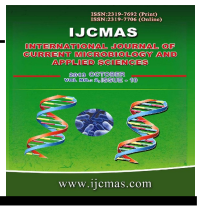
International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 2 Number 10 (2013) pp. 224-229**
http://www.ijcmas.com



Original Research Article

Evaluation of turkey meat for bacteria and indicator microorganisms of public health importance

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Keywords

Turkey; microbiological quality; antimicrobial susceptibility.

A B S T R A C T

Microbiological quality of frozen turkey meat sold at different markets in Umuahia area was investigated. The meat was evaluated for total viable count (TVC), total coliforms (TC), *Salmonella* sp and *Staphylococcus aureus* using standard bacteriological methods. The TVC ranged from 5.2 x 10^5 to 7.2 x 10^5cfu/ml while the TC ranged from 3.4 x 10^5 to 4.9 x 10^5cfu/ml. *Salmonella* sp and *Staphylococcus aureus* were determined at various levels. Antibiotic susceptibility testing of isolates were determined. *Salmonella* sp and *Staphylococcus aureus* were highly resistant to most of the commonly used antibiotics but showed high level of sensitivity to gentamicin. The results of this study suggest that the meats were not properly processed and there might be risk of meat spoilage and food poisoning especially if it is not adequately boiled before consumption.

Introduction

Frozen turkey meat is popular in Nigeria. It can be sold sliced or whole. The production and consumption of poultry meat are on the increase because of the high demand especially during ceremonies or occasions. However, inspection of poultry slaughter houses, processing plants, storage shops are critical points to be considered. The role of poultry meats in human food-borne diseases are known (Alvarez-Astorga *et al*, 2002).

Poultry meat can be contaminated with a variety of microorganisms during processing including those capable of spoiling the product during chill storage (Lidija *et al*., 2006). Special attention must be observed in poultry meat production because of possible contamination from alimentary tracts, water, packaging, utensils and handlers (Ramasastry *et al*., 1999).

Microorganisms such as *Pseudomonas*, *Listeria*, *Campylobater* and other Gram negative bacteria had been associated with frozen meat products. Human illness may follow from handling of poultry meat, cross contamination, inadequate cooking particularly when pathogenic microorganisms are present.

The use of antimicrobials in poultry production as prophylactic. Therapeutic or performance-enhancing purposes may contribute to the development of resistant bacteria. Multi-resistant bacteria are of public health significance.

In order to prevent poultry-borne human diseases there is the need to for regular monitoring of the microbiological quality of poultry meats during production, storage and distribution. Therefore the objectives of this study are to investigate the microbial quality of frozen turkey meats and to determine the antibacterial pattern of the isolates.

Materials and Methods

Collection of samples

A total of 40 samples (about 50g) of turkey meat were collected from different markets located in Umuahia and environs. The locations were World bank housing area, Umuahia main market, Ndioro market and Umudike market. Each sample was placed in an individual sterile plastic bag. Samples were transported to the laboratory immediately after collection in cool container and analysed within 2h.

Microbiological analysis

The methods stated in *Compendium of Methods for the Examination of Foods* (Vanderzant and Splittstoesser, 1992) and Carl, (1997) were used to analyze the samples. Using sterile forceps 25g of each sample was transferred to a sterile blender cup to which 225 peptone water was added. The sample was blended at 15000 rpm for 1min.

Determination of Total Viable Count (TVC)

Total viable count was determined on Nutrient Agar plate using spread plate technique. Ten fold serial dilution the sample was performed. Exactly 0.1 ml of the appropriate dilution was placed on the surface of the agar and sterile bent glass hockey stick was used to spread it evenly on the surface of the agar. The number of colonies was counted after incubating the plates at 30^{o}C for 48h and average count recorded as colony forming unit per ml (cfu/ml).

Determination of Total Coliforms (TC), *Staphylococcus* and *Salmonella* spp

Total coliforms was determined on MacConkey agar incubated at 35^{o}C for 48h. Pink-red colonies grown on this medium were taken into consideration. IMViC (indole production, methyl red, voges proskauer, citrate utilization) tests were performed on representative colonies to identify *Escherichia coli*.

Staphylococcus aureus was determined on manitol salt agar (Biomark laboratories) incubated at 37^{o}C for 48h. After observing Gram reaction and cell morphology, the colonies were tested for coagulase production, catalase activity for presumptive identification of *Staphylococcus aureus*.

For the determination of *Salmonella* sp, 25g of the sample was homogenized with 225 ml of buffered peptone water as previously described and incubated at 37^{o}C for 24h. A 1 ml aliquot of pre enriched culture was transferred to 9 ml of selenite-F broth for enrichment and

incubated at 37^{o}C for 24h. Thereafter serial dilution of the broth was performed and 0.1ml of the appropriate dilution was placed on the centre of the salomonella – shigella agar and spread with a sterile glass hockey stick. The plates were incubated for 48h at 37^{o}C. Colonies with black centres were counted and subsequently inoculated into triple sugar iron agar (Antec Ltd). Presumptive identification of *Salmonella* was done by biochemical tests (production of H_2S.,utilization of glucose, lactose and sucrose, urease activities, indole production) (Cheesbrough, 2004).

Antibiotics susceptibility testing

The antibiotic susceptibility testing of isolates was determined on Mueller Hinton Agar by the disk diffusion method as described in Clinical and Laboratory Standards Institute (CLSI, 2005).Suspension of the test organism was standardized by adjusting its density to equal a barium sulphate ($BaSO_4$) turbidity at 0.5McFarland turbidity standard. The suspension was inoculated over the surface of Mueller Hinton Agar. A sterile forceps was used to pick the appropriate antibiotic disc and placed on the inoculated media. Thereafter the inoculated media was incubated at 35^{o}C for 24h. The diameter of the zone of inhibition was measured to the nearest whole millimeter. Antibiotic discs (Antec ltd) and their concentration used for Gram negative isolates were ampicillin (10µg), colistin (25µg), gentamicin (10µg), nalidixic acid (30µg), Nitrofuratoin (200µg), cotrimoxazole (25µg), streptomycin (10µg), and tetracycline (10µg), while for Gram positive isolates were ampicillin (10µg), gentamicin (10µg), streptomycin (10µg), tetracycline (10µg), chloramphenicol (30µg), cloxacillin (5µg), erythromycin (5µg), penicillin (10µg).

Result and Discussion

The total viable count (TVC) and total coliforms (TC) of turkey meat samples are shown in Table 1 while *Staphylococcus aureus* and *Salmonella* sp values are shown in Table 2. Total viable count ranged from 5.2 x 10^5cfu/ml to 7.2 x 10^5cfu/ml while the total coliforms ranged from 3.4 x 10^5cfu/ml to 4.9 x 10^5cfu/ml (Table 2). Antibiotic susceptibility testing of *Stsphylococcus aureus* and *Salmonella* sp are shown in Table 3 and Table 4 respectively. Both organisms were highly sensitive to gentamicin and resistant to ampicillin.

The microbiological quality of turkey meat samples and the susceptibility of the isolates to antibiotics were studied. Bacteria of the public health importance considered in this study were *Staphylococcus aureus* and *Salmonella* sp because of their association with food borne infection or intoxication leading to human illness (Quist, 1999; Kessel *et al*. 2001).

Higher microbial count was observed in the meat samples. The higher microbial values may be attributed to improper handling and processing of turkey meat. Davidson *et al*., (2000) reported coliform and *E. coli* at the level of 1.2 x 10^4cfu/ml and 4.8 x 10^3cfu/ml respectively in beef. They attributed the quality on technique used to slaughter animals, contamination during evisceration of the internal organs, abattoir hygiene, conditions of the storage, personal hygiene. High total count is undesirable since it indicates that the turkey meats were prepared and stored under less than ideal hygienic conditions. Enumeration of coliforms or faecal coliforms in food products is employed

Table.1 Total viable count and coliforms in turkey meat sample

Sample location	Total viable count (cfu/ml)	Total coliform (cfu/ml)
World bank housing area	5.2×10^5	4.9×10^5
Umuahia main market	7.2×10^5	3.6×10^5
Ndioro market	6.0×10^5	4.2×10^5
Umudike market	5.4×10^5	3.4×10^5

Table.2 Total count of *Staphylococcus aureus* and *Salmonella* in turkey meat sample

Sample location	*Staphylococcus aureus* (cfu/ml)	*Salmonella* (cfu/ml)
World bank Housing area	1.4×10^5	1.8×10^5
Umuahia main Market	1.7×10^5	1.6×10^5
Ndioro market	1.5×10^5	1.3×10^5
Umudike market	1.1×10^5	1.2×10^5

Table. 3 Antimicrobial susceptibility of 30 isolates of *Staphylococcus aureus*

Antibiotic(conc.)	Sensitive Number (%)	Resistant Number (%)
Ampicilin (10µg)	2 (6.7)	28(93.3)
Gentamicin (10µg)	24 (80.0)	6 (20.0)
Streptomycin (10µg)	5 (16.7)	25 (83.3)
Tetracycline (10µg)	7 (23.3)	23 (76.7)
Chloramphenicol (30µg)	12 (40.0)	18 (60.0)
Cloxacillin (5µg)	16 (53.3)	14 (46.7)
Erythromycin (5µg)	18 (60.0)	12 (40.0)
Penicillin (10µg)	2 (6.7)	28 (93.3)

Table.4 Antimicrobial susceptibility of 30 isolates of *Salmonella* spp

Antibiotic conc.	Sensitive Number (%)	Resistant Number (%)
Ampicillin (10µg)	4 (13.3)	26 (86.7)
Colistin (25µg)	14 (46.7)	16 (53.3)
Gentamicin (10µg)	22 (73.3)	8 (26.7)
Nalidixic acid (30µg)	12 (40.0)	18 (60.0)
Nitrofurantoin (20µg)	15 (50.)	15 (50.0)
Cotrimoxazole (25µg)	17 (56.7)	13 (43.3)
Streptomycin (10µg)	8 (26.7)	22 (73.3)
Tetracycline (10µg)	16 (53.3)	14 (46.7)

generally as a sanitation index (Adams and Moss, 1996). These organisms are known as indicators and their presence is an indication that the meat samples were exposed to conditions that might introduce pathogenic organisms (Phillips *et al*., 2001).

Salmonella sp and *Staphylococcus aureus* were isolated from frozen turkey meats and their values were high. The presence of *Salmonella* species in the sample was indication of contamination of the meat with faecal materials. However, the presence of *Staphylococcus aureus* is not surprising considering that the organism is most often associated with handling by humans (Bryan, 2001). Elmali and Yaman (2005) reported high level of *Salmonella*, *Staphylococcus*, coliform, aerobic mesophiles in raw meat.

Salmonella sp. and *S. aureus* showed high resistance to most of the commonly used antibiotics. Similarly, Threlfall *et al*., (2003) reported antimicrobial drug resistance of S. enteric. This high resistant pattern recorded may due to presence of plasmids in the isolates or the use of antimicrobials in poultry production.

The findings of this study showed the poor microbiological quality of frozen turkey meat sold by the retailers. This is most likely due to poor sanitary conditions of the processing environment. The presence of Salmonella sp and *S. aureus* and high count of coliforms are indicative of a potentially hazardous products which is likely to pose a serious public health risk to consumers particularly if the meat is not adequately boiled. Therefore there is the need to implement improved hygiene and to apply effective monitoring throughout the production and distribution of turkey meat products.

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