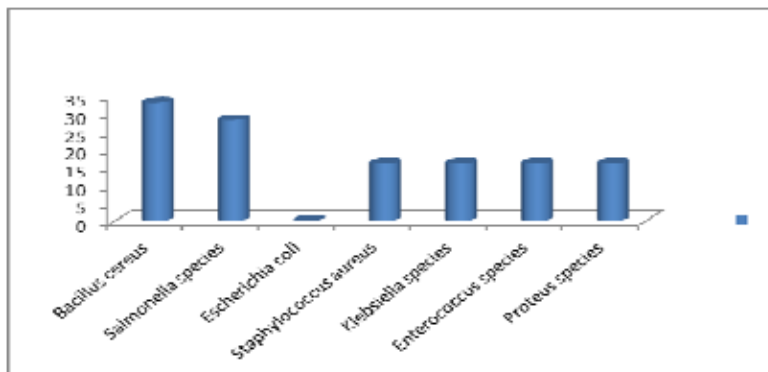


Fig. 6: Graph showing the percentage of organisms isolated from **Aklama**.

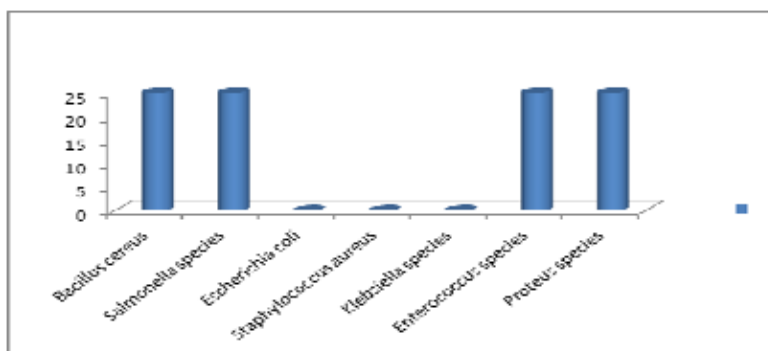


Fig. 7: Graph showing the percentage of organisms isolated from **Ama Hausa**.

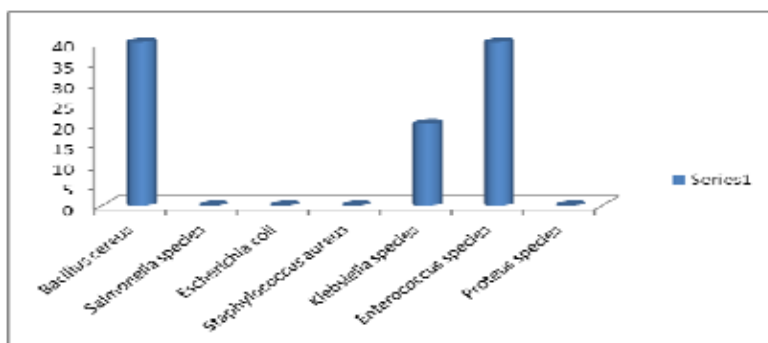


Fig. 8: Graph showing the percentage of organisms isolated from **Hospital Road**.

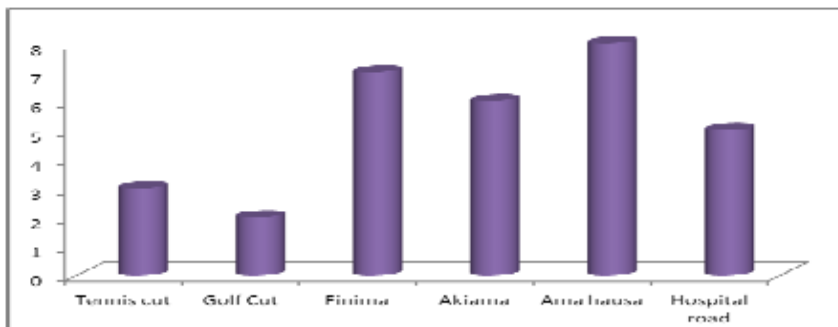


Fig. 9: Graph showing the percentage level of Suya contamination from the six different suya stand in Bonny local government area.

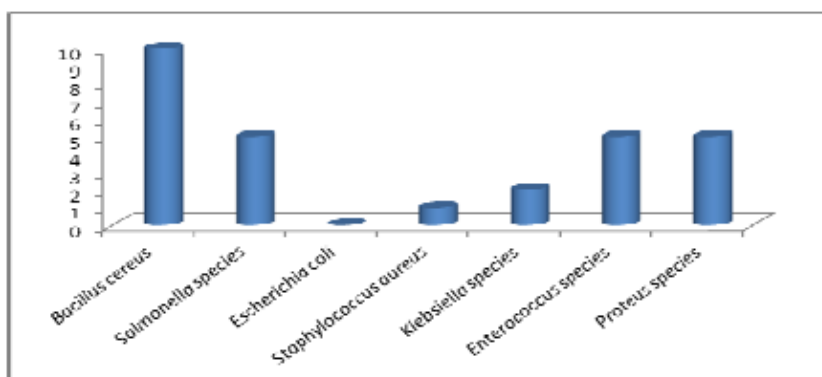


Fig. 10 : Graph showing the highest percentage of microorganism isolated from the Suya meat in Bonny.

DISCUSSION

Result shows that from the 30 (thirty) samples of Suya meat brought from six different locations in Bonny Local Government Areas of Rivers state, were all positive with different microbial contaminations and distribution. The presence of *Bacillus cereus* 2(66%) and *Salmonella species* 1(33%) given a total of 3(9.6%) and 10(34%) of different microorganism isolated and total number of *Bacillus cereus* isolated across the six Suya stands in Bonny, which agreed with Egbebi & Seidu ,(2011) and improper establishment of a Hazard Analysis Critical Control Point (HACCP) Sperker

& Richard, (2001), which is also essential for the control of *Salmonella species*, *Enterococcus species* and *Proteus species*. This method could be used to achieve the potential food safety hazard or could be taken to reduce or totally eliminate the presence of these organisms contained in the meat, may be from the abattoir personnel or the environment (12).

The Golf Club Suya sample assayed indicates that 1(50%) was contaminated with *Bacillus cereus* and 1(50%) of *Enterococcus species*, given a total of 2(6.4%) of different microorganisms and total of 6(20%) of *Enterococcus species* across the six different Suya sold in Bonny. It is believed that *Bacillus cereus* can cause two types of illness, one characterized by diarrhea and vomiting with the aid of their enterotoxins. Though the diarrhea enterotoxin is heat sensitive (could be inactivated by 56°C heat for 5 minutes). But the emetic toxin which induces vomiting is very heat resistant (12). *Bacillus cereus*, a gram positive, facultative aerobic spore forming rod which are different from other *Bacillus species* in their biochemical test with their optimum growth temperature of about 30°C to 50°C, pH value of 4.3 to 9.3 and water activity (AW) values of 0.912. *Bacillus cereus* is commonly found in nature for example in the soil and water. The infective dose of *B. cereus* could be more than 10 cfu (gm) of visible cells consumed to cause disease (12).

The result gotten from Finima, shows that 3(42%) of *Bacillus cereus*, 2(28%) of *Salmonella species* and 2(28%) of *Proteus species* were positives given a total of 7(22%) of different types of microorganisms, and total of 5(17%) of *Proteus species* present across the six Suya stand sold in Bonny. *Salmonella species* could be gotten from uncooked cow meat or taking raw cow meat that is improperly cooked could be harmful to human health (10). The result from Egbebi & Seidu, (2011) of the isolation of *Salmonella species* from Suya meat sample also agreed with the fact that 2(28%) of *Salmonella species* contamination can render the Suya meat unsafe for consumption (5).

Akiama, also shows 2(33%) of *B. cereus*, *Staphylococcus aureus* 1(16%), *Klebsiella species* 1(16%), *Enterococcus species* 1(16%) and *Proteus species* 1(16%) given a total number of 6(19%) different microorganism, and total of 1(3.4%) and 2(6.8%) of *Staphylococcus aureus* and *Klebsiella species* isolated across the six Suya stands in Bonny, an observation in agreement with Egbibi & Seidu, (2011). The presence of *Staphylococcus aureus* in Suya meat from Akiama indicates *Staphylococcus aureus* gram positive coccal bacteria has high salt tolerance which enable its growth in Suya meat *Staphylococcus aureus* also produces toxins which are heat resistant and cannot be destroyed through cooking. It is commonly contracted through food workers. An individual with weakened immune systems may also be vulnerable to its toxins which agreed with Riser & Marth, (1989). Because *Staphylococcus aureus* are commonly found on the skin, hair, nose and human throats, the bacteria could be found in up to 25% of healthy individual and are more common with those individual that has nose, skin, eye and throat infections (10). Ama Hausa results show contamination of Suya meat of 2(25%) *Bacillus cereus*, *Salmonella species* 2(25%), *Enterococcus species* 2(25%) and *Proteus species* 2(25%) given a total of 8(25%) of different microorganisms contamination in Bonny.

Finally, Suya meat picked from Hospital road shows that *Bacillus cereus* has 2(40%), *Klebsiella species* shows 1(20%) and *Enterococcus species* 2(40%) positive out of the total of 5(16%) of different microorganisms in Suya meat from Hospital road in Bonny Local Government area. The presence of *Proteus species* agreed with the fact that, it is commonly found in the human intestinal tract as part of normal flora, and it is also found in multiple environmental habitats, it is a gram-negative bacillus which also colonized both the skin and oral mucosa. *Bacillus cereus* with total of 10(34%) was isolated across the six Suya stand in Bonny making it the highest among other microorganism found from the Suya sample. This confirmed the statement by Sperder & Richard,

(2001), that *B. cereus* has the ability to produce spores which can also germinate if the temperature is lowered, making it to be temperature tolerance.

Salmonella species and *Staphylococcus aureus* with the total of 5(17%) and 1(3.4%) respectively indicates that both organisms could also cause poison to human when consumed in their high infective dose. This confirmed Diana *et al.* (2012), which say the infective dose could be as little as 1.0 nanogram of the toxin per gram of food or meat will produce illness. Ingestion of 1 – 5 microgram of the toxin has been shown to be associated with many outbreaks of diseases (3). *Klebsiella species*, *Enterococcus species* and *Proteus species* have total of 2(6.8%), 6(20%) and 5(17%) respectively isolated from the six different Suya stand in Bonny local government area. But the infectious dose of *Klebsiella species* is still unknown and it is found widely through nature in soil and water so there is that likelihood that Suya contaminated with *Klebsiella species* could be from soil or water source, human skin and mouth (3). Finally, *Escherichia coli* were negative across the six Suya meat stand in Bonny, with the use of Chromagan 0157 media for isolation and differentiation of *E.coli* organisms and there was no growth noticed.

CONCLUSION

In a way to reduce or total elimination *Bacillus cereus* organism which also have contributed to some resistant noticed in the used of our antibiotics, the authority appointed to oversee the proper preparation of our abattoir meats and Suya processing should adhere to required principle by law. Also the need to stored perishable food like the Suya meat within the temperature “danger zone” at the range of 50⁰C to 60⁰C. Suya meat should be reheated to above 75⁰C before eating.

Studies have also shown that food handles especially suya meat handless can also serve as a source of infection and the hand contact with the suya represent the means by which the contamination may occur.

Recommendations

Hazard analysis and critical control point (HACCP) which represents a systematic preventive approach to food safety should be encouraged.

Salmonella can be adequately controlled by relatively mild heat treatments, but effective measures should be in place in order to avoid cross contamination between raw and cooked foods.

Regular hand washing practice with soap and a running tap water and lowering of finger nails thoroughly before cooking and serving the public with Suya meat should be encouraged.

Strictly prohibit employee with wounds or skin infection from Suya -handling in Bonny areas.

Practice routine environment cleaning and disinfection of equipments used in Suya meat processing in Bonny.

REFERENCES

1. Abdullahi, O. I., Umoh, V. J. & Gaadima, M. (2004). Hazards associated with kilishi preparation in Zaria, Nigeria. *Nigeria Journal of Microbiology*, 8(2), 337 – 345.
2. Cheesbrough, M. (2000). District Laboratory Practice in Tropical Countries Part 2. Cambridge University Press, United Kingdom. Pp. 62 - 70.
3. Diana, G., Susana, D., Daniel, V., Beatrice, M., Marta, L. C., Ana, R., Juan, J. H. & Pilar, G. (2012). Incidence of *Staphylococcus aureus* and analysis of associated bacterial communities on food industry surfaces. *Applied and Environmental Microbiology*, 78(24), 8547 – 8554.
4. Edema, M. O., Osho, A. T. & Dials, C. I. (2008). Evaluation of microbial hazard associated with processing of Suya (a grilled meat product). *Science Research Essays*, 3(12), 621 – 626.
5. Egbebi, A.O & Seidu, K.T. (2011). Microbiological evaluation of Suya (dried smoked meat) in Ado and Akure, south West Nigeria. *European Journal of Experimental biology*, 1(4), 1 – 5.

6. Eno-Obong, A. U., Itah, A. Y. & Obun, C. O. (2004). Prevalence of microorganisms in flies and meat cuts in Uyo abattoir, Akwa Ibom State. *Global Journal of Agricultural Sciences*, 3(1), 72 – 82.
7. Inyang, C. U., Inyor, M. A. & Uma, E. N. (2005). Bacteriological quality of a smoke meat product (Suya). *Nigeria Food Journal*, 23, 239 – 242.
8. Judge, D. M., Robert, A. M. & Morris, M. J. (2002). Preparation of Suya in Africa. *Journal of African Foods*, 20, 52 – 55.
9. Nester, E. W., Anderson, D. G., Robert, C. E., Pearsall, N. N. & Nester, M. T. (2001). Microbiology a human perspective. 3rd edition. McGraw-Hill Company. Pp. 3, 12 – 22.
10. Ogbonna, I. O., Sunday, D. M. Oyekemi, A. & Odu, C. E. (2012). Microbiological safety and proximate composition of (suya) stored at ambient temperature for six hours from Maidugari, Northern Nigeria. *Internet Journal for Food Safety*, 14, 11 – 16.
11. Riser, E. T. & Marth, E. H. (1989). New foodborne pathogens of public health significance. *American Journal of Dietary Association*, 89, 948 – 956.
12. Sonal, A. & Chagan, T. (2016). The bacteria with the lowest infections base to cause meat food poisoning. *Journal of Interdisciplinary Science Topics*, 21, 13 – 20.
13. Sperder, W. H. & Richard, F. S. (2010). Happy 50th birthday to HACCP. Retrospective and perspective. *Food safety Magazines*, 20, 42 – 46.
14. Umoh, J. U. (2004). Critical control point of beef products and food. *Resources*, 22, 80 – 85.