

## MICROBIAL CONTAMINATION OF CHICKEN CARCASSES DURING SLAUGHTERING PROCESS IN KHARTOUM STATE, SUDAN

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### ABSTRACT

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A total of 75 swab samples were collected randomly from chicken carcasses slaughtered at modern poultry abattoir in Khartoum state, Sudan. These samples were taken from 5 operational processing, after defeathering, after evisceration, after spray first washing, after spray second washing and after chilling. Also 75 swab samples were collected from workers hands. Total viable count (TVCs) was carried for each samples and also isolation and identification of contaminated bacteria. The study revealed that statistical significant difference ( $p < 0.05$ ) in 5 operations when the samples were taken from the legs, backs and breast sites respectively. There was no statistical significant difference ( $p > 0.05$ ) when the TVCs used from workers hands. The types of bacteria isolated were *E. coli* and *Salmonella* spp. Sudanese abattoirs may reflect the hygienic status of chicken meat production in the developing countries.

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*Key words: Sudanese abattoirs, E-Coli, salmonella spp., Chicken Carcasses*

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### INTRODUCTION

Poultry was an important part of the animal food market and production, it was increasing to satisfy public demand world-wide (Bryan 1980; Anand *et al.*, 1989) However, broilers entering slaughter processing are highly contaminated by microorganisms, including food borne pathogens such as *Salmonella* and *Campylobacter* spp., and these pathogens tend to be disseminated in the processing (Mead *et al.*, 1994).

The micro-organisms were widely distributed over the carcasses under normal circumstances and were spread over the skin during scalding and defeathering and on the inner and outer surfaces during evisceration and further processing (Bailey *et al.*, 1987).

The procedure for converting a live, healthy bird into a safe and wholesome poultry product provided many opportunities for micro-organisms to colonize on the surface of the carcasses (Bryan, 1980; Thomas and McMeekin, 1980; Roberts, 1982; Grau, 1986; Bailey *et al.*, 1987; Connor *et al.*, 1987; Banwart, 1989; Mead, 1989).

Poultry processing had a number of unique features which make control of microbial contamination more difficult than the processing of any other conventional meat animal. Among them was the rapid rate of processing in some processing plants, a condition which favoured the spread of micro-organisms. The carcass must be kept whole throughout the process and the viscera have to be removed rapidly through a small opening in the abdomen without breakage, to minimize contamination of the carcass with intestinal organisms. After defeathering, the skin provided a complex surface with many holes which were capable of trapping bacteria (Mead, 1982; Grau, 1986; Mead,

1989). In the Sudan broiler chickens population was estimated to be 22.5 million chicks. Traditional sector (small farms) produced about 60% of the total broiler production and the modern sector (companies) produced the rest (Ministry of Animal Resources and Fisheries (MARF), 2008). Microbiological status of broiler carcasses depends on several factors, such as: infection level of living birds and/or cross contamination during processing (Abu- Ruwaida *et al.*, 1994).

The purpose of this study was to investigate the contamination level of chicken carcasses during slaughtering processing at modern abattoir in Khartoum state.

### MATERIALS and METHODS

The study was conducted in Khartoum state, Sudan. A total of 75 swab samples were collected randomly from modern poultry abattoir. These samples were taken from 5 operational processing points, after defeathering, after evisceration, after spray first washing, after spray second washing, and after chilling. Also 75 samples were taken from worker hands. The collection of the samples were carried out every one week, on the surface of the carcasses at three sites leg, back and breast and the duration of collection over a period of two months. A sterile metal template of 10 cm<sup>2</sup> area was used to outline the swabbing area on the broiler carcasses the area was swabbed vigorously with sterile swab. The organisms were removed from each swab by shaking for few minutes in 10 ml of sterile 0.5 % peptone water. The method that used as described by Harrigan, (1976) for total viable count (TVC). Isolation and identification of the bacteria was carried by prepared nutrient agar, nutrient broth, MacConkeys agar (MCA) and Blood Agar. The plates were incubated at 37°C for 24 hrs.

Well isolated colonies obtained from agar medium and different broth cultures of Gram-negative and Gram-positive bacteria were constantly subcultured into agar slants from time to time, incubated at 37°C for 24 hrs and stored at 4°C. Identification was based mainly on the biochemical test according to Barrow and Feltham, (1993).

#### Statistical Analysis

The data were analyzed with SPSS software (Statistical Package for the Social Sciences, version 11.5, SSPS Inc, and Chicago, IL, USA). All bacterial counts were converted to  $\log_{10}$  CFU/cm<sup>2</sup> for analysis and ANOVA was performed. Statistical significance was set at a P value of <0.05.

## RESULTS

The mean total viable counts of the 75 swabs samples from chicken carcasses, in defeathering operation

were  $7.69 \pm 2.6$ ,  $7.49 \pm 1.6$  and  $8.38 \pm 2.1$   $\log_{10}$  CFU cm<sup>-2</sup> at legs, backs and breast sites, respectively, with statistical significant differences ( $p < 0.05$ ). Also in evisceration point the TVCs were,  $7.60 \pm 2.8$ ,  $7.80 \pm 2.7$  and  $8.80 \pm 2.4$   $\log_{10}$  CFU cm<sup>-2</sup> at the three sites with statistical significant differences ( $p < 0.05$ ). In point after spray first washing, TVC were  $8.30 \pm 1.9$ ,  $6.09 \pm 1.9$  and  $6.4 \pm 1.1$   $\log_{10}$  CFU cm<sup>-2</sup>, whereas, in after spray second washing the TVCs were  $4.1 \pm 1.07$ ,  $2.6 \pm 1.2$  and  $3.2 \pm 1.01$   $\log_{10}$  CFU cm<sup>-2</sup>, in legs, backs and breast sites, respectively with statistical significant differences ( $p < 0.05$ ). But after chilling operation the mean the TVCs were  $1.7 \pm 0.71$ ,  $1.9 \pm 0.72$  and  $1.8 \pm 0.70$   $\log_{10}$  CFU cm<sup>-2</sup> in legs, backs and breast sites, respectively with statistical significant differences ( $p < 0.05$ ). The TVCs from workers hands were  $1.3 \pm 0.02$  and  $1.4 \pm 0.01$   $\log_{10}$  CFU cm<sup>-2</sup> in the legs and breast sites respectively, with insignificant difference ( $p > 0.05$ ) (Table 1).

**Table 1:** Comparison of mean total viable count of bacteria ( $\log_{10}$  CFU cm<sup>-2</sup>)  $\pm$  Sd at different operational points at different sites on chicken carcasses.

Operation	Legs	Backs	Breast	Significance
Site				
After defeathering	$7.69 \pm 2.6$	$7.49 \pm 1.6$	$8.38 \pm 2.1$	*
After evisceration	$7.60 \pm 2.8$	$7.80 \pm 2.7$	$8.80 \pm 2.4$	*
After spray first washing	$8.30 \pm 1.9$	$6.09 \pm 1.9$	$6.40 \pm 1.1$	*
After spray second washing	$4.10 \pm 1.07$	$2.60 \pm 1.2$	$3.20 \pm 1.01$	*
After chilling	$1.70 \pm 0.71$	$1.90 \pm 0.72$	$1.80 \pm 0.70$	*
Workers hands	$1.30 \pm 0.02$	N.D	$1.40 \pm 0.01$	N.S

\* significant difference at level ( $P < 0.05$ ); N.D. not done and N.S. Not significant ( $P > 0.05$ )

This study revealed two species of bacteria isolated from total of 114 samples of chicken carcasses and these were *E.coli* and *Salmonella* spp. *E.coli* was isolated in all operational points After Defeathering, After Evisceration, After spray first

washing, After spray second washing and After chilling, whereas *Salmonella* spp. was isolated in two operational process After Evisceration and After spray first washing. (Table 2)

**Table 2:** Incidence of *E.coli* and salmonella spp. Isolated from chicken carcasses in different operational points.

Different operational points	<i>E.coli</i>		<i>Salmonella</i> spp.	
	No.	%	No.	%
After defeathering	20	17.54	-	-
After Evisceration	23	20.18	7	6.14
After spray washing 1	21	18.43	6	5.26
After spray washing 2	19	16.67	-	-
After chilling	18	15.78	-	-

## DISCUSSION

It is obvious that the variability in microbial counts (especially after washing) indicate the need for use of prerequisite programs. The reduction of the microbial contamination in this study (Table 1) is in agreement with Rahkio and Korkeala (1996) who said that the enforcement of hygienic practice such as regular disinfection of working tools and worker hands is important in reducing the microbiological

contamination of carcasses. John *et al.* (2000) reported that the reduction of bacterial contamination during slaughtering after using a degree of sanitation.

Another study by Jeffery *et al.* (2003) revealed that the workers hands and the equipments were the sources of meat contamination; these results are in accordance with the present results. The elimination of contamination sources by practicing good sanitary measures will reduce the occurrence of microorganisms. Appropriate methods should be applied during slaughtering

operations, using adequate water and disinfection. Such control measures should include an extensive education programs for proper hygiene and improvement of managements.

Both methods trimming and washing for reducing contamination can be applied, aiming to the use of chicken for cutting and processing. So, immersion pre-chilling system is the determinant to the decreasing of number of microorganisms, as long as it is following all legislation requirements. If the chicken carcass is only washed without the trimming it can be commercialized intact with quality assurance. Economically, to keep the carcasses with skin is more interesting for the company.

Sudan is a tropical country, with ambient temperatures conducive for the growth of microorganisms, which can rapidly render meat unsafe for human consumption. The levels of microbial contamination in Sudanese abattoirs may reflect the hygienic status of poultry meat production in the developing world.

The microbial count on either the carcass depends on various factors. These are the initial count on carcasses, the ambient temperatures, personal hygiene, the efficiency of applied sanitary programmes. Beside changes in the water supply and quality, levels of cleaning of the carcass surface and the general management procedures applied throughout the carcass production (Nortije *et al.*, 1990).

From public health point of view, the most elaborate hygienic precautions in the slaughterhouse can largely be modified by subsequent poor handling of the meat. Little or no control anywhere along the lines i.e. slaughterhouse, Market and restaurant, usually means the onset of a human disease (Ahmed, 2004).

Qualitative bacterial examination of carcass samples in this study revealed *Salmonella* spp. and *Escherichia coli* isolated at different stages of carcass preparation; in skinning and evisceration, chilling and after the washing point. Sites selected for sampling included those most favoured by the consumers i.e. the flank, Shoulder and hind leg. Slaughterhouse personnel were also included where their knives checked for aerobic bacterial presence (Ahmed, 2004).

The presence of *Escherichia coli* as a contaminant of fresh meat which is reported here has also been reported by several workers. Omer (1990) and Ahmed (2004) suggested faecal contamination as a cause of the large numbers of isolates of *E. coli* they recovered. The isolation of bacteria from workers in this study, and the presence of *E. coli* in fresh meat can be attributed to carcass contaminated with the gastrointestinal contents during the processing.

An important observation in the present study is that *Salmonella* spp. was isolated from the samples examined. This is in contrast with the result of Ahmed (2004). The highest contamination levels recorded in the point of washing in all sites (flank, Hind leg and Shoulder) may be due to unclean management during the washing, this is in agreement with (Ali, 2007) who reported the highest level of contamination with regard to the critical control point was found in washing point.

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#### التلوث الميكروبي لذبائح الدجاج أثناء عملية الذبح في الخرطوم - السودان

لقد تم جمع ٧٥ عينة ماسحة عشوائية من دواجن ذبحت حديثاً بمسالخ دواجن نموذجية بولاية الخرطوم - السودان. ان هذه العينات جمعت من خمسة عمليات في المسلخ بعد نزع الريش ، بعد استخراج الاحشاء ، بعد الغسيل بالرش الاول والثاني وبعد التبريد. ايضا جمعت ٧٥ عينة ماسحة من ايادي العمال. لقد اجري التعداد الحيوي الكلي وايضا قد تم عزل ومعرفة انواع البكتيريا الملوثة. هذه الدراسة قد اوضحت بالتحليل الاحصائي اختلافات هامة ( $P<0.05$ ) في العمليات الخمسة عندما اخذت هذه العينات من الصدر، من الظهر والارجل علي التوالي. لا توجد اختلافات احصائية ( $P>0.05$ ) عندما اجري التعداد الحيوي الكلي للعينات التي اخذت من ايادي العمال. ان انواع البكتيريا التي عزلت هي الاشريكية القولونية وانواع السالمونيلا. ان المسالخ السودانية تعكس الحالة الصحية لانتاج لحوم الدواجن في الدول النامية.