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**AEROBIC BACTERIA ASSOCIATED WITH BROILER PROCESSING AT  
KHARTOUM NORTH, SUDAN**

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**ABSTRACT**

Microbiological criteria in traditional broiler processing are proposed for bacteriological testing which include types and level of contamination throughout the process by applying qualitative and quantitative risk assessment. Ninety six different samples were investigated to determine the load and types of aerobic bacteria associated with traditional broiler processing at Khartoum North, Sudan. High recovery rates of aerobic bacteria were obtained from chilling water (19.7%), washing water (17.1%) and hands of workers (17.9%). One hundred and sixty two isolates were recovered. The most prevalent bacteria isolated were *Micrococcus* spp. (25%), *Staphylococcus* spp. (14.8%), *Bacillus* spp. (14.8%), *Pseudomonas* spp. (8.6), *Escherichia coli* (12.3%), *Klebsiella* spp. (9.2%), *Proteus* spp. (6.1%), *Actinobacillus* spp. (4.3%), *Citrobacter* spp. (3.7%), *Aeromonas* spp. (2.4%) and *Salmonella* spp. (3%). Significant decrease on viable bacteria count on broiler carcasses was detected after 14 days storage at -20°C. Results showed that better sanitary measures should be applied throughout the processing operations to uplift the quality and safety of the end product.

**Keywords: Aerobic bacteria, Broiler processing, Sudan**

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## INTRODUCTION

Food borne diseases (FBD) is a public health concern worldwide especially in developing countries where food safety requirements are not strictly adopted [1, 2], bacteria remain the main cause of FBD [3]. To cope with increase of broiler meat consumption, processing operations have become larger and many processing plants potentially create problems due to cross contamination and difficulties which can be encountered during evisceration [4].

Bacterial load of broiler carcasses depends on infection level of living birds and/or cross contamination during processing through a farm to fork approach at all stages of supply chain [5]. Although processing generally reduces microbial contamination of broiler carcasses, cross-contamination between carcasses, processing water and equipment may actually increase the level of carcass contamination [6]. Heavy contamination shortens the shelf life of carcasses and some of these contaminants may be potential pathogens [7].

Many bacterial pathogens were incriminated in outbreaks of FBD globally. *Salmonella spp.*, *Campylobacter spp.*, *Clostridium spp.* and *E.coli* remain the organism of global concern; others include *Arcobacter* and *Helicobacter spp.* and occasionally,

verotoxigenic *Escherichia coli*. These organisms considered as a growing problem of antimicrobial resistance among poultry associated pathogens [4].

Nevertheless, no data were so far available concerning bacterial contamination on broiler meat in the Sudan. The aim of this study was to investigate the load and types of aerobic bacteria associated with traditional methods of broilers processing and the effect of storage in bacterial load on carcasses at Khartoum North, Sudan.

## MATERIALS AND METHODS

### Study area

This study was conducted at Khartoum North, Sudan. A total of 96 samples were collected randomly from four different small scale broiler farms (2000 – 6000 birds/farm), where chickens were reared in open system. Birds were processed at the farm traditionally. Twenty-four samples were collected from each farm in two visits.

### Sampling procedure

Broiler processing operations involved bleeding, scalding at hot water (approximately 60°C), defeathering, and feet removal, evisceration, washing and soaking in chilled water. Defeathering and evisceration were performed manually. Before processing cloacal swabs were

moistened with 0.01% bactopectone and collected from six -week old broilers. Swabs from knives and hands of workers were collected at the time of processing (three replica of each sample). Twenty five millilitre (ml) of scald, washing and cooling water were collected in sterile glass containers treated with 0.05% sodium thiosulphate. Samples were transported to the laboratory in an ice box and cultured on the same day of slaughtering.

#### **Aerobic cultivation and purification**

Samples were streaked onto Blood and MacConkey's agar plates and incubated aerobically at 37°C for 24hrs, plates were examined visually for growth. Pure cultures were persevered into cooked meat medium and stored at 4°C.

#### **Identification of isolates**

Pure isolates were identified biochemically according to [8].

#### **Statistical design and analysis**

Means and standard errors were calculated by Statistical Package for the Social Sciences (SPSS) using completely randomized design

(CRD) and means separated using Least Significant Difference (LSD).

#### **Bacterial viable count**

Three medium-sized broilers were aseptically collected from each farm per visit at random basis and placed in sterile plastic bags kept in cooling box containing crushed ice for transportation to the laboratory within 30min. They were preserved at -20°C until investigated. Each of the broilers were subjected to bacterial viable count at day zero, 7 and 14 according to [9].

### **RESULTS**

#### **Bacterial isolation**

One hundred and sixty two isolates were obtained from all 96 samples. Sources and frequency of isolation were shown in table-1, bacterial spp were noted in Table 1.

#### **Aerobic bacterial load**

The aerobic plate counts of broilers carcass were showed in the table below (table 3).

**Table (1): Frequency of isolation of aerobic bacteria from broilers processing:**

Samples source	Total No. of isolates (%)	No. of Gram positive isolates (%)	No. of Gram negative isolates (%)
Live birds	25 (15.4)	11 (44)	14 (56)
Hands	29 (17.9)	19 (65.5)	10 (34.5)
Knives	23(14.1)	12 (52.2)	11 (47.8)
Scalding water	22(13.5)	16 (72.7)	6 (27.3)
Washing water	30 (17.1)	12 (40)	18 (60)
Chilling water	33(19.7)	13(39.4)	20(60.6)

Table 2: Viable bacterial spp. isolated from different samples

Bacteria	Source of samples						Total No
	Live birds % (cloacal swabs)	Hands %	Knives	Scalding Water	Washing Water	Chilling Water	
<i>Micrococcus spp.</i>	8/162 (4.9%)	8/162 (4.9%)	8/162 (4.9%)	6/162 (3.7%)	6/162 (3.7%)	4/162 (2.4%)	40
<i>Staphylococcus spp.</i>	2/162 (1.2%)	4/162 (2.4%)	2/162 (1.2%)	2/162 (1.2%)	2/162 (1.2%)	6/162 (3.7%)	18
<i>Bacillus spp.</i>	1/162 (0.6%)	7/162 (4.3%)	1/162 (0.6%)	8/162 (4.9%)	4/162 (2.4%)	3/162 (1.8%)	24
<i>Pseudomonas spp.</i>	1/162 (0.6%)	1/162 (0.6%)	3/162 (1.8%)	1/162 (0.6%)	5/162 (3.0%)	3/162 (1.8%)	14
<i>Proteus spp.</i>	1/162 (0.6%)	2/162 (1.2%)	2/162 (1.2%)	0/162 (0%)	3/162 (1.8%)	2/162 (1.2%)	10
<i>Actinobacillus spp.</i>	2/162 (1.2%)	0/162 (0%)	0/162 (0%)	0/162 (0%)	1/162 (0.6%)	4/162 (2.4%)	7
<i>Cetrobacter spp.</i>	2/162 (1.2%)	2/162 (1.2%)	0/162 (0%)	0/162 (0%)	2/162 (1.2%)	0/162 (0%)	6
<i>Aeromonas spp.</i>	0/162 (0%)	1/162 (0.6%)	0/162 (0%)	0/162 (0%)	1/162 (0.6%)	2/162 (1.2%)	4
<i>Salmonella spp.</i>	1/162 (0.6%)	0/162 (0%)	1/162 (0.6%)	0/162 (0%)	0/162 (0%)	3/162 (1.8%)	5
<i>E. coli</i>	5/162 (3.0%)	4/162 (2.4%)	3/162 (1.8%)	1/162 (0.6%)	4/162 (2.4%)	3/162 (1.8%)	20
<i>Klebsiella spp.</i>	2/162 (1.2%)	1/162 (0.6%)	2/162 (1.2%)	4/162 (2.4%)	2/162 (1.8%)	3/162 (1.8%)	14
<b>Total</b>	<b>25 (15.4%)</b>	<b>30 (18.5%)</b>	<b>22 (13.6%)</b>	<b>22 (13.5%)</b>	<b>30 (18.5%)</b>	<b>33 (20.4%)</b>	<b>162</b>

Table 3: Effect of freezing (- 20 °C) on viable bacterial counts in broiler carcasses:

Time (days)	Bacterial count (log <sub>10</sub> CFU/ml)		
	Mean	Minimum	Maximum
Zero	4.8 <sup>a</sup>	4.5	5.1
7	4.1 <sup>b</sup>	3.8	4.4
14	3.5 <sup>c</sup>	3.2	3.8

a, b, c

Mean values in the same column having different superscript, differ significantly (P&lt; 0.05).

SE± 0.142

## DISCUSSION

Poultry meat can be contaminated with a variety of microorganisms. In this study attempts were made to highlight the nature of bacterial contamination during traditional processing of broilers. One hundred and sixty two isolates were identified including *enterobacteria* (*E.coli*, *Salmonella spp*, *Klebsiella spp*, *proteus spp* and *citrobacter spp*), *Micrococcus spp*, *Staphylococcus spp*, *Bacillus spp*, *Actinobacillus spp* and *Pseudomonas spp*. No marked reduction in carcass contamination and no critical control point at which a significant reduction in contamination can be guaranteed, but a significant difference in the frequency of isolation of different species of bacteria between different farms investigated was reported. It may be due to changes in temperature of water at time of sampling and sampling methods.

The results indicate that *Micrococcus spp*, *Staphylococcus spp*, *Klebsiella spp*, *Escherichia coli*, *Salmonella gallinarum* and *Pseudomonas aeruginosa* were detected more frequently in different stages of processing. *Proteus spp*, *Citrobacter spp*, and *Actinobacillus spp*. were detected in relatively lower proportions. The results obtained are in agreement with [10] who stated that processed broiler carcasses and raw poultry products are frequently contaminated with pathogenic micro-organisms of public health significance. Spoilage bacteria are routine inhabitants of the

immersion chiller water and chiller ice [11, 7]. Bacterial cross contamination of carcasses occurs during all stages of processing and that some bacteria can survive processing and proliferate on carcasses during refrigerated storage [12].

Significant reduction on aerobic bacterial load on freeze broiler carcasses was noticed. Chilling is effective in lowering the temperature of broiler carcasses and has been shown to substantially reduce numbers of carcass associated total aerobic bacteria [13].

Broiler processing failed in reduction of bacteria and some bacterial species appeared later in certain stages of processing which seemed to be related to poor personnel hygiene, contaminated environment, equipment and the system employed in processing which was noticed [11, 7].

It is possible that the level of contamination depends on the microbial profile of flocks or loads of live birds presented for slaughter [5, 14]. The farm of origin or conditions during processing may be more significant in determining the level of carcass contamination [5, 6]. Processing water and equipment may actually increase the level of carcass contamination during some processing steps [7].

## CONCLUSION

The study found that no reduction in contamination was achieved during broiler processing. Therefore, good hygienic practices in plants should be incorporated as part of an

effective HACCP system to minimize exposure of carcasses to faecal material and potential pathogens to reduce opportunities for cross contamination.

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