Investigation of *Salmonella* spp. and *Escherichia coli* and *staphylococcus aureous* at six points in Traditional poultry slaughtering process in Khartoum State Sudan.

Abdelrahman Khalifa Omer, Galal Eldin Alazhari Mohammed *1* Mohammed Abdelsalam Abdalla *2*, Maha Mubarak Mohamed Ahmed *3*

1. College of Veterinary Medicine, Sudan University of Science and Technology.
2. College of Veterinary Medicine, Sudan University of Science and Technology.
3. College of Animal Production Science and Technology.

*Corresponding author:* E-mail: dr.rahomma@gmail.com.

### ARTICLE INFO

**ARTICLE HISTORY**
- Received: 11/5/2018
- Accepted: 30/6/2018
- Available online: June 2018

**KEYWORDS:**
- Poultry,
- Traditional Slaughtering process,
- Critical Points - bacteria.

### ABSTRACT

The study was aimed to isolate and to identify three types of bacteria at six different operational processes in Traditional poultry slaughtering process in Khartoum state. 90 swab samples were collected from carcasses of broiler chicken at six processing stages (Scalding, defeathering, evisceration, after washing, after chilling, hands of Employees.) during slaughtering process. Traditional methods were used to determine the isolation and identification of three bacteria (*Salmonella* spp., *Escherichia coli* and *Staphylococcus aureus*). The results revealed that, the highest contamination level was at Evisceration which showed high total bacterial count (mean (log$_{10}$CFU/ml) 7.43 ±0.16) and the numbers of bacteria isolated as follows 12(6.9%) samples were positive for *Salmonella* spp., 10(5.7%) samples were positive for *Escherichia coli*, and 8(4.6%) samples were positive for *Staphylococcus aureus*, the low level contamination after Chilling which showed (mean(log$_{10}$CFU/ml) 7.30 ±0.14) and the numbers of bacteria isolated were 14(7.3%) samples were positive for *Salmonella* spp., 7(4%) samples were positive for *Escherichia coli* and 10(5.7%) samples were positive for *Staphylococcus aureus*. The results at scalding stage showed total bacterial count (mean (log$_{10}$CFU/ml) 7.28±0.11) 14(8%) and the numbers of bacteria isolated as follows samples were positive for *Salmonella* spp.,6(3.4%) for *Escherichia coli*, and 9(5.1%) for *Staphylococcus aureus*  The results at defeathering stage showed total bacterial count (mean (log$_{10}$CFU/ml) 7.43±0.08) and the numbers of bacteria isolated as follows 12(6.9%) samples were positive for...
Salmonella spp., 8(4.6%) for Escherichia coli, and 6(3.4%) for Staphylococcus aureus. The results after washing stage showed total bacterial count (mean (log$_{10}$CFU/ml) 7.36±0.11) and the numbers of bacteria isolated as follows 12(6.9%) samples were positive for Salmonella spp., 3(1.07%) for Escherichia coli, and 10 (5.7%) for Staphylococcus aureus. The results at employees stage showed total bacterial count (mean (log$_{10}$CFU/ml) 7.37±0.16) and the numbers of bacteria isolated as follows 12 (6.9%) samples were positive for Salmonella spp., 10 (5.7%) for Escherichia coli, and 12 (6.9%) for Staphylococcus aureus. The statistical analysis of results revealed that, there was significant difference at P-Value (P≤ 0.01) in all Different Operational Points in traditional slaughtering process in Khartoum state.

INTRODUCTION: Most countries have been worried about food-borne diseases nearly in developing countries due to food problems reported cases. Economic and social costs effect around the world (Zhao et al., 2001) Poultry meat can simply contaminated with microorganisms, thus modern processing needs an elevated rate of through put to meet consumers demand (Kabour 2011). Skin of poultry carcasses always exposed to high average rate of microorganisms, they can be pathogenic causing food-borne illness as well as food spoilage, they series of microorganisms on the surface of carcasses which can be canalized in order to indicate the microbial quality (Sandrou and Arvanitoyannis, 1999). These systems present some advantages over traditional methods, results obtained in slaughter houses suggested that HACCP systems can maintain or even improved food safety (Cates et al., 2001). The contamination and or cross-contamination of carcasses, during slaughter process were demonstrated and results indicated presence of bacteria potential public health significances (Doyle, 1991, Biss & Hathaway 1995). Also dirty work hands, clothes, equipments of slaughterhouse. Acts as intermediated sources of contamination of meat (Gill, 1998; Gilmour et al; 2004). Obtaining poultry meat is a similar process in all the slaughterhouses, with some differences in specific stages. Basically, this process consists on a highly coordinated system of different operations aimed at slaughtering the birds, removing the inedible portions of the carcasses and preserving the edible portions for distribution to consumers (Sams and McKee 2010). The poultry slaughtering process involves the following phases: stunning and bleeding, scalding, defeathering, evisceration, washing and chilling. The whole process can be divided in two basic areas: the “dirty zone”, including stunning, bleeding, scalding, defeathering and evisceration stages and the “clean zone” including washing and chilling (Escudero-Gilete et al., 2005). Chicken carcasses have higher pathogenic and spoilage bacterial counts than most other foods, where carcass can be contaminated at several points throughout the processing operation during scalding, de-feathering and evisceration as well as cross
contamination from other birds and processing and employees. All slaughter-process should implement HACCP or similar food safety management system to control all food hazards in the slaughtering processes to ensure the production of safe and wholesome food for human consumption. The objective of the study were to isolate and indentify the (Salmonella spp., Escherichia coli and Staphylococcus aureus) at six processing stages during slaughtering process in Traditional poultry slaughtering processes in Khartoum state.

Materials and Methods:
Sampling:
Each colony represented a bacterium or colony forming unit (cfu).

Isolation and identification of bacterial:
The standard procedures for isolation and identification of Salmonella species, Escherichia coli and Staphylococcus aureus were conducted by using the surface plate method and the respective selective media as described by Barrow and Feltham (1993).

Results:
The study revealed the isolation and identification of three types of bacteria in different operational points. Salmonella spp., Escherichia coli and Staphylococcus aureus. (Table 1). Isolation and identification of bacteria at different operational points under investigation revealed that highest contamination level at the Traditional Slaughtering process at Evisceration.
**which** showed high total bacterial count (mean (log$_{10}$CFU/ml) 7.43 ±0.16) and the numbers of bacteria isolated were 12(6.9%) samples were positive for *Salmonella* spp., 10(5.7%) samples were positive for *Escherichia coli*, and 8(4.6%) samples were positive for *Staphylococcus aureus*, the low level contamination **after Chilling which showed** (mean(log$_{10}$CFU/ml) 7.30 ±0.14) and the numbers of bacteria isolated were 14(7.3%) samples were positive for *Salmonella* spp., 7(4%) samples were positive for *Escherichia coli* and 10(5.7%) samples were positive for *Staphylococcus aureus*.

The results at scalding stage showed total bacterial count (mean (log$_{10}$CFU/ml) 7.30±0.11) and the numbers of bacteria isolated as follows samples were positive for *Salmonella* spp., 12(6.9%) for *Escherichia coli*, and 8(4.6%) for *Staphylococcus aureus*.
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The results after washing stage showed total bacterial count (mean (log$_{10}$CFU/ml) 7.36±0.11) and the numbers of bacteria isolated as follows samples were positive for *Salmonella* spp., 3(1.07%) for *Escherichia coli*, and 10 (5.7%) for *Staphylococcus aureus*.

The results at employees stage showed total bacterial count (mean (log$_{10}$CFU/ml) 7.37±0.16) and the numbers of bacteria isolated as follows 12 (6.9%) samples were positive for *Salmonella* spp., 10 (5.7%) for *Escherichia coli*, and 12 (6.9%) for *Staphylococcus aureus*.

The statistical analysis of results revealed that, there was significant difference at P-Value (P≤ 0.01) in all Different Operational Points (scalding, defeathering, evisceration, after spray wash, after chilling and hands of workers.) in traditional slaughtering process in Khartoum state.

![Table 1: Mean Total Viable Counts of Bacteria (log$_{10}$ CFU/ml) at Different Operational Point in traditional slaughtering processes. Table1](image)

<table>
<thead>
<tr>
<th>CCP</th>
<th>Traditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalding</td>
<td>7.28±0.11</td>
</tr>
<tr>
<td>Defeathering</td>
<td>7.43±0.08</td>
</tr>
<tr>
<td>Evisceration</td>
<td>7.43±0.16</td>
</tr>
<tr>
<td>After Washing</td>
<td>7.36±0.11</td>
</tr>
<tr>
<td>After Chilling</td>
<td>7.30±0.14</td>
</tr>
<tr>
<td>Employees</td>
<td>7.37±0.16</td>
</tr>
</tbody>
</table>

±SD = Standard Deviation
Fig1: Mean Total Viable Counts of Bacteria (log10 CFU/ml) ±Standard Deviation at Different Operational Point in traditional poultry slaughtering processes

Table 1: Numbers of bacteria and percentages were isolated from the Traditional poultry Slaughtering Processes (*Salmonella* spp. and *Escherichia coli* and *Staphylococcus aureus*).

<table>
<thead>
<tr>
<th>Critical control points</th>
<th>No. of Samples</th>
<th><em>Salmonella</em> spp.</th>
<th><em>Escherichia coli</em></th>
<th><em>Staphylococcus aureus</em></th>
<th>Phases %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>Scalding</td>
<td>15</td>
<td>14(8%)</td>
<td></td>
<td>6(3.4%)</td>
<td></td>
</tr>
<tr>
<td>Defeathering</td>
<td>15</td>
<td>12(6.9%)</td>
<td></td>
<td>8(4.6%)</td>
<td></td>
</tr>
<tr>
<td>Evisceration</td>
<td>15</td>
<td>12(6.9%)</td>
<td></td>
<td>10(5.7%)</td>
<td></td>
</tr>
<tr>
<td>After Washing</td>
<td>15</td>
<td>12(6.9%)</td>
<td></td>
<td>3(1.07%)</td>
<td></td>
</tr>
<tr>
<td>After Chilling</td>
<td>15</td>
<td>14(7.3%)</td>
<td></td>
<td>7(4%)</td>
<td></td>
</tr>
<tr>
<td>Employees</td>
<td>15</td>
<td>12(6.9%)</td>
<td></td>
<td>10(5.7%)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>90</td>
<td>76(42.4%)</td>
<td></td>
<td>44(25.01%)</td>
<td></td>
</tr>
</tbody>
</table>
Fig2: Isolated Bacteria (Salmonella spp. and Escherichia coli and Staphylococcus aureus) from the Traditional poultry Slaughtering processes

**Discussion:** In this study the total bacterial viable count (TVCs) obtained from the result showed that the high level of contamination was detected in defeathering stage (mean(log$_{10}$CFU/ml) 7.43 ± 0.08) and the numbers of bacteria isolated as follows 12(6.9%) samples were positive for *Salmonella* spp., bacterial population associated with water from the scald tank, rubber fingers at the exit of defeathering machine (Feathers generally may contaminate external surface of the carcass skin during early processing stages. Presence of *salmonellae* in chicken meat may be attributed bad hygienic conditions during slaughtering, cross contamination either from other birds, instruments, machines, workers, scalding tanks, defeathering machines, crop removal, manual evisceration, during slaughter intestinal contents can spill and contaminate the muscle and organs of the chicken, which is the important source of presence of *Salmonella* in meat and chilling tanks (Paiao et al., 2013). *Escherichia coli* has been isolated worldwide from at carcasses muscles 8(4.6%) samples were positive for *Escherichia coli*, and 6(3.4%) samples were positive for *Staphylococcus aureus*). This data in accordance to the finding of Mead (2004) and Georanras et al, (1997 ). who reported that substantial decrease in TBCs Contamination may occur due to (Contamination of poultry properly due to increased used antimicrobials (Miranda et al., 2008; Adetunji et al., 2011). Also due defeathering the microorganisms are widely distributed under normal circumstances and are spread over the skin during scalding and defeathering on inner and outer surface Bailey et al., (1987). Low contamination was detected after chilling stage (mean (log$_{10}$CFU/ml) 7.30 ± 0.14). 14(7.3%) samples were positive for *Salmonella* spp., 7(4%) samples were positive for *Escherichia coli and 10(5.7%) samples were positive for *Staphylococcus aureus*.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) who
reported 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 washing; this is in agreement with Ali (2007) who reported the highest level of contamination with regard to the critical control point found in the washing point.

**CONCLUSIONS**

The contamination in the traditional poultry processes in Khartoum State which causing by *Salmonella* species, *Escherichia coli* and *Staphylococcus aureus* were isolated from poultry meat at all stages of processing. The highest contamination was shown at defeathering stage and the lowest contamination after washing stage. Most of poultry slaughter houses are not applying HACCP System

**References:**


Glimour, A.; Murry, K.A. and Madden, R.N, (2004): Determination of


