Microbial Quality Indicators of Poultry Meat during Processing in Modern and Traditional Slaughterhouses - Omdurman Locality Khartoum State - Sudan

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Abstract: _Background_: *Poultry meat recently became a major source of animal protein for a lot of population, This required restricted regulations , procedures , standards and quality indicators to ensure wholesomeness and safety.* _Objective_: *This study aims to investigate the major microbial quality indicators of poultry meat at different critical control points during processing in modern and traditional slaughterhouses.* _Methods_: *Methods used, Filler press for measuring water holding capacity. PH meter. pour plate count stable control culture, nutrient broth dispersed in liter of demonized water and macconkey broth. Cross-contamination of poultry through handlers was found to be the most frequent factor of contamination.* _Results_: *Cross-contamination of poultry through handlers was found to be the most frequent factor of contamination.* _Conclusion_: *Microbial hazards encourage the production of contaminated poultry meat. Salmonella, staphylococcus aurens, coli forms are the isolate detected in the samples from both the traditional and the modern farms. Total Bacterial Count (TBC) was estimated as highest load among the fresh samples of the traditional farm (54×10^4) CFU/g, due to environmental contamination, the load was decreased in the same sample after thirty days of storage (25×10^4), this explains the impact of storage on microbial quality of poultry meat.*

Keywords: Poultry meat, microbial quality indicators, environmental contamination

1. Introduction

Chicken is one of the most common types of birds found in the tropical countries after crows and sparrows. It is also one of the most popular domesticated animals in the world. The population of chicken is more than any bird. It is the primary source of food, in terms of both meat and eggs. Poultry meat recently became a major source of animal protein for a lot of population as a result poultry trade gain grounds and a lot of poultry industry spared around and produce plenty poultry meat. This required restricted regulation , procedure , standard and quality indicators to ensure wholesomeness and safety of consumed poultry meat Poultry meat is perishable and enhancing growth and multiplication of many dangerous pathogens.

Production and consumption of poultry and poultry products are universally popular and show an upward trend. This of course requires adequate control and inspection both during poultry rearing and slaughter houses, processing plants and shops. Consumers are also a link in the chain of food-borne human diseases, because of the way they store and cook, poultry meat and meat products.The micro flora of poultry is transferred from the primary production sites to production lines, and further by subsequent contamination. Micro flora of crude chicken meat is heterogeneous hands, equipment and outfit, water and air.

Contamination with pathogenic bacteria in particular salmonella, plays an important role in the veterinary sanitary control of meat. Fries, since (2002) people has pointed out the significance of subsequent contamination of meat with salmonella SPP during slaughter house processing of poultry microbiological quality of poultry meat course of slaughter, contamination of carcasses with this bacterium may be as high as 50% and more (). Contamination with S.aureus is important in the evaluation of safety and hygienic quality of chicken meat, but also in etiology of food poisoning.

In developed countries, poultry production and processing practices are controlled, at least in part, by legislation, and good practices may be further specified in various quality schemes that are efforts to co-ordinate quality requirements at specific stages of the supply chain. Such schemes can be led by producers, retailers, industry associations or government agencies.

Consumers define quality according to their own perceptions, goals and personal preferences, but, in practice, the quality concept has both subjective and objective components, and Becker (2002) recognizes `quality cues' (QC) and `quality attributes' (QA). The former are what the consumer observes at the point of sale as a means of predicting quality performance, when the food is consumed. Examples of QC are the reputation of the place of purchase and products from free range or organically produced birds.

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QA, on the other hand, are what the consumer actually wants in relation to product quality. These include the scientifically measurable characteristics of color appearance, texture and flavour it is important to keep them comfortable in the holding area, scheduling arrival at the plant can reduce waiting time. On-farm processors usually hold crated birds under trees or other shade.

2. Materials and Methods

Study Design

The study was designed as a descriptive comparative case study (operational research) utilizing different dependent and independent variables.

Study Area

Modern and traditional Poultry Plant in Umdroman and Bahry locality.

Study population and replication techniques:

Six Samples or replicates, three from each slaughter house, were taken from different critical points during slaughtering processes of poultry carcass represent study population. Distributed as follows:

Storage	Modern (A)	Traditional (B)
W_0	R_1	R_1
	R_2	R_2
	R_3	R_3
W_4	R_1	R_1
	R_2	R_2
	R_3	R_3

R = Replication R_1 = Taken immediately
R_2 = after 2 days R_3 = after 3 days
W_0 = week zero W_4 = after 4 weeks
Physical parameters:
pH
Measurement: pH was measured by pH meter equipped with an electrode that calibrated at pH 7.0 and at the room temperature and adjusted 10 grams from the breast muscle were weighted homogenized and put into flask content (100m) of distill water, mixed then the result was recorded after being calibrated.

Water holding capacity (WHC):
Was measured by filter press method of Judge ,0.3 gram of different samples were put under an ash less filter paper between two glass plates and pressed and weighed. Difference between the two weights was calculated and multiplied by 100.

Microbial parameters:

Total bacterial count:
(235g) grams of plate count agar were weighed and dispersed in 1 liter of deionised water. Brought to boiling with frequent stirring to dissolve the ingredient. Dispensed into tubes and sterilized by autoclaving at 121°c for 15 minutes cooled to 46°c for 3 hrs prior to use.

Total bacterial count was carried out using the pour plate count method. One ml aliquots from suitable dilution were transferred aseptically into sterile petty dishes. To each dilution 15ml of melted and cooled (45°c) plate count agar were added. The inoculum was mixed and allowed to solidify. The plates were incubated in an incubator at 37°c for 48 hrs. a colony counter (and hard tally) was used to count bacteria.

Mould and yeast
50 grams of melt extract agar weighed and dispersed in 1 liter of deionised water, allowed to soak for 10 minutes. Swirled to mix then sterilized at 121°c for 10 minutes. 5ml vial of XO37 added to lower the pH of medium to 3.5-4 cooled to 47°c before making additions and pouring plates.

From suitable dilutions of sample 0.1 ml was aseptically transferred onto solidified malt-extract agar containing 0.1gm cholraphenicol per one liter of medium to inhibit bacterial growth.

Staphylococcus

149g of the staphylococcus 110 suspended in 1 liter of purified water. Mixed thoroughly heated with frequent agitation and boiled for 1 minute to completely dissolve the powder. Sterilized by autoclaving at 121°c for 10 min. the precipitate was evenly dispersed when dispensing. samples of the finished product were tested for performance using stable, typical control cultures from suitable dilutions, 0.1 ml was spread on dried staphylococcus medium 110 and the plates were incubated at 37°c for 24 hrs.

Salmonella

25 grams of nutrient broth were weighed and dispersed in liter of deionised water, allowed to soak for 10 minutes, and sterilized for 15minutes at 121°c.

4 grams of sodium biselenite were dissolved in 1 liter of cold deionised water. 19 grams of selenite Broth Base were added to dissolve. Distributed into tubes or bottles and sterilized for 10 minutes in a boiled water bath 36.4 grams of Bismuth sulphate and mixed with 1 liter of deionised water. Sterilized for 15 minutes at 121°c cooled to 50°c and added 100ml of chemical mixture 'B'. Mixed well and poured using thin plates stored at 4°c for 3 days to mature, before use chemical mixture 'B' , 18 grams of powder were suspended in 100 ml of deionised water.

25 gram of sample were weighed aseptically and mixed well with 250 ml sterile nutrient broth. This was incubated at 37°c for 24 hrs. then 100 mls selenite broth. The broth was incubated at 37°c for 24 hrs a loopful streaking was done on dried bismuth sulphate agar plates, and plates were incubated at 37°c for 24hrs.

Black metallic sheen discrete colonies indicated the presence of salmonella SPP. A confirmatory test was carried out by taking a discrete black sheen colony and sub-culturing it in triple sugar iron agar slopes production at a black color at the bottom, confirmed the presence of salmonella.

Coli form test

Presumptive coli form test

35 grams of MacConkey broth were weighed, dispersed in 1 liter of deionised water mixed well and dispended into tubes or bottles with inverted Durham tunes. Sterilized by autoclaving for 15 minutes at 121^oc. Double strength broth was prepared (70g/i) 50ml amounts of inoculum are to be added to equal volumes of broth. One ml of each dilution was added to nine mls of Mac Conkey broth using the three tube technique with Druhan tubes. The tubes were incubated at 37^oc for 48 hrs as described by.

Confirmed coli form test:

40grams of Brailliant green bile 2% broth were weighed and dispersed in 1 liter of deionised water, allowed to soak for 10 minutes, swirled to mix then warmed to dissolve. Dispensed into tubes with inverted Durham tubes sterilized by autoclaving at 115^oc for minutes. The MPN was used to record coli form number

Methods of data analysis:

Data generated was subjected to MSTAT software. RCD design (Randomized complete design) was adopted in analysis of variance range, the means were obtained and tested using Duncans multiple kange test (DMRT). ted **.**

3. Results and Tables

The mean value for water holding capacity (WHC) of the modern treatments was to be found as 34.17 and 30.8 at zero time and after thirty days of storage respectively. For the traditional it estimated as 31.9 and 30.47 at zero time and after thirty days of storage respectively.

The mean value of PH for the modern(B) treatments was found as 6.63 and 6.43 at zero time and after thirty days of storage respectively . the mean value of PH for traditional plant (A) was measured as 6.63 and 6.77 at zero time and after thirty days of storage respectively.

Total Bacterial count (CBC) was measured as $5.4*10^5$ CFU/g (5.73) and $2.5 * 10^4$ (5.4) for the traditional replicates at week zero and thirty days of storage respectively. Table 3. Total Bacterial Count(TBC) for the modern treatments were measured as $1.5*10^4$ CFU/g (5.18) at zero time and $1*10^4$ (4) thirty days of storage.

Yeast and Moulds were not isolated in any treatment. The major pathogens isolated were Staphylococcus aureus , colifoms in the traditional treatment before and after storage. Colifoms were also isolated in modern treatment before and after storage table (5)

Table 1: Table 1: Mean values and their standard errors (S.E) for water-holding capacity of the various treatments.

Independent variable	Treatments*				Lsd$_{0.05}$	±SE
	A		B			
	Storage time (days)					
	0	30	0	30		
WHC	31.90^b	30.47^c	34.17^a	30.80^b	0.96	0.30

Means bearing different superscript letters are significantly different (P≤0.05).
*A = Traditional poultry plan, *B = Modern poultry plan

Table 2: Mean values and their standard errors (S.E) for pH-value of the various treatments

Independent variable	Treatments*				Lsd$_{0.05}$	±SE
	A		B			
	Storage time (days)					
	0	30	0	30		
pH-value	6.63^a	6.77^a	6.63^a	6.43^a	0.43	0.13

^{a}Means bearing similar superscript letters are not significantly different (P>0.05).
*A = Traditional poultry plant
B = Modern poultry plant

Table 3: Mean values and their standard errors (S.E) for pH-value of the various treatments

Independent variable	Treatments*				Lsd$_{0.05}$	±SE
	A		B			
	Storage time (days)					
	0	30	0	30		
pH-value	6.63^a	6.77^a	6.63^a	6.43^a	0.43	0.13

^{a} Means bearing similar superscript letters are not significantly different (P>0.05).
*A = Traditional poultry plant
B = Modern poultry plant

Table 4: total Bacterial count (TBC), yeast and mould of the treatments

Independent Variable	Traditional Poultry plant	Modern Poultry plant			Independent Variable	Traditional Poultry plant	Modern Poultry plant		
	0	30	0	30		0	30	0	30
TBC	5.73	5.4	5.18	4	TBC	5.73	5.4	5.18	4
Yeast 2 moulds	neg	neg	neg	neg	Yeast 2 moulds	neg	neg	neg	neg

Note: neg = negligible

Table 5: Pathogen in the treatments

Independent Variable	Traditional Poultry plant		Modern Poultry plant	
	0	30	0	30
Salmonella	–	–	–	–
Listeria monocytegen	–	–	–	–
Staph aureus	+	+	–	–
coliforms	+	+	+	+

Note:
+ = positive

4. Conclusion

Microbial hazards encourage the production of contaminated poultry meat. Salmonella, staphylococcus aurens, coliforms are the isolate detected in the samples from both the traditional and the modern farms. Total Bacterial Count (TBC) was estimated as highest load among the fresh samples of the traditional farm ($54x10^4$) CFU/g, due to environmental contamination, the load was decreased in the same sample after thirty days of storage ($25x10^4$), this explains the impact of storage on microbial quality of poultry meat.

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