Microbial Quality Of Turkey Meats Sold In Some Locations In Port Harcourt Metropolis

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Abstract: This study was aimed at assessing the microbiological quality of fresh, frozen and refrigerated turkey thighs and wings from different locations in Port Harcourt metropolis. The samples used for this study were collected from three different location (Open Market, Cool room and Retailers store) all in Port Harcourt, Rivers State, and was transported aseptically to the laboratory using sterile bags and were analyzed using standard method for total bacterial counts, total coliform counts, total fungi counts. Bacterial isolated that were identified include *Salmonella spp, Shigella spp, Staphylococcus aureus and Escherichia coli* and they are all foodborne pathogens that causes foodborne illness and food contamination. The total bacterial count of the turkey wing samples was from 3.7 x 10^6 to 9.9 x 10^6 while the total bacterial count of the turkey thigh samples was from 1.0 x 10^6 to 9.3 x 10^6, The total coliform count of the turkey wings was from 3.4 x 10^5 t 4.6 x 10^5 and the total coliform count of the turkey was from 1.8 x 10^5 to 5.5 x 10^5. The total fungi count was from 2.6 x 10^4 to 3.7 x 10^4 for turkey thigh sample and for turkey wings sample the total fungal count was from 4.0 x 10^4 to 4.7 x 10^4. Also, the presence of these organisms indicated that there were poor hygienic conditions during the slaughtering, packaging, storage and sales process. Therefore, this food is a serious risk to the public health. Temperature control also is a key issue in producing frozen turkey meat. In addition, it is also important that the products must be manufactured under good hygienic practices. Because of the growing global concerns on pathogenic microorganisms which can be pass from animal to human, good hygiene practices should be obtain to avoid contamination. Adequate treatment should be given to the turkey to eliminate the possibility of antibiotics resistancee bacteria surviving which play a role in prevention and spread of diseases.

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Key words; turkey meat, food borne pathogens,microbial contamination

Introduction

Poultry meat is an important part of the animal food and the volume of their production, marketing and consumption is increasing to satisfy the public demand worldwide within the last decades. Modern poultry processing requires a high rate of production throughout to meat consumers demand, as poultry can be easily be contaminated with microorganism due to many factors as nutrients, high water activity and neutral pH (Kabour, 2011)). However healthy turkey entering slaughter processing might be highly contaminated by microorganism including foodborne pathogens such as *Salmonella* spp, *Shigella* spp, *Staphylococcus aureus* and other bacteria and these pathogens tend disseminate in the processing plant, they can be found in the surfaces of feet, feather, skin and also in the intestines. During processing a high proportion of these organism will be removed but further contaminations can occur at any stage of the processing operation (Kabour, 2011). The procedure for converting a live healthy product provides many opportunities for microorganisms to colonize on the surface of the carcasses during the various processing operations opportunities exist for the contamination via knives, equipment, the hands of workers and cross contamination from carcass to carcass. Some processing operations increase contaminating microorganism or encourage their multiplication (Gould, 2008). As a result, the microbial population changes from mainly Gram positive rods and micrococci on the outside of the live turkey on gram negative microorganisms on the finished product (Gill *et al.*, 2005). Effort should be made to prevent the buildup of contamination peaks during processing. Rinsing of the carcasses especially defeathering and evisceration is therefore of great importance (Mead, 2004). Spoilage bacteria grow mainly on the skin surfaces, in the feather follicles and on cut muscle surface under the skin. Contamination to poultry meat with foodborne pathogens remain an important public health issue, because it can lead to illness if there are malpractices in handling, cooking or post cooking storage of the product. In developed countries, foodborne illness causes human suffering and loss of productivity and add significantly to the costs of food production and health care. It is also a possible cause of mortality which is even more of a problem in developing regions, where the health status of many individual is already comprised. Since there exist pathogen microorganisms widely, and these can

spread over the flog rapidly, turkey meet should also be taken into account for food-borne illnesses. The main bacterial infection and intoxication factors arising from turkey meat are *Salmonella spp., Listeria monocytogenes, Campylobacter jejuni, Staphylococcus aureus* and *Clostridium perfringens.* From poultry farm to table in all the stages, in case of not taking the required protective provisions, microorganisms and contamination can be formed, and due to these contaminated factors, consumption of turkey meat may cause infections and intoxication (Aydın Vural et al., 2013). Despite the several studies conducted to determine the hygienic quality of the red meat and poultry meats, there are not sufficient number of studies to determine the food safety and public health risk dimensions of turkey meat and turkey products which have been produced to a large extent in recent year. The aim of this study is to determine the microbial quality of the turkey meat sold at different location (retailer stores, open market and cool room) in Port Harcourt metropolis, to determine the contamination rates among the poultry purchase in different locations, to evaluate the risks in terms of public health of the turkey meats put on sale in different locations and antibiotic susceptibility of the isolates.

Materials and Methods

Collecting the Samples

A total of 18 samples of frozen,fresh and refrigerated turkey thigh and wings were purchased from three locations(three locations (retailer stores, coolroom and open market) Open market (fresh) at Choba, Retailer Store (Refrigerated) at Rumuokoro and cool room (Frozen) at Tank, all in Port Harcourt, samples were immediately brought into the laboratory keeping their storage temperatures and without letting it dissolved, followed by microbial analysis. The complete process of thawing, dilution and culturing was performed in a laminar flow to avoid contamination.

Microbiological Analyses

Thawing of chicken meat was performed at room temperature before 50 g of sample was taken aseptically by scalpel excision and stomached in a sterile stomacher bag containing 450 mL of peptone water (PW Oxoid Ltd., Hampshire, England) for 2 min. Ten fold serial dilutions were carried out using the same diluents and from the appropriate dilution aliquots of 1 mL were used for microbiological investigations using officially recommended techniques as follows: Total aerobic plate count (APC) was determined by spread plate technique using plate count agar (PCA) (Oxoid) as described by Maturin and Peeler (US FDA, 2001). Inoculated plates were incubated at 30 °C for 72 h before developed colonies were counted. 50 grams of turkey meat sample was weighed and 450 mL of buffered peptone water (oxoid) was added and incubated for 16–20 h at 35–37 ◦C for pre- enrichment of Salmonella spp. One milliliter of the mixture was transfer to 10 mL of selenite cystine broth (oxoid) and incubated for 24 h at 35–37 ◦C for selective enrichment. and Salmonella – Shigella agar (oxoid) were used as selective agar medium. After incubation for 24 -48hours at 35–37 ◦C, Potato Dextrose Agar (Oxoid CM139) was used for the purposes of mold & yeast isolation. The counting was achieved after 5 days of incubation at 25 °C, Total Staphylococcus counts was done using Mannitol salt agar(oxoids) incubated at 37^0c for 24-48 hours and total coliform count was done using MacConkey agar(oxoids) incubated at 37 ^{0}c for 24-48 hours, biochemical tests were performed for typical colonies. All the pure isolates in Nutrient agar slants were put to systematic studies for identification. Those were studied on the basis of morphology, cultural characteristics, biochemical and sugar fermentation reactions. The isolates were identified on the basis of Gram's staining, motility, cultural characterization and biochemical screening by indole test, methyl red (MR) test, Voges Proskauer (VP) test, citrate utilization test, urease production test, TSI agar test, H2S production test and nitrate reduction test.

Results

It is well documented that contamination of food with pathogens is a major public health problem. Because of the relatively high frequency of contamination of poultry with pathogenic bacteria, raw poultry products are reported to be responsible for a significant number of cases of human food poisoning (Georgnaras, 1995). In the absence of hygienic conditions, the birds may highly exposed to bacterial pathogens such *Listeria monocytogenes, Campylobacte*r and other enteric bacteria (Maretha *et al*, 1996), In addition to pathogenic bacteria special attention in the hygiene production and storage of poultry meat is paid also to total bacteria counts, enterobacter and *Escherichia coli.* These bacteria are considered indicators of microbiological quality. Aerobic plate counts are widely accepted measure of the general degree of microbial contamination and the hygienic conditions of processing plants Cohen *et al.*, 2007. In this study the average total bacteria count for turkey wings for the three locations are as follows open market $6.8x\ 10^6$, retailer store $6.9x\ 10^6$,cold room $5.9x10^6$ while that of turkey thigh for the three location open market $6.3x\ 10^6$,retailer store $6.5x\ 10^6$, cold room $5.3x10^6$,the average total coliform count for turkey wings open market $4.9x10^5$, coolroom $3.6x10^5$ retailerstores. $3.7x10^5$, Turkey thighs $4.7x10^5$ open market, $3.5x10^5$ retailer stores, $3.2x10^5$ cold room.

Table 1. Bacterial population of turkey wings sample

Samples	TBC	SC	STAP COUNT	TCC
CRTW1	7.1×10^6	5.5×10^3	4.1×10^4	3.4×10^5
CRTW2	5.3×10^6	9.2×10^3	5.0×10^4	3.9×10^5
CRTW3	5.5×10^6	8.0×10^3	7.7×10^4	3.7×10^5
OMTW4	6.9×10^6	6.8×10^3	3.4×10^4	3.8×10^5
OMTW5	9.9×10^6	6.8×10^3	3.4×10^4	3.8×10^5
OMTW6	3.7×10^6	4.6×10^3	5.2×10^4	3.9×10^5
RSTW7	4.0×10^6	3.6×10^3	6.1×10^4	6.1×10^4
RSTW8	7.8×10^6	6.6×10^3	5.0×10^4	3.5×10^5
RSTW9	6.6×10^6	7.0×10^3	3.6×10^5	3.4×10^5

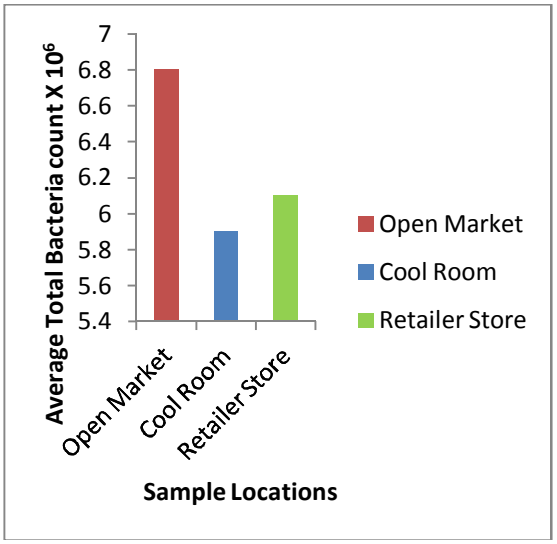
TBC; Total bacteria count; SC; Salmonella count, Staph count; Staphylococcus count, TCC; Total coliform count

OMTW - Open Market Turkey Wing
CRTW - Cool Room Turkey Wing
RSTW - Retailers Store Turkey Win

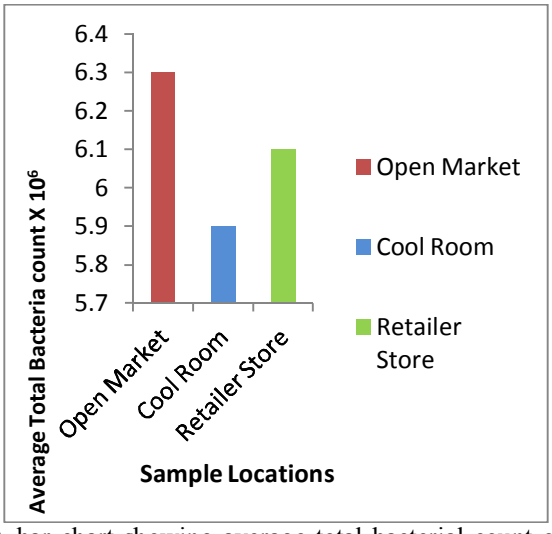
Table 2. Bacterial population of turkey thigh sample

Samples	TBC	ST	SA	TCC
OMTT1	5.6×10^6	3.7×10^3	3.2×10^4	4.9×10^5
OMTT2	7.0×10^6	4.1×10^3	3.4×10^4	4.6×10^5
OMTT3	6.4×10^6	8.6×10^3	4.4×10^4	5.2×10^5
CRTT4	1.7×10^6	5.5×10^3	4.3×10^4	3.4×10^5
CRTT5	4.1×10^6	4.5×10^3	9.2×10^4	5.5×10^5
CRTT6	4.4×10^6	4.7×10^3	3.3×10^4	1.8×10^5
RSTT7	9.3×10^6	3.2×10^3	7.7×10^4	4.2×10^4
RSTT8	1.0×10^6	9.7×10^3	6.7×10^4	3.1×10^5
RSTT9	6.0×10^6	9.6×10^3	5.6×10^5	3.7×10^5

Total bacteria counts TBC, *Salmonella* count SC, *Staphylococcus count* SA,
OMTT- Open Market Turkey Thigh
CRTT-Cool Room Turkey Thigh
RSTT- Retailers Store Turkey Thigh



A bar chart showing average total bacterial count of turkey (wings)



A bar chart showing average total bacterial count of turkey (thigh)

Table 3. The fungal count for turkey wing sample from 3 different locations was shown in table

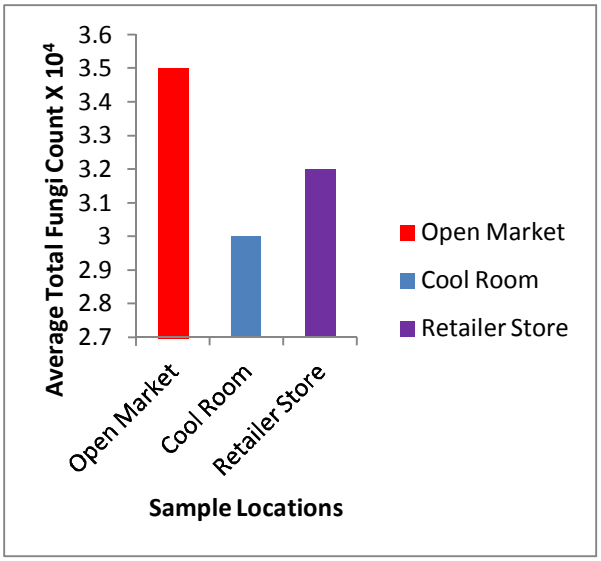
Location	Sample code	Fungal count cfu/ml	Average
Choba	OMTW 1	4.2×10^4	4.4×10^4
	OMTW 2	4.7×10^4	
	OMTW 3	4.3×10^4	
Tank	CRTW 4	4.3×10^4	4.2×10^4
	CRTW 5	4.0×10^4	
	CRTW 6	4.5×10^4	
Rumuokoro	RSTW 7	4.4×10^4	4.4×10^4
	RSTW 8	4.3×10^4	
	RSTW 9	4.7×10^4	

OMTW - Open Market Turkey Wing
CRTW - Cool Room Turkey Wing
RSTW - Retailers Store Turkey Wing

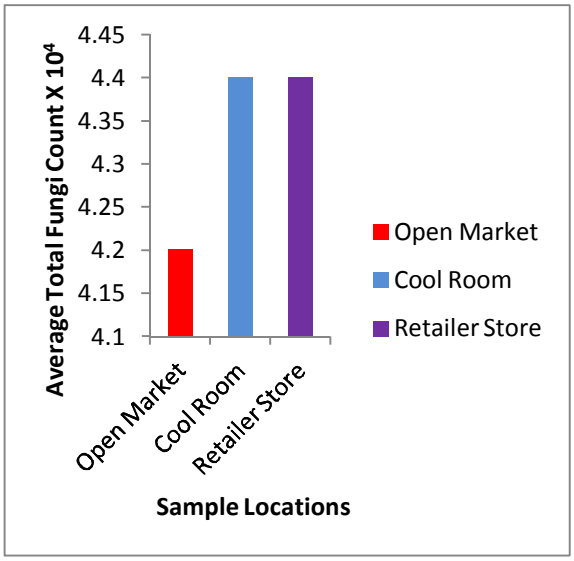
Table 4. The fungal count for turkey thigh sample from 3 different locations was shown in table.

Location	Sample code	Fungal count cfu/ml	Average
Choba	OMTT 1	3.6×10^4	3.5×10^3
	OMTT 2	3.3×10^4	
	OMTT 3	3.7×10^4	
Tank	CRTT 4	3.1×10^4	3.0×10^3
	CRTT 5	3.4×10^4	
	CRTT 6	2.6×10^4	
Rumuokoro	RSTT 7	3.1×10^4	3.2×10^3
	RSTT 8	3.5×10^4	
	RSTT 9	3.0×10^4	

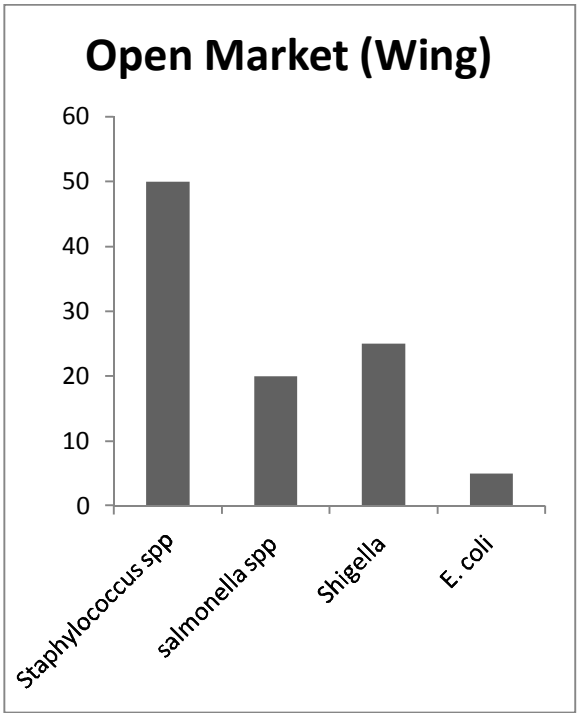
OMTT - Open Market Turkey Thigh
CRTT - Cold Room Turkey Thigh
RSTT - Retailers Store Turkey Thigh



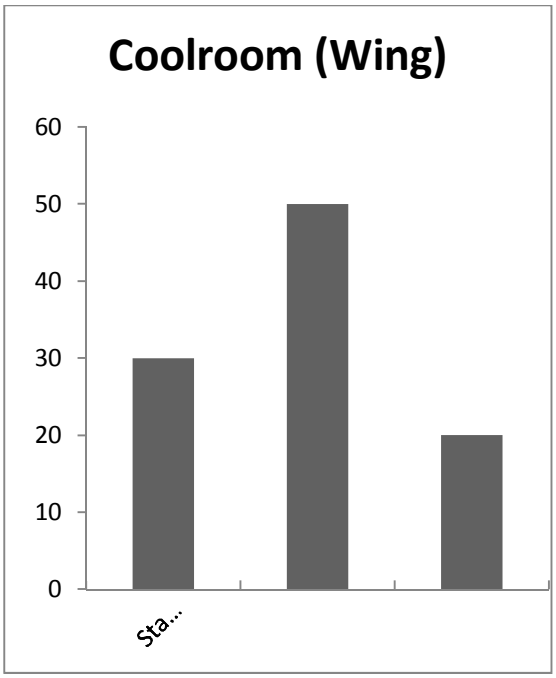
A bar chart showing average Total Fungi Count of Turkey (Wings)



A bar chart showing average Total Fungi Count of Turkey (Thigh)



A bar chart showing the percentage occurrence of bacteria isolated from turkey wing sample.



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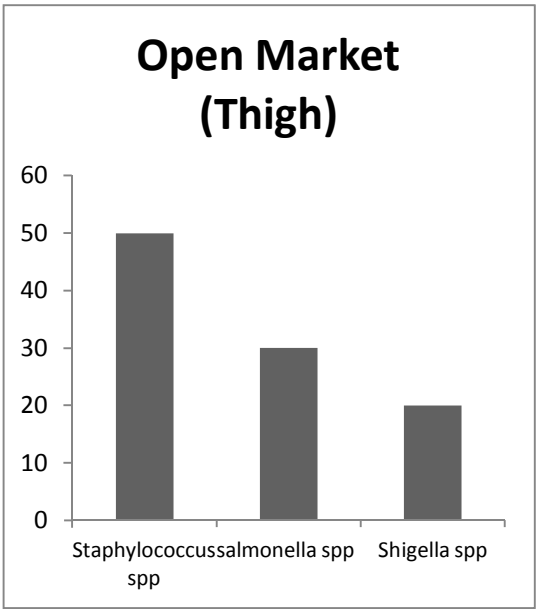
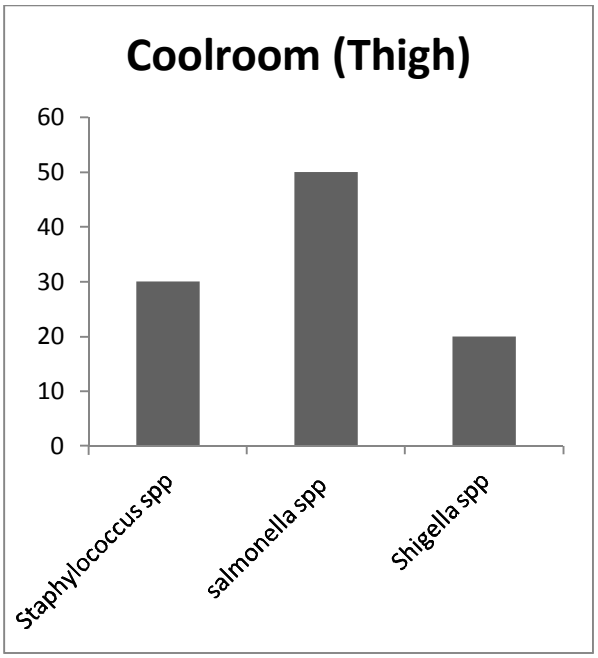
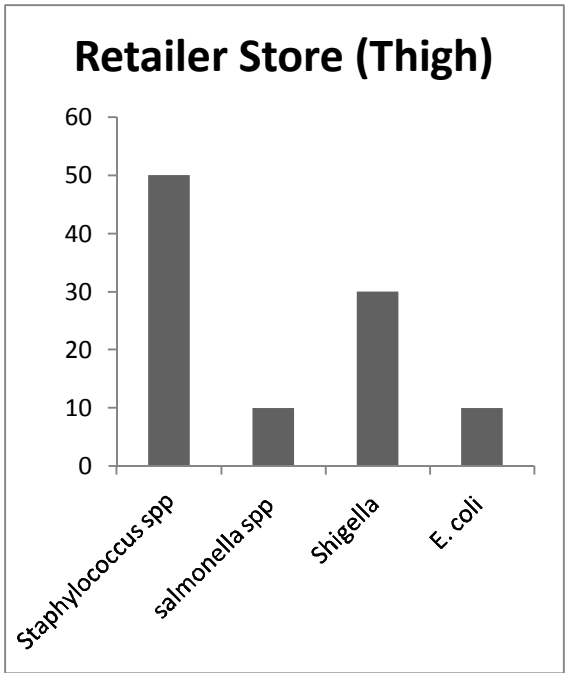


A bar chart showing the percentage occurrence of bacteria isolated from turkey Thigh sample



A bar chart showing the percentage occurrence of bacteria isolated from turkey Thigh sample



A bar chart showing the percentage occurrence of bacteria isolated from turkey Thigh sampl

Discussion

This is well established facts that contaminated food is the main source of transmission for pathogenic bacteria. It is the major cause of enteric diseases in developing countries and is a major cause of mortality and morbidity. Poultry meats as a main source of foodborne infections have great impact in food safety. This study result shows the microbiological quality of turkey meat carcasses and creates a potential danger with regard to public health. Because of the need for systematic and universally applicable approach to food safety control, the Harzard Analysis Critical Control Point (HACCP) concept, is increasingly being introduced into poultry industry and Quantitative Risk Assessment (QRA) is being applied to microbial hazards. *Staphylococcus aureus, Echerichia coli, Shigella* spp and *Salmonella* spp were the most prevalent microorganisms in turkey meat sample collected during the study from various location in Port Harcourt. The study also shows *Staphylococcus* spp is the highest occurring pathogen, followed by *Salmonella spp*. In this study, the presence of *Salmonella* and *S. aureus* was found about 30% for Salmonella and for S. aureus about 40% in all the samples obtained from Open market, retailer stores and cool room turkey meat. Pathogenic bacteria like *Salmonella* and *S. aureus* from food sources have been confirmed by different authors all over the world. Ellerbroek et al. reported 13% prevalence of Salmonella isolates from imported chicken carcass in Bhutan. (Ellerbroek et al., 2010). While Minami et al. reported 25% prevalence in different types of meat including chicken in Thailand Minami et al., 2010).

Their study shows that *Salmonella* is more prevalent in the case of chicken or poultry meat. Fernández et al. in their study in 1993 and 2006 recorded 22.7% prevalence of Salmonella in poultry meat samples in Spain. (Fernández et al 2012) Zhao et al. reported 4.2% prevalence of Salmonella contamination in chicken meat in a similar study in USA (Zhao et al 2001]. Seza and Ayla reported 29.3% prevalence of Salmonella in poultry meat. *Staphylococcus aureus* can cause food intoxication which may lead to nausea, vomiting, cramps chills and weak pulse. S. aureus has a wide range of habitats including human body parts, which may contaminate the food. It is considered being one of the most important foodborne illnesses causing pathogenic species. It's present in food indicates poor hygiene and improper storage conditions (Gundogan etal., 2005). De Boer et al. reported 11.9% MRSA prevalence in meat whereas 16% in chicken meat alone. De Boer et al., 2009) reported 53% of S. aureus contamination of meat and chicken samples. Atanassova et al. found 51.1% S. aureus contamination in raw pork meat by PCR detection while he claimed 57.7% S. aureus contamination by using classical microbiological procedures. Atanassova. Heo et al. reported 11% S. aureus prevalence in meat, while Lee reported 13% S. aureus presence in poultry meat of Korea. (Lee et al., 2003) (Heo et al., 2008). We can see that the averaged total bacterial counts were highest in the open markets

which can be as a result of the abused temperatures and cross contamination by vendors, buyers and flies since the turkey carcasses were displayed on the tables in the open markets which is similar to the findings of Odetunde and Lawel, 2011, which stated that the total bacterial counts for all the parts examined sold in open market in Ibadan ranged from 3.3 x 10^6 to 6.9 x 10^7 cfu/g, the bacterial count of the retail store was in the range of 3.1 x 10^5 cfu/g to 6.0x10^6 cfu/g and the ones stored in coolroom has a range of 1.5 x 10^4 cfu/g to 3.2 x 10^6cfu/g. The coliform count obtained in all the turkey parts ranged from 1.2 x10^4cfu/g, 3.2 x10^4cfu/g, 1.2 x10^4cfu/g, and 7.2 x10^4cfu/g for turkey stored in the coolroom, retailer store and open market respectively, while the mould and yeast count gave a range of 1.4 x10^2cfu/g to 1.5 x10^2cfu/g, 1.2 x10^2cfu/g to 7.2 x10^3cfu/g for coolroom, retailer store and open market respectively while the coolrooms had the lowest average Total Bacterial Counts (TBC). For fresh poultry meat, acceptable upper limits are 6.7 log10 cfu/g A for aerobic plate counts (APC), 4 log10 cfu/g for fecal coliforms, 3.7 log10 cfu/g for *Staphylococcus. aureus* and 2.5log10 cfu/g for C. perfringens. In addition, *Salmonella* and and *L. monocytogenes* should be undetectable in a 25-g poultry meat sample Cohen e*t al*., 2007].The present study however revealed the total bacterial count ranged from 1.0 x10^6cfu/g to 9.9 x10^6cfu/g total *Staphylococcal* count ranged from 3.2 x10^4cfu/g to 9.6 x10^4cfu/g, *Salmonella* count ranged from 3.2 x10^4cfu/g to 9.2 x10^4cfu/g, none of the results aligned with the set microbiological limit which show negligence on the part of meat inspection agencies in Nigeria. Turkey wings have considerably higher values of the total bacterial and fungal counts than the turkey thighs which could be as a result of the bulk of the defeathering process carried out more on the wings than in the thigh.

The isolated organisms in the course of this research can constitute public health hazards if ingested is large quantitative and are described as follows *Salmonella* spp can lead to *Salmonellosis*, which is characterized by mild to severe nausea, abdominal cramps, diarrhea, fever, malaise, mucous, membrane congestion etc. *Escherichia coli* may produce verocytotoxins which can cause diarrhea and heamorrhagic colitis in human and can lead to life threatening sequels, such as haemolyticureamic syndrome and thrombocytopaemic purpura. *Shigella* causes *Shigellosis* or "bacilary dysentery". The presence of these organism in turkey meat could be as a result of feceal contamination. Lack of hygiene practices, unwashed hands of the vendors and workers. The presence of yeast and mould isolate of Rhizopus spp, Cladiosporum, Aspergillus niger, Aspergillus flavus, pencillum spp and Saccharomyces in all the sample stored under various condition might have been due to contaminations experienced during processing and storage. Contaminated turkey parts as a source of numerous infectious disease performed metabolites of these microbial isolate could be fatal. For instance, some Aspergillus spp isolate from the samples might have been introduced as spores from the atmosphere. The Aspergillus are known to produce Aflatoxin (jideani and Osuide, 2001). In conclusion, this study has shown the wide range of microorganisms associated with turkey meat. It was observed that the microbial counts of the turkey meat were at level that pose health implications for consumers. The result also educate retailers on personal hygiene and environmental sanitation practices during handling process to prevent cross contamination, thereby making available to consumer quality products.

Recommendations

- Regulations agencies should be set up to ensure the enforcement of microbiological safety of meat by providing documents containing microbial limits clearly specified for assessment of safety and for monitoring the nature and quality of meats.
- Consumers of poultry meat should cook properly inorder to eliminate both resistance and susceptible foodborne pathogen.
- Utensils and equipment should be kept clean always to avoid contamination.
- In addition it is also important that the products should be produced under good hygiene practices.

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