Microbial Profile of Meat Sold in Local Retail Markets of Jammu

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(Received 15.05.2010; accepted 30.09.2010)

ABSTRACT

Chicken, chevon, mutton and pork samples were collected from various retail shops of Jammu to evaluate for standard plate count (SPC), psychrotrophic count (PTC), Enterococcus faecalis count (EFC), Staphylococcus aureus count (SAC), Escherichia coli count (ECC) and the presence of Salmonella spp. and Listeria monocytogenes. Poultry meat samples had higher (P<0.05) SPC, PTC, EFC and SAC than chevon, mutton and pork. E. coli was recovered from 42.36% chicken, 29.32% mutton, 23.42% pork and 20.14% chevon samples. The prevalence rate of Salmonella spp. was 12.32% in poultry meat, compared to 6.24% in mutton, 4.86% in pork and 3.46% in chevon. L. monocytogenes was recovered only from 0.94% poultry samples. These findings indicated that poultry meat had higher microbial contamination with foodborne pathogens of potential zoonotic importance in comparison to chevon, pork and mutton.

Keywords: Chevon, Enterococcus, Escherichia coli, Listeria, microbiological quality, mutton, pork, poultry meat, Salmonella, Staphylococcus

Introduction

Poultry meat, mutton, pork and chevon are most popular meat in this part of the country. Consumers purchase these meat from local retail shops, which lack hygienic condition. Microbial contamination of carcass surfaces is unavoidable, but most of the microflora acquired by the carcasses during the slaughtering process is non-pathogenic. However, there is possibility that pathogens such as Salmonella spp., E. coli, Campylobacter spp. and L. monocytogenes may be present on the carcasses (Buckle et al., 1989; Borch and Arinder, 2002) making it most critical quality and safety issues faced by the meat industry. Moreover, during recent years with the increase in global trade and awareness of the consumers for the hygienic quality of the meat, attention is being focused on ways to improve the microbial quality and safety of food. Thus it was considered to carry out a survey of microbial quality of poultry meat, chevon, mutton and pork available in local markets of Jammu, to determine general microbial profile and prevalence of food pathogens viz., L. monocytogenes, Salmonella spp., and E. coli.

Materials and methods

Sampling

A total of 364 chicken, mutton, pork and chevon samples (91 each) were collected from local retail shops of Jammu with all possible aseptic precautions. About 50 g of the sample was obtained and transferred into pre-sterilized colorless self-sealing polyethylene bags and transported to laboratory over ice. The samples were analyzed immediately in the laboratory.

General microbial profile

Standard plate count (SPC), psychrotrophic count (PTC), Enterococcus faecalis count (EFC),
generic *E. coli* count (ECC), *Staphylococcus aureus* count (SAC) in the samples were enumerated as per the methods of American Public Health Association (APHA, 1984) with suitable modifications. All the media and biochemical kits used in the study were procured from M/s Hi-Media Laboratories Pvt. Ltd., Mumbai. For serial dilution, a 10 g portion of tissue sample was aseptically transferred to pre-sterilized mortar containing 90 ml of sterile 0.1% peptone water. The sample was homogenized using sterile pestle for uniform dispersion and serial 10 fold dilutions were prepared using 0.1% peptone solution. For SPC and PTC determination, 1 ml of appropriate dilutions were pour-plated in triplicate with tempered standard plate count agar. Plates were incubated at 37±2°C for 48 h or 4±1°C for 14 days, colonies were counted and expressed as log cfu/g. EFC was determined using Slantz and Bartley medium and typical colonies of red purple colour with about 0.5 mm diameter were counted. Determination of ECC was conducted using MaConkey agar. Briefly, 1 ml of the 10\(^{-1}\) dilution were pour plated in triplicate and incubated at 37±2°C for 48 h. The presumptive colonies were determined by counting number of sharp pinkish colonies of about 0.5 mm in diameter and the average numbers of colonies were recorded as log cfu/g of sample. *E. coli* colonies were further confirmed by streaking on EMB agar and biochemical tests using HiMViC\textsuperscript{TM} test kit. SAC was determined using Baird Parker (BP) agar. Briefly, 1 ml of the 10\(^{-1}\) dilution were pour plated in triplicate and incubated at 37±2°C for 48 h. The presumptive colonies were determined by counting number of sharp pinkish colonies of about 0.5 mm in diameter and the average numbers of colonies were recorded as log cfu/g of sample. 

**Determination of Salmonella spp. and L. monocytogenes**

*Salmonella* spp. in meat samples were determined as per procedure outlined by the International Commission on Microbiological Specifications for Foods (ICMSF,1996). Hi-Salmonella\textsuperscript{TM} Identification Kit was used for confirmation along with other biochemical tests. For *L. monocytogenes*, samples were analyzed using the USDA method described by McClain and Lee (1988) after making suitable modification. In modified method, *Listeria* enrichment broth was used for enrichment of bacterial inoculum before streaking directly on *Listeria* selective agar. The listeria colonies appeared as yellowish green colour, sharp and pointed colonies were characterized biochemically for the identification of *L. monocytogenes* using Hi-Listeria\textsuperscript{TM} Identification kit.

**Statistical analysis**

Statistical analysis of data was performed using statistical software packages following the procedure of Snedecor and Cochran (1994). The general microbial count of tissue samples were expressed as Mean±SE and range, and were analyzed with one-way analysis of variance. The means between samples were compared by Student’s ‘t’ test and a value of P < 0.05 was considered as significant.

**Results and discussion**

**Standard plate count (SPC)**

The log mean of the standard plate count (37°C) in poultry meat (6.58±0.84) was significantly higher (P<0.05) than mutton (5.44±0.58), chevon (4.76±0.48) and pork (5.78±0.72). The overall mean of the SPC was 5.64 log cfu/g (Table 1). But, the range of SPC in poultry varied from 4.34 log cfu/g to as high as 8.96 log cfu/g, whereas in chevon these counts were from 2.16 to 6.98 log cfu/g. Higher SPC in poultry might be due to greater amount of faecal and feathers contamination onto the skinned carcasses (Little, et al., 1999). Chevon and mutton contained significantly (P < 0.05) lower bacterial counts that may be due to removal of viscera at a separate place. Little et al. (1998) and Casalinuovo et al. (2001) reported similar counts. The average APC as reported by Davies and Board (1998) was similar to the results of this study. The suggested SPC for meat are < 5 log cfu/g (ICMSF, 1998). However, in present
study poultry meat, mutton, pork and chevon samples showed higher average counts.

**Psychrotrophic count (PTC)**

Psychrotrophic counts (PTC) for poultry meat, mutton, pork and chevon were in the range of 2.46 to 5.08 log cfu/g, 1.92 to 5.36 log cfu/g, 1.92 to 5.28 log cfu/g and 0.86 to 4.46 log cfu/g, while the mean PTC were 3.62±0.28, 3.86±0.32, 3.94±0.32 and 2.88±0.88 log cfu/g, respectively (Table 1). The PTC found in pork and mutton samples were significantly (P < 0.05) higher than chevon and poultry. The present findings were in contrast with investigation of Selvan et al. (2007), but in agreement with the findings of Oblinger and Kennedy (1980).

**Enterococcus faecalis count (EFC)**

Results in the present study indicated that EFC counts in pork and poultry meat were significantly higher (P < 0.05) than the counts obtained in mutton and chevon (Table 1). Higher bacterial counts might be attributable to low skill levels of operators during the processing and processing plant physical facilities. (Hitchins et al., 1992). All the meat samples tested showed higher counts than the safety limits i.e. 3 log cfu/g (ICMSF, 1998).

**Escherichia coli count (ECC)**

The incidence of *E. coli* was more in poultry meat (42.2%) than in mutton (37.8%), pork (31.4%) and chevon (29.2%). Enumeration data as depicted in (Table 1) indicated that ECC in poultry meat was in the range of 4.08 to 6.86 log cfu/g with mean value of 5.32±0.42 log cfu/g. ECG range (log cfu/g) was 1.92 to 5.16 in chevon, 2.14 to 6.82 in mutton and 2.66 to 6.28 in pork. However, Madden et al. (2001) reported higher ECC counts of above 7.19 log cfu/g in raw beef samples.

### Table 1. Mean±SE (log CFU/g) for standard plate count (SPC), psychrotrophic count (PTC), *Enterococcus faecalis* count (EFC), *E. coli* count (ECC), *Staphylococcus aureus* count (SAC) in meat samples.

<table>
<thead>
<tr>
<th>Micro-organisms</th>
<th>Poultry</th>
<th>Chevon</th>
<th>Mutton</th>
<th>Pork</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPC</strong></td>
<td>6.58 ± 0.84&lt;sup&gt;a&lt;/sup&gt; (4.34-8.96)</td>
<td>4.76 ± 0.48&lt;sup&gt;b&lt;/sup&gt; (2.16-6.98)</td>
<td>5.44 ± 0.58&lt;sup&gt;ab&lt;/sup&gt; (3.68-7.68)</td>
<td>5.78 ± 0.72&lt;sup&gt;a&lt;/sup&gt; (3.96-8.08)</td>
</tr>
<tr>
<td><strong>PTC</strong></td>
<td>3.62 ± 0.28&lt;sup&gt;ab&lt;/sup&gt; (2.46-5.08)</td>
<td>2.88 ± 0.18&lt;sup&gt;a&lt;/sup&gt; (0.86-4.46)</td>
<td>3.86 ± 0.32&lt;sup&gt;a&lt;/sup&gt; (1.92-5.36)</td>
<td>3.94 ± 0.32&lt;sup&gt;a&lt;/sup&gt; (1.92-5.28)</td>
</tr>
<tr>
<td><strong>EFC</strong></td>
<td>4.96 ± 0.38&lt;sup&gt;a&lt;/sup&gt; (3.82-6.14)</td>
<td>3.28 ± 0.12&lt;sup&gt;b&lt;/sup&gt; (1.76-4.14)</td>
<td>4.22 ± 0.38&lt;sup&gt;b&lt;/sup&gt; (2.18-5.40)</td>
<td>5.14 ± 0.45&lt;sup&gt;a&lt;/sup&gt; (2.84-7.02)</td>
</tr>
<tr>
<td><strong>ECC</strong></td>
<td>5.32 ± 0.42&lt;sup&gt;a&lt;/sup&gt; (4.08-6.86)</td>
<td>3.26 ± 0.34&lt;sup&gt;b&lt;/sup&gt; (1.92-5.16)</td>
<td>4.64 ± 0.46&lt;sup&gt;b&lt;/sup&gt; (2.14-6.82)</td>
<td>4.54 ± 0.48&lt;sup&gt;b&lt;/sup&gt; (2.66-6.28)</td>
</tr>
<tr>
<td><strong>SAC</strong></td>
<td>2.37 ± 0.28&lt;sup&gt;b&lt;/sup&gt; (1.94-4.88)</td>
<td>1.88 ± 0.88&lt;sup&gt;b&lt;/sup&gt; (0.78-2.76)</td>
<td>2.42 ± 0.10&lt;sup&gt;a&lt;/sup&gt; (0.94-3.02)</td>
<td>1.96 ± 0.12&lt;sup&gt;b&lt;/sup&gt; (0.88-2.74)</td>
</tr>
</tbody>
</table>

<sup>a,b</sup>Mean±SE bearing different case letter row-wise differ significantly at P < 0.05; Values in parenthesis indicate Median (range)

### Table 2. Occurrence (%) of *E. coli*, *Listeria monocytogenes* and *Salmonella* spp. in meat samples.

<table>
<thead>
<tr>
<th>Micro-organisms</th>
<th>Poultry</th>
<th>Chevon</th>
<th>Mutton</th>
<th>Pork</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em></td>
<td>42.36</td>
<td>20.14</td>
<td>29.32</td>
<td>23.42</td>
</tr>
<tr>
<td><em>L. monocytogenes</em></td>
<td>0.94</td>
<td>0.20</td>
<td>0.42</td>
<td>0.24</td>
</tr>
<tr>
<td><em>Salmonella</em> spp</td>
<td>12.32</td>
<td>3.46</td>
<td>6.24</td>
<td>4.86</td>
</tr>
</tbody>
</table>
**Staphylococcus aureus count (SAC)**

The distribution of *S. aureus* in poultry, mutton, pork and chevon has been shown in Table 1. Results indicated variation in the number of bacterial counts in all types of meat, but poultry had significantly higher (*P*<0.05) count than others. It was observed that about 37% poultry, 29% mutton, 19% pork and 11% chevon samples contained higher counts than the recommendation of ICMSF (ICMSF, 2002). The values reported in our work were in concordance with the earlier studies of Bachhil and Jaiswal (1988) in raw meat and Haque et al. (2008) in chevon.

**Occurrence of *E. coli***

Of the samples screened, 42.36% poultry meat samples were found to be positive for *E. coli* in comparison to 29.32% mutton, 23.42% pork and 20.14% chevon (Table 2). Variations in occurrence rates of *E. coli* in meat samples may be attributed to differences in sampling techniques, level of contamination during slaughtering and processing, plant environment and seasonal effects (Regez et al.,1988).

**Occurrence of Salmonella spp. and *L. monocytogenes***

The occurrence of *Salmonella* spp. in poultry, mutton, pork and chevon as presented in Table 2 indicated that 12.32% poultry meat samples were positive for *Salmonella* spp. This prevalence was much higher than the previously reported prevalence by Bachhil and Jaiswal (1988), and Sofos et al. (1999). *L. monocytogenes* was found only in few samples viz., poultry (0.94%), mutton (0.42%), pork (0.24%) and chevon (0.20%). This was in accordance with Hinton et al. (2004). Although very few samples were positive, the presence of *Salmonella* spp. and *L. monocytogenes* in meat has major public health significance.

It was evident from the present study that poultry, chevon, mutton and pork carcasses available in local markets may pose various health hazards. The retail shops providing meat under grossly unhygienic condition that could endanger the health of consumers. Therefore, people should be made aware about the various health hazards arising from consumption of unhygienic meat and local retail shopkeepers should be elucidated about the maintenance of hygienic condition and humane slaughtering of the animals.

**References**


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