Bacteriological Study of Poultry Meat in Semi-Automatic Abattoir in Khartoum State-Sudan

Ahmed A. Abdalla; Siham E. Suliman; Yassir A. Shuaib; and Mohamed A. Abdalla*

College of Veterinary Medicine, Sudan University of Science and Technology, P.O. Box: 204, Khartoum North, the Sudan. WWW.sustech.edu
* Corresponding author email: salamaa2000@sustech.edu
Article history: Received: 03/02/2014 Accepted: 23/2/2014

Abstract
The current study was conducted to investigate the contaminating microorganisms that can be found on broiler carcasses during slaughtering in semiautomatic poultry abattoir in Khartoum State. Forty five swab samples were collected randomly from chicken carcasses and worker’s hands. The samples were taken after following processing steps: defeathering, evisceration, spray wash, chilling and from workers hands. Total Viable Count (TVC) of contaminating bacteria was done besides isolation and identification of bacteria. The results revealed that there was statistically significant difference in the TVC after defeathering (p≤ 0.05). The highest contamination level was recorded after evisceration on the legs, 8.16±0.11 log_{10} CFU/cm^2, back, 8.68±0.25 log_{10} CFU/cm^2 and the breast, 9.18±0.13 log_{10} CFU/cm^2. The contaminating bacteria isolated were Escherichia coli, Pseudomonas spp., Shigella spp. and Salmonella spp. High levels of microbial contamination can be carried by bad evisceration and poor hygienic managements, but better facilities and processing units with better hygiene make broiler meat have a concern for suppliers, consumers and public health officials.

Keywords: Hygienic approaches, poultry meat, contamination, poultry abattoir

Introduction
Food borne infections and illness is a serious worldwide health problem associated with economic losses. Chicken and poultry products have become popular due to their specific sensory attributes and the increasing tendency of the public to consider white meat as being healthier compared to red meat. Poultry is an important part of the animal food market and production is increasing to satisfy public demand world-wide (Bryan 1980). The consumption of poultry meat has increased worldwide within the last decades (FAO1993; McNamara; 1997; Mead 1997). Meat is considered as an important source of proteins to man and is the most perishable of all important foods because of its rich nutrients that supports microbial growth (Magnus, 1981; Ukut et al., 2010). Epidemiological data suggest that contaminated products of animal origin, especially poultry; contribute significantly to food borne diseases. Reduction of raw poultry contamination levels have a large impact on reducing the incidence of illness (Keener et al, 2004). Each year, millions of people worldwide suffer from food-borne diseases (WHO, 2000), and illness resulting from the consumption of contaminated food.
has become one of the most widespread public health problems in contemporary society (Notermans et al., 1995). Some microorganisms such as *Salmonella* spp., *Escherichia coli* 0157:H7, and *Listeria monocytogenes* pose a threat to consumer health (Samelis et al., 2001). Number of bacteria on carcass surfaces vary considerably by different stage of processing (Barnes, 1960; Lahellec et al) 1972; Mead and Impey, 1970). Broilers entering slaughter house 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 plant during processing (Mead et al., 1994; Kotula and Pandya, 1995). The aim of the present study was to investigate the contaminating microorganism associated with broiler meat in semiautomatic abattoir.

**Materials and Methods**

**Sampling:**
A total number of 45 swab samples from broiler carcasses were collected randomly from the legs, breast and backs after 5 Critical Control Points (CCPs), namely; defeathering, evisceration, spray wash, chilling and hands of workers. A sterile metal template was used to outline 10 cm² area of the thigh region on the broiler carcasses and then the area was swabbed vigorously with sterile cotton gauze wrapped around the end of a flat swab stick. The organisms were removed from each swab by shaking for few minutes in 10 ml of sterile 0.5% peptone water. The collected swabs of each carcass were marked, numbered and transported promptly on ice to the laboratory in College of Veterinary Medicine, Sudan University of Science and Technology.

**Bacterial colony count:**
The total viable count (TVCs) of the isolated microorganism was carried out according to the method of Harrigan and MacCance (1976).

**Bacterial examination:**
Smears were made from colonies on agar media, by clean slides fixed with heat and subjected to Gram stain and examined under microscopic oil immersion. In addition to that, the identification has been also based mainly on the procedure of Barrow and Feltham (2003).

**Data analysis**
The data were analyzed with SPSS software (Statistical package for social science version 20, IBM/SPSS). Descriptive statistics were used to analyze the data. In addition, all TVCs bacteria were converted to log10 CFU/cm² for analysis. ANOVA was performed. Statistical significance was set at P-value of ≤ 0.05.

**Results**
The study revealed a statistically significant difference at (p ≤ 0.05) after defeathering between the legs, backs and breast respectively but there was no significant difference after the other CCPs (evisceration, washing, chilling and hands of workers).

As shown in Table 1, the TVC revealed the highest contamination level of the legs, backs and breasts recorded after evisceration 8.16±0.11 log₁₀ CFU/cm², 8.68±0.25 log₁₀ CFU/cm², 9.18±0.13 log₁₀ CFU/cm² respectively, whereas the lowest contamination level of the legs, backs and breasts recorded after chilling 3.84±0.16 log₁₀ CFU/cm², 4.50±0.41 log₁₀ CFU/cm², 4.14±0.20 log₁₀ CFU/cm² respectively.
Table 1: Comparison of mean total viable count of bacteria (log$_{10}$ CFU cm$^{-2}$) ± Sd at different operational points at different sites on poultry carcasses

<table>
<thead>
<tr>
<th>Operation Site</th>
<th>Legs</th>
<th>Backs</th>
<th>Breast</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>After Defeathering</td>
<td>5.40±0.52</td>
<td>7.06±0.59</td>
<td>7.08±0.34</td>
<td>*</td>
</tr>
<tr>
<td>After Evisceration</td>
<td>8.16±0.11</td>
<td>8.68±0.25</td>
<td>9.18±0.13</td>
<td>NS</td>
</tr>
<tr>
<td>After washing</td>
<td>4.18±0.13</td>
<td>5.76±0.32</td>
<td>6.20±0.32</td>
<td>NS</td>
</tr>
<tr>
<td>After chilling</td>
<td>3.84±0.16</td>
<td>4.50±0.41</td>
<td>4.14±0.20</td>
<td>NS</td>
</tr>
</tbody>
</table>

*significant difference at level (P < 0.05); N.S. Not significant (P > 0.05)

Isolation and identification of bacteria at different operational points under investigation revealed 4 species of bacteria (Table 2), which were, after defeathering E. coli (15.6%), Pseudomonas spp. (2.2%) and Shigella spp. (2.2%), after evisceration E. coli (11.1%), Pseudomonas spp. (2.2%), after spray washing E. coli (6.7%), Pseudomonas spp. (11.1%), Salmonella spp. (2.2%), and after chilling, E. coli (17.8%), Pseudomonas spp. (2.2%), and hand of workers E. coli (11.1%), Pseudomonas spp. (6.7%) and Salmonella spp. (2.2%).

Table 2: Number and percentage of bacteria isolated and identified in different operational points

<table>
<thead>
<tr>
<th>Operations</th>
<th>E. coli</th>
<th>Pseudomonas spp</th>
<th>Salmonella spp</th>
<th>Shigella spp</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>After defeathering</td>
<td>7 (15.6%)</td>
<td>1 (2.2%)</td>
<td>0 (0.0%)</td>
<td>1 (2.2%)</td>
<td>9 (20.0%)</td>
</tr>
<tr>
<td>After evisceration</td>
<td>5 (11.1%)</td>
<td>3(6.7%)</td>
<td>1 (2.2%)</td>
<td>0 (0.0%)</td>
<td>9 (20.0%)</td>
</tr>
<tr>
<td>After spray washing</td>
<td>3 (6.7%)</td>
<td>5 (11.1%)</td>
<td>1 (2.2%)</td>
<td>0 (0.0%)</td>
<td>9 (20.0%)</td>
</tr>
<tr>
<td>After chilling</td>
<td>8 (17.8%)</td>
<td>1 (2.2%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>9 (20.0%)</td>
</tr>
<tr>
<td>Hand of workers</td>
<td>5 (11.1%)</td>
<td>3(6.7%)</td>
<td>1 (2.2%)</td>
<td>0 (0.0%)</td>
<td>9 (20.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>28 (62.2%)</td>
<td>13 (28.9%)</td>
<td>3 (6.7%)</td>
<td>1 (2.2%)</td>
<td>45 (100.0%)</td>
</tr>
</tbody>
</table>

Discussion

In the present study the majority of the samples had coliform bacteria specially after defeathering. Contamination may occur due to bacterial population associated with water from the scald tank, rubber fingers at the exit of defeathering machine (Geornaras et al., 1997). Feathers generally may contaminate external surface of the carcass during early processing stages. The highest level of viable aerobic bacteria recovered from the samples in this study after evisceration (table 1), this result is in agreement with finding of Ramires et al., (1997) and Hinton et al., (2000) who reported that broiler carcass can be contaminated by bacteria when contact with ingesta or faeces from alimentary tract during grow-out, transport to the processing plant holding or evisceration. In this study the bacterial contamination at various processing steps at slaughterhouse have revealed that evisceration markedly increased bacterial counts on broiler carcasses, this contribute to contamination of carcasses by visceral content during evisceration. The mean total viable counts obtained from our result after evisceration were lower than recorded by Mohammed –Noor et al., (2012) this may be due to using of evisceration machine in modern abattoir which may rupture the viscera and contaminate the carcasses. Also this result come in line with observation of Iroha, et al., (2011), who mentioned that the method of slaughtering of animals is responsible for microbial contamination; traditional method of butchering using knives and cutting line appear more capable of minimizing faecal contamination than modern machine systems which are managed by team of operator. Moreover the bacterial count obtained from this study after spray wash
was lower than that obtained from carcass after defeathering and after evisceration, this data in accordance to the finding of Mead (2004) who reported that a substantial decrease in TVCs and coliform bacteria counts after washing and after chilling. Contamination of poultry meat by microorganism that cause food borne disease which are not able to prevent them (Afshin et al 2013).

In the present study E.coli (62.2%) Pseudomonas spp (28.9%) were isolated from all operational points, this finding is in agreement with finding of Mead (2004) and Kabour et al (2012). The isolation of E. coli, Pseudomonas spp and Salmonella spp (table1) from the hands of the workers in our study was in accordance with study of Jeffery et al (2003) who revealed that the hands of workers and the equipment are the source of contamination .The increase of the prevalence of Salmonella spp in the poultry processing may be due to evisceration if the gut of the bird is colonized with pathogen (WHO, 2000). Poultry is considered as the source of food poisoning by Salmonella spp. to the human (Afshin et al 2013). In this study Shigella spp. (2.2%) was isolated; this result is inline with those recorded by Mead (2004).

In conclusion, when the evisceration is not correctly done, then the microbial level on poultry carcasses is increased due to occurrence of pathogenic bacteria which reflect to the poor hygienic management in meat processing. But better facilities and processing units with better hygiene make broiler meat safe and suitable for consumers.

References
Keener KM, Bashor MP; Curtis PA; Sheldon BW; Kathariou, S. (2004)
Comprehensive review of *Campylobacter* and poultry processing. *Compr Rev Food Sci Food Safety* 3: 105-116


دراسة البكتريا في لحوم الدواجن بمسلخ شبه آلي في ولاية الخرطوم - السودان

أحمد عبد الرحيم عبدالله، سهام الياس سليمان، ياسر إدم شبيب و محمد عبدالله عبده

كلية الطب البيطري - جامعة السودان للعلوم والتكنولوجيا

المستخلص

الثقوب الميكروبي لذبائح الدواجن يمكن أن يتأثر بالعديد من العوامل أثناء عملية الذبح والتجهيز. أجريت الدراسة الحالية للتقسيم عن الكائنات الدقيقة الملوثة التي يمكن العثور عليها على نباتات لاحمة أثناء الذبح في مسلخ دواجن شبه اوتوماتيكي في ولاية الخرطوم. تم جمع خمسة وأربعين عينة مسحة عشوائية من ذبائح الدجاج وأيادي العمال. وتم أخذ العينات بعد خطوات عملية الذبح التالية: نفخ الرغيف، إزالة الأحشاء، الغسيل الرذازي، التبريد ومن أيادي العمل. وقد تم حساب إجمالي العدد الحي (TVC) من البكتريا الملوثة إلى جانب العزل والتنمر على أنواع البكتريا. و كشفت نتيجة الدراسة أن هناك اختلاف إحصائي بعد عملية نفخ الرغيف (ع ≤ 0.05). وسجل أعلى مستوى للثقوب بعد إزالة الأحشاء على الساقين، 8.16 ± 0.11، الظهر، 8.68 ± 0.25، و الصدر، 9.18 ± 0.13.

أنواع البكتريا الملوثة كانت الإلشبيشية القولونية، الزائفة، أنواع الشيجلا النباية. وأنواع السالمونيلا. المستوى العلائي من الثقوب الميكروبي كان بسبب سوء عملية إزالة الأحشاء وضعف إتباع الإرشادات الصحية، ولكن تجريد مرافق المجهر ووحدات الذبح والمعالجة مع النظافة تجعل لحوم الدواجن ذات أهمية للموردين والمستهلكين ومسؤولي الصحة العامة.