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Bacteriological Evaluation of Street Vended Guinea Fowl Meat Sold at Nkalagu, Ishelu Local Government Area, Ebonyi State, Nigeria

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***Abstract*: Street vended foods have become part of life in this part of the world. These foods are sold mostly uncovered thereby exposing them to dust and other environmental hazards that could contaminate them. The study was aimed at evaluating microbial quality of Street Vended Guinea fowl Meat sold in Nkalagu in Ishielu Local Government Area of Ebonyi State Nigeria. Guinea fowl meat samples were randomly purchased from three different hawkers or vendors in Nkalagu and transported to the lab for analysis. With the aid of swab stick, samples were collected from the purchased meat and dislodged in 10ml peptone water. 0.1ml of the sample was inoculated onto prepared media and incubated at 370C for 24hrs. Following standard identification protocol, six genera of bacteria viz *Staphylococcus s.p, E. coli, Enterobacter aerogenes, Klebsiella sp., Salmonella sp. and Pseudomonas sp.* were isolated. Physical observation revealed that the meat sellers were involved in unhygienic practices such as using of knives without sterilizing them; wearing of dirty aprons and clothes. From the foregoing, it is recommended that consumers of guinea fowl meat should endeavor to re-cook the meat before eating as they are already contaminated before purchase; there is need for public creating awareness on the best way to hawk this meat; regular monitoring of the street vended meat should be undertaken by the Local Government health authorities so as to checkmate the unhygienic practices.**

***Keywords*: Guinea fowl, ready-to eat meat, vended food.**

1. Introduction

Street vended Guinea fowl meats are ready-to eat meat prepared and sold by vendors, especially in streets and other similar public places. Street vended guinea fowl meats are known to be popular due to their low cost, variety and nutritional value. Meat is consumed by many people worldwide, probably because of its good taste and nutritive value. It has a high biological value and is easily absorbed and incorporated into human body proteins (Ahmad et al., 2018). However, it also serves as a suitable medium for bacterial growth and is a major contributor to foodborne diseases (Bintsis, 2017; Ashwathi, 2020). Vended foods such as Guinea fowl meat constitute part of foodborne infections. According to Adzitey et al., (2015), foodborne infections still remain one of the major problems of public health worldwide. Data from different countries differ because food production, processing and distribution differ from country to country (Adzitey et al., 2012a). One of the major causes of foodborne infection is the consumption of meat and meat products contaminated with foodborne pathogens (Adzitey et al., 2012a; EFSA., 2012; Public Health England, 2013).

The predominant foodborne bacterial species that have frequently been associated with meat include *Salmonella enterica, Escherichia coli, Campylobacter species, Clostridium species, Staphylococcus aureus, Listeria monocytogenes, Bacillus cereus, Shigella spp., Vibro parahaemolyticus, and Yersinia spp.* (Anachinaba et al., 2015; EFSAECDPC, 2018; Tay et al., 2019; Adzitey, 2020, Adzitey et al., 2020). These organisms are linked to several human illnesses and deaths annually (EFSAECDPC, 2018; Omer et al., 2018; CDPC, 2020; WHO, 2020; USFDA2020).

The World Health Organization estimated that 600 million people fall ill after eating contaminated food, and 420,000 die every year as a result (WHO, 2020). Additionally, USD 110 billion is lost each year in productivity and medical expenses due to the consumption of unsafe foods. The European Food Safety Authority and European Center for Disease Prevention and Control (EFSAECDPC, 2018) indicated that out of 5079 food/waterborne outbreaks, Salmonella was the most common bacterium detected. Furthermore, Salmonella species from meat, meat products, and eggs were the highest risk source. A review by Omer et al. (2020) on bacterial foodborne outbreaks related to red meat and meat products between 1980 and 2015 showed\ that Salmonella species caused 21 outbreaks, mostly in Europe and the United States of America. Salmonellae are responsible for millions of cases of enteric diseases, thousands

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of hospitalizations, and deaths worldwide each year (EFSAECDPC, 2018; USFDA2020). Ninety-six (96) Salmonella outbreaks associated with beef were reported by Laufer et al. (2015) in the United States.

The increasing consumption of guinea fowl meat among Nigerians especially among the Nkalagu people of Ebonyi State may be due to its low cost in meeting the protein need of the people and affordability. One sees this ready-to-eat meat being carried on tray by secondary school age girls in the parks and along the roads. These exposed thereby given the possibility of contamination by microbes. The way and manner these meat are exposed calls for investigation to ascertain its bacteriological quality. It is based on this fact that this study is conceived to bacteriological evaluation of street vended guinea fowl meat sold at Nkalagu, Ishelu Local Government Area, Ebonyi State, Nigeria.

2. Materials and methods

1) Area of the Study

The study was carried out within Nkalagu in Ishielu Local Government Area Ebonyi State. Here, the vendors of this product are seen carrying the read-to-eat meat on tray pans in all the parts along Abakaliki Enugu road looking for potential buyers.

2) Sample Collection

Samples were randomly collected from three different vendors of guinea fowl meats at Nkalagu, Ishielu L.G.A, and then taken to microbiology laboratory for microbial analysis.

3) Microbiological Analysis

Moistened swab sticks were swirled on the surface of the individual ready-to-eat meats to collect samples from the meat. It was then dipped into 10ml peptone water and shaken so as to dislodge the organisms inside the peptone water. With the aid of pipette, 0.1ml of the sample was inoculated by spread plate technique onto the solidified media. The plates were incubated for 24 hours at 37^{o}C. Isolates were identified by standard microbiological methods through their colonal, cellular and biochemical features.

3. Result

Table 1
Samples Cultural morphological characteristics of isolates

Samples	Cultural Features	Morphological Features	Probable Organisms
Sample: A	Pink, yellow pigments Mucoid, flat, rough	Rods, cocci	*Staphylococcus spp, E. coli Salmonella spp.*
Sample: B	white, light, Pink, Pigments	Cocci, rods	*Enterobacter aerogenes Klebsiella sp., Salmonella sp*
Sample: C	Yellow, pink	Cocci cluster	*Staphylococcus sp Pseudomonas sp.* *Salmonella sp..*

The samples yielded different colonies with varying pigmentation which implies the presence of different organisms in each of the samples (Table 1.).

Table 2
Biochemical and microscopic characteristics of isolates

Catalase	indole	urase	citrate	oxidase	motility	coagulase	gram	VP	G.	M	S	L	isolated organism
Sample A													
-	-	-	+	-	-	-	-	+	+	-	+	ND	*S. aureus*
+	+	-	-	-	-	-	-	+	+	-	+	+	*E. coli.*
+	-	-	-	-	+	+	-	-	-	-	+	-	*Salmonella* sp.
Sample B													
+	+	-	+	-	-	-	+	+	+	+	+	+	*Enterobacter aerogenosa*
+	-	+	+	-	-	ND	-	+	+	+	-	+	*Klebsiella* sp
+	-	-	-	-	+	+	-	+	+	-	+	ND	*S. aureus.*
Sample C													
-	-	-	+	-	-	-	-	ND	ND	-	ND	-	*Staphylococcus Aureus*
+	-	ND	-	+	+	-	-	-	+	-	-	ND	*Pseudomonas* sp.
+	-	-	-	-	+	+	-	-	-	-	+	-	*Salmonella spp.*

KEY: + = Positive; - = Negative, ND = Not Done G: Glucose, L =Lactose, S=Sucrose, M=Manitol.

The biochemical characterization of the isolates revealed the presence of six bacteria. These included *E. coli. Salmonella spp. Enterobacter aerogenes, Klebsiella sp, Staphylococcus spp, Pseudomonas spp*. (Table 2).

4. Discussion

The present study aimed at evaluating the bacteriological quality of street vended guinea fowl meat sold at Nkalagu, Ishielu Local Government Area of Ebonyi State. The fact that guinea fowl meat is relished and cherished by most Ebonyians and none-Ebonyians as a result of its nutritional quality and pocket friendliness have placed it at the heart of many people especially those passing through Nakalagu – Enugu road. The result obtained from each of three randomly purchased samples showed that each of the samples harboured many genera of bacterial which was identified by differences in pigmentation, size and macroscopic morphology of the isolates (Table 1)

The cellular and biochemical characterization of the isolates revealed the presence of six bacterial namely: *E. coli., Salmonella spp. Enterobacter aerogenes, Klebsiella sp, Staphylococcus spp, Pseudomonas spp*. (Table 2). The organisms *Klebsiella spp*, E. coli. *Salmonella spp, Pseudomonas spp*. and *Enterobacter spp*. isolated in this present study (table 2) agrees with the works of Basin et al., (1998) who reported that other bacteria isolated from guinea fowls in a surveys they conducted included, *E. coli. Salmonella, Klebsiella, Proteus, Pseudomonas and Enterobacter sp*. The ability of this organisms to contaminate meat have been well documented. Anachinaba et al., (2014) in their assessment of the Microbial Quality of Locally Produced Meat (Beef and Pork) in Bolgatanga Municipal of Ghana noted the recovery of *S. aureus, Salmonella, E. coli* etc.

The presence of organisms as *E. coli, Salmonella spp. Staphylococcus spp*. in this present study cannot be unconnected with the unhygienic nature of the vendors involved in the hawking these products. As most of the

organisms such as *E. coli and Salmonella spp*. are indicator organisms of feacaoral contamination of the samples. The issue of hygiene is very important as these vendors are majorly secondary school age. Also the environment at which this animal is slaughtered, the pans with which it is sold and the way and manner at which these meats are exposed and sold exposes these meats to microbial contamination. This position agrees with the separate views of Warriess, 2000; Adzitey et al; 2014 when they noted that the muscle tissue are easily contaminated with both pathogenic and nonpathogenic microorganisms at time of slaughter condition, when these are done poorly and under any faulty processing condition.

Also the issue of poor personal hygiene being responsible for the contamination of the meat is consistent with the position of Anachinaba, et al., (2014), when they observed that various poor handling and unhygienic practices were observed during their data collection. They noted that for instance, that butchers handling meat paid little or no attention to their personal hygiene and served the meat with dirty hands and clothing. That meats were put on tables which are not well cleaned before and after the day's work and also in the open exposing the meat to houseflies. Poor sanitation was also observed in the immediate environment were meats are sold. Adzitey et al., (2014) observed similar unhygienic practices in the handling of meat in the Yendi Municipality of the Northern Region of Ghana.

Environmental factors such as humidity and temperature can significantly contribute to the rate and quality of microbial contamination of meat. Ebonyi state is one of the states with high temperature and Nkalagu where the guinea fowl meat is processed and marketed is cannot be exemption. This position is in consistent with the view of Mukhopadhyay (2009) who opined that, hot and humid climate areas contribute to increasing total aerobic counts on meat; and that could have contributed to the high total aerobic counts of the meat in this study since Bolgatanga is a hot and humid area. Warriss, (2000); Alvarez et al. (2009); Adzitey, (2011); Adzitey and Nurul (2011) buttressed this issue further when in their separate postulations noted that under poor processing conditions, pathogenic and non-pathogenic microorganisms are introduced during slaughtering of animals and processing of carcasses into meat

However, most of the isolates contaminate the guinea fowl meat as a result of its high nutritional composition. Warriss, (2000); Komba et al. (2012) in their separate studies echoed this position when they remarked that in addition the high nutritional value of meat makes it susceptible to high levels of microbial contaminations. The high rate of proliferation of vendors of guinea fowl ready-to-eat meat at Nkalagu in Ishielu L.G.A. Ebonyi state and the high number of customers seen patronizing these vendors could be as a result of the good flavour and high meat quality of the guinea fowl meat. This position is line with the findings of Koney (1993) when he observed that the guinea fowl yields higher, firmer and tastier meat than chicken. Most visitors to Northern Ghana always request for guinea fowl meat to eat. The high rate of unemployment in this country could be cautioned by people venturing into the business of guinea fowl production and marketing. This position is buttressed by the view of Awotwi (1975) when he observed that guinea fowl production has great potential for income generation to reduce poverty, malnutrition and food insecurity among rural and pen-urban farm families.

The presence of these organisms portends the possibility of food-borne illnesses as these organisms are pathogenic. Some strains of E. coli for instance cause varying degrees of illnesses such as diarrhea and respiratory illness. This assumption is buttressed by the position of Adams and Moss, (1995) in their remarks that some E coli are pathogenic, meaning they can cause illness either diarrhea or illness outside of the intestinal track. E coli that causes diarrhea can be transmitted through contaminated water or food, or through contact with animals or people. E. coli also causes diarrhea, urinary tract infections, respiratory illness, blood stream infection and other illness as to agree with. However, the presence of Enterobacter aerogenosa in this present study is another cause for concern as this organism is known to be opportunistic in nature. This agrees with the view of Janda and Sharon, (2006) in their statement that E. aerogenosa are opportunistic and only infect those who already have suppressed host immunity defenses. Infants, the elderly, and those who are in the terminal stages of other disease or are immunosuppressed are prime candidates for such infections.

Salmonella sp. as recovered in this present study is another cause of serious concern. Salmonella sp. is well known to cause enteric fever. With this organism in the meat samples, there is the possibility of outbreak of salmonellosis in this community and beyond as the people who buy this meats are not just within Nkalagu community but from far and wide.

5. Conclusion

Ready – to – eat guinea fowl meats sold at Nkalagu, Ebonyi State where purchased from three different vendors and their microbial quality analyzed. The analysis revealed the recovery of six genera of bacteria that are of medical importance. They include: *Salmonella spp. Enterobacter aerogenes, Klebsiella sp, Staphylococcus spp, Pseudomonas spp and E. coli*. This discovery reveals there is need for consumers of guinea fowl meat should endeavor to cook the meat before eating as they are already contaminated before purchase; there is need creating awareness on the medical implication of the way and manner guinea fowl meats are hawked in Nkalagu through radio jingles; regular monitoring of the street vended meat is suggested as this will help improving the quality and will also make the general public aware of the microbiological status of the street guinea fowl meats and provision of relevant agencies such as consumers protection rights and other need to ensure and enforce strict compliance to hazard analysis and provide critical control points for all meat production in Nigeria, Ebonyi State precisely.

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