Assessment of Bacterial Quality of Beef Carcasses Collected from a Meat Processing Plant

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ABSTRACT

In the present investigation 40 beef carcasses were randomly selected during April to June 2002 from a meat processing plant located at Kochi in Kerala which procures carcasses from two slaughtering units viz, A and B, located in Tamil Nadu. From each carcass, surface area of 500 cm$^2$ was swabbed which consisted of 100 cm$^2$ each from neck, brisket, loin, flank and outer round. The samples from each carcass were examined for the bacterial quality by estimating the total viable count (TVC), coliform count (CC), Escherichia coli count (ECC) and faecal streptococcal count (FSC). All samples were subjected to the isolation and identification of E. coli and Staphylococcus aureus. The samples had an overall mean TVC, CC, ECC and FSC of $7.40 \pm 0.17$, $3.41 \pm 0.13$, $1.83 \pm 0.22$ and $3.27 \pm 0.10$ log$_{10}$ cfu/cm$^2$, respectively. E. coli was isolated from 10 carcasses belonging to source A and 5 carcasses from source B. The serotype O157 was isolated from two of the carcass samples belonging to source A. Four isolates from this source belonged to serotype O36. The serotypes O36, O157 and O172 were isolated only from the samples obtained from the source A. The serotype O8 was isolated from both the sources. However, the serotypes O13, O65, O69 and O75 were isolated only from samples of source B. S. aureus was isolated from two (5%) carcasses belonging to source A and one (2.5%) of the carcasses belonging to the source B. The study emphasizes on the need for hygienic requirements to be taken at all levels of production.

Keywords: Bacterial pathogens, beef carcass, slaughtering plants

In India, meat is primarily produced in about 3600 registered slaughterhouses, which are under the control of local bodies. The infrastructure and other facilities available in these slaughterhouses are quite unsatisfactory and the hygienic practices followed are far from satisfactory. During the slaughter and dressing of food animals contamination of the carcasses occur from the animal’s hide, intestinal content, personnel engaged in these processes and also from contaminated equipment and environment. The safety and hygienic quality of meat are largely determined by the load of microorganism, which are ubiquitous in nature (Gill et al., 1999). The total bacterial count and the number of spoilage organisms in meat should be reasonably low so that no decomposition or development of undesirable flavour occurs during the period of processing, distribution or storage (FAO, 1985).

The information on the presence and distribution of bacterial pathogens on the carcass surface help the producers to take appropriate hygienic measures for production of wholesome meat. Hence the present study was undertaken to assess the bacterial quality by enumerating...
bacterial counts and detecting the presence of *E. coli* and *S. aureus* on the carcass.

During the investigation, a total of 40 beef carcasses were randomly selected from a meat processing plant located at Kochi in Kerala. The factory procures the carcasses from two sources (A and B) located in Tamil Nadu for processing and production of meat products. From each randomly selected carcass surface, 500 cm$^2$ area was swabbed, which consisted of 100 cm$^2$ each from neck, brisket, loin, flank and outer round. The samples were collected and brought to the laboratory in thermocool containers and processed immediately to evaluate the bacterial quality. Total viable count (TVC), coliform count (CC), *E. coli* count (ECC) and faecal streptococcal count (FSC) were estimated according to the procedures described by Swansson et al. (2001); Anon (1968), Anon (1973) and BIS (1980), respectively. The isolates were identified by the cultural, morphological and biochemical characteristics described by Barrow and Feltham (1993). All the suspected isolates of *E. coli* were sent for serotyping at National *Salmonella* and *Escherichia* Centre, Central Research Institute, Kasauli, Himachal Pradesh.

The mean Total viable count, Coliform count, *Escherichia coli* count and faecal streptococcal count of carcasses belonging to the sources A and B are given in Table 1.

### Table 1: Mean bacterial counts of the samples

<table>
<thead>
<tr>
<th>Source of samples</th>
<th>TVC Mean±SE (log$_{10}$ cfu/cm$^2$)</th>
<th>CC Mean±SE (log$_{10}$ cfu/cm$^2$)</th>
<th>ECC Mean±SE (log$_{10}$ cfu/cm$^2$)</th>
<th>FSC Mean±SE (log$_{10}$ cfu/cm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.32 ± 0.17</td>
<td>3.61a* ± 0.13</td>
<td>2.53a* ± 0.19</td>
<td>3.55a* ± 0.11</td>
</tr>
<tr>
<td>B</td>
<td>7.47 ± 0.18</td>
<td>3.21a ± 0.13</td>
<td>1.13a ± 0.25</td>
<td>3.00a ± 0.10</td>
</tr>
<tr>
<td>Overall mean</td>
<td>7.40 ± 0.17</td>
<td>3.41 ± 0.13</td>
<td>1.83 ± 0.22</td>
<td>3.27 ± 0.10</td>
</tr>
</tbody>
</table>

N=40, 20 each from source A and B; *P<0.05
Figures bearing the same superscript differ significantly.

Statistical analysis of the data using paired t-test revealed a significant and positive association between the mean total viable count and faecal streptococcal count (P<0.05). The samples had an overall mean TVC of $7.40 ± 0.17$ log$_{10}$ cfu/cm$^2$. The mean count of samples from the sources A and B were $7.32$ and $7.47$ log$_{10}$ cfu/cm$^2$, respectively. According to Ingram (1949), the counts of the carcasses produced from abattoir with poor hygienic practices were in the range of $10^6$ to $10^7$/cm$^2$. Therefore, it may be inferred that the two sources from which the carcasses were produced had a poor hygienic practice. The samples had an overall mean CC of $3.41 ± 0.13$ log$_{10}$ cfu/cm$^2$. It is higher when compared to the FSIS microbiological study (1994) in which 96.4% of the samples had the count under $10^2$ cfu/cm$^2$. This indicates that the hygienic practices, followed in the above source were not satisfactory. This also confirms the observation of Lasta *et al.* (1992), who reported that carcasses produced from very good abattoirs had the count lower than one cfu/cm$^2$. The overall mean ECC count of the samples was $1.83 ± 0.22$ log$_{10}$ cfu/cm$^2$ and that of streptococcal count was $3.27 ± 0.10$ log$_{10}$ cfu/cm$^2$. All samples revealed the presence of faecal streptococcal organism and its presence in large number could be attributed to direct or indirect faecal contamination, as these organisms are true commensals of the alimentary tract of man and animals. At times, the organisms are associated with diarrhoea and other diseases.
with "sours" or "bone taint" on the carcasses (Jay, 1996). The detection of organism on cent per cent samples revealed that the hygienic practices followed during the slaughter and dressing of these animals was not satisfactory.

*E. coli* is a mesophilic, Gram negative organism found in the intestinal tract of man and animals. *E. coli* and *S. aureus* have public health impact and their presence on the carcasses indicate that the contamination might have occurred from the intestinal content of the animal and/or from the contaminated water used for various activities during slaughter and dressing of carcasses. The per cent samples positive for *E. coli* and *S. aureus* are given in Table 2.

Of the 40 samples tested, *E. coli* was isolated from 15 (37.5%) samples. Ten *E. coli* were isolated from the samples belonging to source A and five from the samples collected from the source B. Fourteen *E. coli* isolates belonged to nine serotypes and 1 was untypable (Table 2). The serotypes O36, O156, O157, and O172 were isolated, only from the samples obtained from the source A. The serotype O8 was isolated from both the sources. However, the serotypes O13, O65, O69 and O75 were isolated only from the carcasses belonging to source B. Contamination of the carcasses with presumptive *E. coli* on 17% and 34.4% beef samples has been reported by Ingham and Scambitd (2000). The isolation of the serotype O157 from the carcasses is of great significance since this serotype is associated with hemorrhagic colitis, hemolytic uremic syndrome and thrombocytopenic purpura in man. The serotype O156 is an enterohaemorrhagic *E. coli* isolated from one of the carcasses belonging to source A. The serotype O8 which is an enterotoxigenic *E. coli* was isolated from one carcass each belonging to the source A and B, and is the major causative agent of infantile and travelers diarrhoea. The isolation of the serotype O157 from buffalo beef has been reported by Banerjee et al. (2001). The serotypes O65 and O75 were isolated from one carcass each of the source B. The former is associated with urinary tract infection and the latter is an enteroaggregative organism. The isolation of *E. coli* from carcasses, which are associated with various diseases in man and animals, is of great significance.

*S. aureus* was isolated only from two (5%) carcasses from source A and one (2.5%) of the carcasses from source B. The occurrence rate of the study was much lower than that recorded by Philips et al. (2001) who isolated the organism from 24.3% of sponged beef carcasses and 25.3% of excised carcasses. The isolation of the organism was also reported from 30% of fresh buffalo meat (Bachhil et al., 1998) and 16.6% of beef samples (Hansson et al., 2001). *S. aureus* is generally regarded as a potential pathogen.

### Table 2: Pathogenic organism isolated from beef carcass samples

<table>
<thead>
<tr>
<th>Carcass source</th>
<th>No. of samples tested</th>
<th>No. (%) of samples positive for <em>Escherichia coli</em></th>
<th>Serotypes of <em>Escherichia coli</em> (Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20</td>
<td>10 (50)</td>
<td>O8 (1), O36 (4), O156 (1), O157 (2), O172(1), UT (1)</td>
</tr>
<tr>
<td>B</td>
<td>20</td>
<td>5 (25)</td>
<td>O8 (1), O13 (1), O65 (1), O69 (1), O75 (1)</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>15 (37.5)</td>
<td>3 (7.5)</td>
</tr>
</tbody>
</table>

UT = Untypeable
However, its presence on fresh carcasses can be considered as an indicator of poor hygienic practices, since the organism is usual inhabitant of anterior nares, axilla and skin of man and animals.

References


