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## The Food and the Poison, a Retrospect of Abattoir, Butcher Markets and Buckateria in Nigeria: An Emperical Study -

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## ABSTRACT

Meat forms a considerable component diet of large number of people around the world but unfortunately, meat is prone to contamination at various stages from primary production (abattoir and Butcher markets) to when it is ready for consumption (Kitchen, Restaurant etc) which call for food safety at every stages of meat food production. This study therefore, compliment the principle of Hazard Analysis Critical Control Points (HACCP) by ensuring the wholesomeness and safety of meat products from farm to fork, by addressing the poor hygiene and sanitations in the abattoir, slaughter slab, butcher shops and the place of premises, personnel, process and products (4Ps) in various buckateria. The study adopted the descriptive/diagnostic cross sectional designed, purposively and randomly involving 100 pieces of structured schedules administered in a ratio of 1:2:1. The study revealed the deplorable state of poor hygiene and sanitary practices employed right from the abattoir, slaughter house, transportation to butcher shops, processing at the butcher shops and the activities in the buckateria. At 5% there was no statistical significance difference of the activities in the abattoir and the slaughter slab in relation to the meat supply; so also between activities in the butcher market and the meat supply, though sanitation and hygiene difference was recorded. Therefore, the wholesomeness of meat food is a shared responsibility to all stakeholders along the food chain, calling on the significant needs for education and training in the prevention of foodborne diseases among Abattoir workers, butchery, meat food producers, suppliers, handlers and the general public to key into this course and reshape the anomaly's right from the farm to the folk.

**Keywords:** Abattoir; Slaughter house; Buckateria; Sanitation; Meat Hygiene; 4Ps

## BACKGROUND TO THE STUDY

Meat forms a considerable component diet of large number of people around the world [1]. It is an essential proteins source of human nutrients in the classes of food, making livestock production a potential food for the world's needy populace, whose activities are done in an Abattoir [2]. However, meat is a perishable food and its composition is ideal for the growth of a wide range of spoilage and pathogenic bacteria [3]. These pathogenic bacteria are responsible for the outbreak of new diseases like bird flu, Taeniasis, Tularemi, Trichinella, Ebola Virus Disease (EVD), bovine tuberculosis, among others. This has made meat hygiene gained immense prominence as a matter of utmost public health concern especially to the meat consumer, which called for meat safety and quality supply.

Unfortunately, in Nigeria safety and quality supply is not self sustaining in the food production due to the poor state of abattoirs and slaughter houses. Marcus [4] revealed that there are only three (3) standard Abattoirs in Nigeria, mostly located in Lagos, Borno and Nasarawa State; the rest are operating below standards whose operation remained illegal. Therefore, the cleanliness and operations of abattoirs and slaughter houses is a major public health concern as it revealed the poor state of meat processing plants, the ineffective meat inspection services and the resultant consumption of unwholesome meat by the public. EHORECON [1] posed that in most abattoirs; ante-mortem (pre-slaughter) inspection of animals is rarely done though it is mandatory and in certain cases, it has been observed that the abattoir workers lack necessary tools and equipment which exposed them to zoonotic infections.

On the contrary, Macus [4] further expresses that though animal mark for slaughtering may be healthy, they end up contaminated during processing due to unsafe and poor operational hygiene act. Similarly, on a daily basis meat from the abattoirs were transported in bags and cartons, wheel barrows, passengers in vehicle and motorcycles in addition to the hawking and displaying of meat in the open street; exposing meat to contaminants as flies, dust, fumes, pollens and other pathogens in the environment. Regrettably, the meat inspections organs often lack the necessary information and guidelines to assess the sanitary status of carcasses, meat and meat products; while in worst cases is the unwillingness to raise an alarm on observed localised and generalised lesions, chronic and acute (organs and viscera) of meat parts by corrupt officers as against the

countless treats from the abattoir management; a dilemma raised by Olalekan, Olawale; Christian & Simeon [5]. Moreover, the authorities are most likely interested only in the revenue collection rather than good management and maintenance of this Abattoir; besides the proliferations of cooperative slaughter slabs and illegal slaughter houses which posed serious danger to public health. In additions, the safety of meat supply for public consumptions of recent is questionable as meat supply, sources from dead animal, fermented PONMO burned with tyres, to meat from animal literarily condemned by the public as unwholesomely inedible (inviolable) such as Donkeys, Horse etc, but ungraciously ends up in various individual and public kitchens as buckateria, restaurants, hotels etc.

According to Odiye, et al. [6] Food safety has become one of the ten threats to global health in 2019; as the outbreaks of foodborne diseases had caused approximately 76 million illness, 325,000 hospitalizations and 5000 deaths yearly. However, 60-75% of such illness is associated with the consumption of contaminated foods of animal origin while bukateria premises are the most frequently cited sources of sporadic outbreak of foodborne infection including WASH related diseases.

Based on the presupposition, this work is undertaken to guide and compliment the principal of Hazard Analysis Critical Control Points (HACCP) by ensuring the wholesomeness and safeness of meat products from farm to fork. Interestingly, over the years, researcher's interest on related subjects tailored towards the impact of Abattoir operation on surface and ground water resources [7-9]; effects of abattoir on residential neighborhoods [10]; the management problem of abattoir waste [11-12]; while literature in safety and wholesomeness of meat supply for public consumption remained scanty, hence the important of this study seek to address the standard and quality of Abattoir operations; the wholesomeness/quality of meat made available in the markets (Butcher's shops); Butcher's hygiene, handling and safety towards the final consumer and also the safeties of meat in various food vendors (bucketaria) in terms of Premises, Personnel, Processes and Products (4Ps).

## MATERIALS AND METHODS

### Study area

The study is done within the Yenagoa metropolis, the capital city of Bayelsa State. Yenagoa city is the meat hub to her hinterlands

communities and towns; hence it hoisted the central abattoir and other slaughter slabs, majorly for meat food supply for human consumptions. The study covers the state central abattoir at Bayelsa Palm road, two slaughter slabs located at Swali market and Tombia Junction, four major daily meat markets located within the 5 Kilometers radius (Swali and Kpansia) and 15km radius (Opolo and Tombia market) of the Yenagoa city master plan (Figure 1).

**Study design and method of data collection**

This study adopted the descriptive/diagnostic cross sectional designed, purposively and randomly involving 100 piece of structured schedules administered in a ratio of 1:2:1 to respective stakeholders (domain) within 5km and 15 km radius in Yenagoa, the capital of Bayelsa State. The study involved the central abattoir; slaughter slabs, Butchers shops in daily market centers and few Buckers (food vendor) owned by small operators. To elucidate the aim and objectives of the study, the study area is grouped into three (3) targeted groups (domain) viz: group 1. Comprised of the Abattoir and slaughter slabs, which were purposively selected. Group 2 is randomly selected which comprised of the Butcher Shops in daily Markets (Swali, Kpansia, Opolo and Tombia); Group 3 also randomly selected and it comprises of the food vendors (buckers, mama-puts etc) (Table 1 & 2.)

The sample size was determined following Taro Yamane sample size determination formula of

$$N = N/1+N(e)^2 \text{ with a population size of } 100 (N) \text{ at } 5\% (e) \text{ significant level .....Equ 1.}$$

Furthermore, the number of schedules administered to each group was computed using Bowler’s proportional allocation formulae as (Table 1)

$$n_1 = n(n_1)/N, \text{ with } N \text{ as population } (100); n_1 \text{ schedule distribution..... Equ 2.}$$

**Analysis**

Field data were presented in percentages were necessary and further analyzed using the Two-Way ANOVA analysis of variance to test for significant difference. Arising from the fact that meat

and its byproducts got contaminated at various stages (domain) of processing; data were classified on the basis of three factors at various stages (domain) of meat processing to reveal the possible sources of cross-contamination. The quality of meat in the abattoir as it is influenced by the overall activities in that domain so also the quality of meat supply in the butcher shops. The first hypothesis addressed the quality of meat products in the abattoir in relation to the operational hygiene; sanitary status; veterinary studies and food security while the second hypothesis addressed the quality of meat supply in the Butchers shop as influenced by the quality of meat supply from source (abattoir); sanitary operation and handling hygiene. The two-way Anova thus, explained the amount of variations in the domain as attributed to chance and causes.

**RESULTS AND DISCUSSION**

**Abattoir and slaughter slabs**

An abattoir is a place designed statutorily and designated by approving bodies for the slaughtering of animals, processing, preserving and storing of meat and by-products of livestock for human consumption [13]. It is commonly called slaughter houses, slaughter slabs and places where livestock especially animals like Bovines (cattle), Ovines (sheep), Porcines (pigs), Caprines (goats), etc. are slaughtered or butchered for foodin the case were the general requirements for abattoir are not met. Mamhobu-Amadi, et al. [14], posed that, abattoir facility undertake a number of operations ranging from the temporary storage of the animals in lairage, pennens before proceeding for stunning, laughtering and bleeding, scalding, skinning, dehairing, plunking, evisceration, Chilling/Hanging of capus and tatus, to washing, cutting/debonning, roasting of the skin, etc. These activity exclusively depend upon the adoption of highest sanitary and hygiene principle to safeguard meat food supply from cross-contamination. Chukwu, et al. [15] stated that Slaughter activities if not properly controlled and managed may posed serious danger to both the farmers, butcher’s, environment and the consumers. Ali, et al. [16] also confirmed that without proper hygiene control, the environment in abattoir and butcher services act as important sources of bacterial contamination.

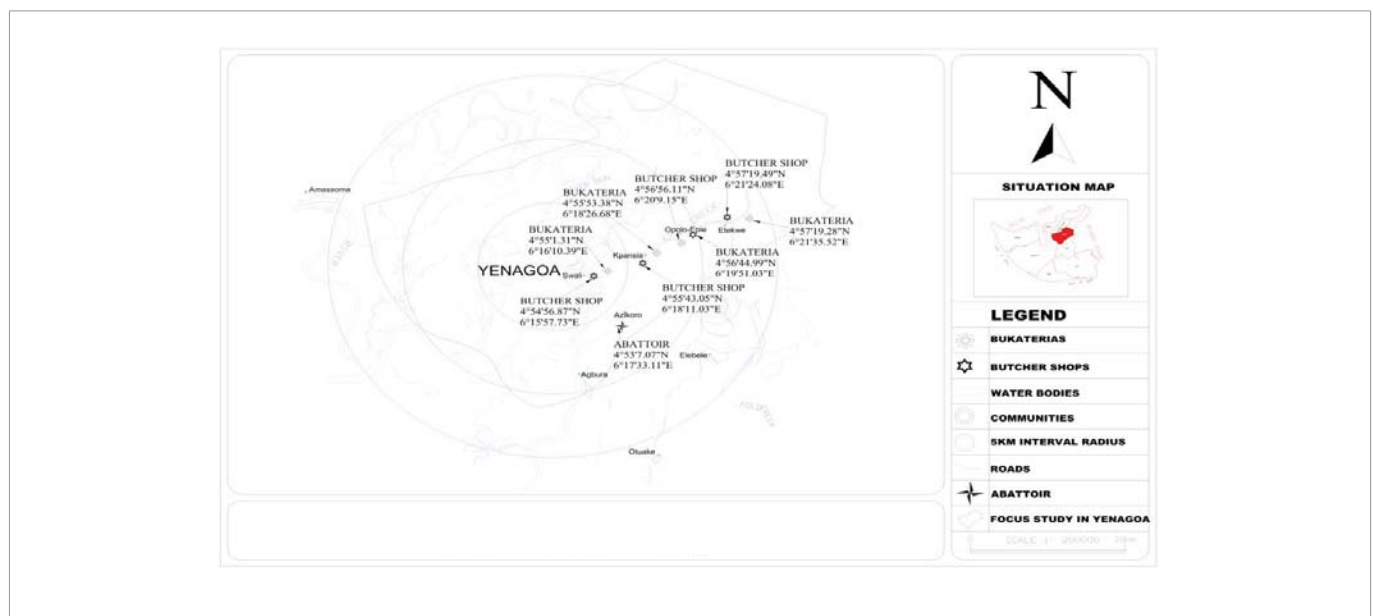


Figure 1: Abattoir, Slaughter slab, Bukateria within 5, 10 and 15 kilometers radius of Yenagoa.

**Table 1:** Presents the calculated sample size of each study group.

Study Group	Assign Sample Schedules	Sample Size Of Each Group n(n <sub>1</sub> )/N
Abattoir and Slaughter Slabs (n <sub>1</sub> )	25	80 x 25/100 = 20
Dairy Markets (n <sub>2</sub> )	50	80 x 50/100 = 40
Food Vendors (n <sub>3</sub> )	25	80 x 25/100 = 20

Source: Researcher, 2020.

**Table 2:** The study group and focus.

Group	Focus
Group 1. - Abattoir and Slaughter Slabs	Assessment of Sanitary, general operations and hygiene measures practiced during and after animal slaughtering.
Group 2.- Butcher Shops in Dairy Markets	Assessment of Sanitary, general operations and hygiene measures practiced by Meat Butcher's during and after meat Sale and services.
Group 3. - Food vendors (Bukateria)	Assessment of Sanitary, general operations and hygiene principles adopted in terms of 4Ps (Premises, Personnel, Process and Products) in meat food supply.

Source: Researcher, 2020.

The study disclosed that, 85% respondents accepted that abattoir operations in the study area is yet crude i.e below required standards (Table 3) possible of constituting health and environmental hazards; a situations were meat skin's were burned with tyres, repeatedly immense burnt skin in polluted water and washed without changing the water; meat are placed in unprotected floor and exposed to flies infestation, bagging of meat in a mixed used bags and transported same in wheel barrow, commercial motorcycle, tricycles and cab (Plate 1-8). These acts not only exposed abattoir workers to several infectious agents but served as potential vehicles of transmission of zoonotic infections both inside and outside the abattoir environment.

Obiri-Danso, et al. [17] reported that ignited and burned tyres produces smoke that contained potential dangerous substances such that as it cools, poisonous substances like benzene is produced which when ingested, inhaled or touched, cause dizziness, giddiness, headaches, nausea, weakness, respiratory irritation, skin and eye irritation, central nervous system depression and cancer, capable of incapacitating the victim.

Toxicologically, tire fires have been shown to be more toxic (e.g., mutagenic) than those of (16 times) wood combustion and (13,000 times) of other fuel [18]. Open tire fire emissions include "criteria



plate 1. Personnel without PPE in Slaughtering and Evisceration process in the Abattoir



plate 2. Debonning of meat products in unhygienic manner



plate 3. Meat skin roasted with tyre freely drop on contaminated floor



Plate 4. Washing of meat roasted with tyre in a polluted water source



plate 5. Chilling of Meat part



plate 6. Skinning in an unprotected floor



plate 7. Skin burning with combustible tyre



plate 8. Unhygienic act at the Butcher shop (Touch was exchanging to)

**Plate 1-8:** Unprofessional activities and poor hygiene in the Abattoir/Slaughter slabs and butcher shops. Source from [20]; 6-7 [25]

**Table 3:** Respondents of Abattoir operations.

Abattoir Operation (n = 20)	Frequency and Percentages
Crude	17 (85%)
Mechanized	3 (15%)

Source: Researcher, 2020.

and non criteria” pollutants, such as particulates, Carbon Monoxide (CO), Sulfur Oxides (SO<sub>2</sub>), Oxides of Nitrogen (NO<sub>x</sub>), and Volatile Organic Compounds (VOCs), Polynuclear Aromatic Hydrocarbons (PAHs), dioxins, furans, hydrogen chloride, benzene, Polychlorinated Biphenyls (PCBs); and metals such as arsenic, cadmium, nickel, zinc, mercury, chromium, and vanadium which represent significant acute (short-term) and chronic (long-term) health hazards to workers, the meat and nearby residents [18]. Another observable fact remained the lack of cooling and sterilizing facility and preventive mechanisms installed for insects and rodents in the abattoir and slaughter slab exposing meat to possible contamination; concurring with the report of [19-21].

Furthermore, there was no preventive mechanism installed for insects and rodents in the abattoir and slaughter slabs; concurrently, Kumar, et al. [22] findings.

There is no statistical significance difference between the activities in the abattoir, slaughtered slabs and meat food supply, as the calculated F values of 1.765 and 1.216 is less than 5.14 and 4.76 table values respectively (Table 4 & 5). It could be recorded that the meat quality may be influenced as a result of poor hygiene operations, having realized that the overall operational services in the slab and abattoir is crude-operating below standards; hence the sanitary status of the abattoir is poor coupled with food insecurity caused by poor veterinary services.

### Market (Butcher shops)

Butcher Market is a geographic area of economic activity in which buyers and sellers come together and the forces of supply and demand affect prices of demand for meat commodities and services. Recently, the deplorable state of poor hygienic and sanitary practices employed right from the slaughtering house, transportation to butcher shops, and processing at the butcher shops is reported by Haileselassie, et al. [19]. Kikiope [23] also reechoed on the shady acts of selling infected

meat with diseases like worm, *Mycobacterium bovis*, *tuberculosis* and *Brucellosis* unknown to the public for consumption.

The study demonstrated that 65% of butchers shop sources their meat products from the slaughter slab as against 35% due to proximity, transportation cost and accessibilities. More so, it was revealed that, meat are conveyed in such unhygienic means as head portage (7.5%), wheel barrows (45%), motorcycles/bike (32.5%) and open vehicles (15%) in mixed form (dressed organs, head, tail and head in a single container) to the butcher chops; possible of contaminations (Table 6). Fasanmi, et al. [24] reported that meat contamination in retail meat outlets resulted from the use of contaminated water, unhygienic practices like poor handling, use of contaminated tables to display meat intended for sale, and the use of contaminated knives, wooden boards, weighing scales which promote the spread of *Staphylococcus aureus* and *Shigella species*.

Moreover, the study (97%) knives and tables are washed only with water with poor sterilization and continuous use of a single knife and table despite contact with dirty or contaminated surfaces possible of causing meat contaminations (Table 6); a related observation by Ali, et al. [16] who posed that lack of knowledge on disinfection and sanitization by the butcher caused high microbial load on the knife and cutting tables. Correspondingly, Bersisa, et al. [20] discovered that a total mean count of such pathogenic bacteria was found on the abattoir carcass (4.53 log<sub>10</sub> cfu/cm<sup>2</sup>); (2.4 log<sub>10</sub> cfu/ml) from water samples, (6.58 log<sub>10</sub> cfu/cm<sup>2</sup>) from butcher shops cutting table and (6.1 log<sub>10</sub> cfu/cm<sup>2</sup>) from cutting knife swab samples. Adetunde, et al. [25] added that the hygienic conditions of butcher has potential to contribute to the contamination of meat supply and in this study 90% Butcher’s handle money with bare hands and wore jewelries (watch, rings bracelets etc) possible of harboring and transmitting same microbes to meat (Plate 8). Evidently, detachable gadgets can help build *Staphylococcus aureus* around such items and most importantly they pose risk of foreign body contamination if they fall into the meat [20]. Current study revealed that most of the butcher shops are found on the road margin, exposed meat to dust and smoke due to wind or passing vehicles since only 5% displayed meat product in a pellucid case, the rest 95% displayed meat products in the open. On a related note, cross contamination by potential buyers with unkept nails with hand cuts and unwashed hands freely holdings meat products displayed in the open while pricing (cost negotiations) also render the

**Table 4:** Test of significance differences between activities and meat food in the abattoir.

Criteria	OH	SS	VSFS	Total
Best	0	1	1	2
Better	5	3	3	11
Good	9	9	5	23
Poor	6	7	11	24
Total	20	20	20	60

Source: Researcher, 2020. Where OH= Operational Hygiene; SS= Sanitary Status; VSFS = Veterinary Studies and Food Security

**Table 5:** Setting of the two-ways Anova table.

Sources	SS	d.f	M.S	F- ratio	F-Limit
B/W Column	900	2	450	1.765	2,6 = 5.14
B/W Row	930	3	310	1.216	3,6 = 4.76
Error	1530	6	255		

Source: Researcher, 2020.

**Table 6:** Percentage respondents (frequency) at the butcher markets.

Sources of meat supply (n = 40)	Frequency/Percentages
Abattoir	14 (35%)
Slaughter slab	26 (65%)
<b>Hygiene on Meat Displayed at Butcher (n=40)</b>	
Pellucid Case	2 (5%)
Open	38 (95%)
<b>Sterilization of Knives and tables (n=40)</b>	
Sterilized	1 (2.5%)
Non-Sterilized	39 (97.5%)
<b>Hygiene on Receiving and Giving out Money (n=40)</b>	
with Cloves	4 (10%)
Bare Hands	36 (90%)
<b>Means of Meat Transportation to the Butcher Chop (n = 40)</b>	
Head	3 (7.5%)
Wheel Barrow	18 (45%)
Tricycle/Motorcycle	13 (32.5%)
Open Trucks	6 (15%)

Source: Researcher, 2020.

**Table 7:** Test of significance difference between activities in the butchers shop and meat supply in the butcher shops using two-ways ANOVA.

Ranking	QMS	SO	HH	Total
Best	0	1	2	3
Better	4	10	5	19
Good	20	18	21	59
Poor	14	11	12	37
<b>TOTAL</b>	38	40	40	118

Source: Researcher, 2020. Where: QMS= Quality of Meat Supply; SO= Sanitary Operation; HH= Handling Hygiene

**Table 8:** Setting up the two-way analysis table.

Source	SS	D.F	M.S	F-Ratio	F-Limits
<b>B/w Column</b>	3483.7	2	1741.85	1.507	5.14 (2,6)
<b>B/w Row</b>	4059.7	3	1353.23	1.171	4.76 (3,6)
<b>Error</b>	6931.7	6	1155.28		

Sources: Researcher, 2020.

meat unfit. More so, meats in the open are vulnerable to infestation with flies and other pollens, which complement with the report of [20]. Similarly, an estimated 91million death in Africa is traceable to foodborn diseases and more than 70% diarrhea is linked to unhygienic ways of meat processing in Abattoirs according to WHO [26].

The Null Hypothesis was uphold as the calculated *F*-ratio value of 1.507 and 1.171 is less than the table values of 5.14 and 4.76 respectively at 5% significance difference (Table 7 & 8). And that the differences in meat from the abattoir and butcher shop are due to poor sanitary operation and poor handling hygiene of meat products in the market.

### Bukateria

Bukateria - a cafeteria, canteen or simply eating place (also known as buka, a West African "Hausa originated" word for Food stands

whose Etymological Note {Buka+cafeteria} according to Odipe, et al. [6].

Food poisoning is a gastroenteritis caused by eating meat that has been contaminated by bacteria or chemicals. Food poisoning is doubling in the developing countries due to the uncontrollable proliferations of unlicensed food vendors, supplying meat food of doubtful status to the public at low cost, mostly caused by poverty. This act exposed patronized to chronic and acute health challenges. Fatiregun, et al. [27] pointed that 58% of this food poisoning resulted from meat. Hence the places of 4Ps (Premises, Personnel, Processes and Products) in Hazard Critical Control Point analysis (HCCP) is addressed below.

### Premises

This refers to the immediate environment where Bukateria are located. The study revealed that 75% (15) Bukateria is located in poor



shanty and hovel environment due to space affordability and free business operation. Such an environment without fitted or screen doors and windows, rodents and flies freely perching on meat product to cross contaminate meat food supply for consumption.

### Personnel (Food handlers)

This includes all resource personnel generally involved in meat food productions in a given food premises. Bryan [28] disclosed that poor personnel hygiene practice by food handlers can be the vector for growth of microorganisms through hands, cuts, mouths, skins and hairs. In Nigeria, the law made it compulsory for public food handlers to undergo routine six months medical fitness but poverty of the mind, corruptions and levity has swept it under the rug. The study reported that 60% (12) of food handlers are unwitting of such services requirement and out of the 40% (8) that are informed; 80% never renew their fitness after six months validity period. Hence, proper hygiene services is lacking giving rise to unkept nails, cut and burned skin, negligence to the wearing of the required PPE (Personnel Protective Equipment) even as they sneezed profusely with an uncovered mouth and nose; an act possible of cross contamination.

### Processes (Preparation)

This refers to the whole range of activities perform to arrive at a ready final product. The wholesomeness of food products is mostly determined by the process; such as a break in the preparation chain leads to meat food poisoning. Lately, the quest for quick profits and easy money, food processing and food supplier (food vendors) inadvertently flimflam to the used and cooking with paracetamol (*acetaminophen*) tablets; potash (*EKEIN*) and aluminum objects such as nails to ease soften offals (*Meat Tenderization*) for public consumption which has arouse health risk. The Nigerian Association of Nephrology (NAN) has linked 25million kidney and liver failures (*Liver Necrosis*) as well as hypertension due to the consumptions of meat cooked with paracetamol (*acetaminophen*) as a major contributor [29].

The used of potash in meat tenderization can lead to gradual increased in potassium concentration which causes kidney damage and Heart disease known as *Cardiomyopathy*. Okeke, et al. [29] lamented that hundreds of households, restaurants and bars, especially those owned by small operators, has engaged on the continuous uses of paracetamol (*acetaminophen*) to tenderize meat to save cost as the prices of firewood/charcoal, kerosene and cooking gas hit the rooftop, yet the product remained accessible and cheap. Interestingly, paracetamol is a paraspecific acid of aminophenol and also a chemical substance while cooking it hydrolyzed into *4-aminophenol*, which is highly toxic to the kidney and liver accompany by acute renal failure [29]. The study revealed that 65% (13) of food vendors adopted other means to tenderized meat rather than the long time boiling for public consumption; which has resulted to improper boiling (Undercooking) of meat food product, similar to the report of Clayton and Griffith [30]. In 2019, Rachael pointed out that the consumption of undercooked meat food can leads to parasitic infections (*trichinosis*) and foodborne illness [31].

### Products

Product is the result of processes. It is the final edible material mainly prepared for human consumption. Since our study is limited to observations and human perceptions on meat food poisoning, medical investigations as regards to wholesomeness of food products where major limitation. A Professor of Food Science and Technology,

Alfred Ihenkuryonye pointed out that no fewer than 200,000 persons die annually of food poison in Nigeria [29]. In complementarily, the product is a function of the material, premises, personnel and processes. The four play an integral role in ensuring the quality and wholesomeness of the final product such that a twist in the above determinant rendered a crack down on the quality of products.

## CONCLUSION

Results from the study have showed that food safety is a nonexclusive complex process that must flow rightly in a sequential order from farm to folk. Notably, findings pointed that poor environmental sanitations, ineffectiveness and levity of responsible government organs, poor handling hygiene, poor transportation channel and means, personnel uncleanliness, poor production processes and predominance of illegal slaughter houses/slabs are causes of food poisoning in the study area. This is further amplified by the prevailing poor food handling and sanitation practices, tokenism and inadequate food safety laws, weak regulatory systems, lack of financial resources to invest safer equipments, and lack of education for food handlers. Therefore, the safety of food is a shared responsibility of all the stakeholders along the food chain, calling on the significant need for education and training on prevention of foodborne diseases among Abattoir workers, butchery, food producers, suppliers, handlers and the general public to key into this course and reshape the anomaly's right from the farm to the folk to promote food safety. In addition, all the stakeholders along the food chain must work closely with national governments to help set and implement food safety strategies and policies that will in turn guarantee the supplying of wholesome meat food for the world populations.

## RECOMMENDATION

The study therefore recommends for the following:

1. The abattoir and slaughter houses should be improved both in personnel and equipment to guarantee safety and wholesomeness of food supplying to the final consumers.
2. Responsible Government organs on meat safety should rise up to the tasked and take up the challenges while also calling on the government at all levels to support the provision of this service to manned the inadequate preparedness and lack of public health laboratories in the state.
3. A routine and adequate training /transfer of such training to behavior into practices to help reduce the resulting effects of contamination on health and economy.
4. Food vendors should adopted other established safe methods for tenderizing meat such as cooking with a pressure cooker, marinating (soaking) with vinegar, citrus juices or wine before cooking as approved by NAFDAC (National Agency for Food and Drugs Administration and Control).

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