Quality and Safety Assessment of Raw Bovine Milk in Herat Province, Afghanistan

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Introduction

- Afghan annual per capita milk consumption is ~66K/yr.
- Large national focus on increasing milk production and consumption
- Much growth in both small and large milk businesses
- To date, there are no comprehensive studies on the quality of milk available to consumers in Herat
Introduction

- **Objective:** assess the quality of milk from open markets and small milk shops

- **Measured:**
  - Total bacteria
  - Coliforms
  - Composition (fat%, protein%, sugar%, ash%)
  - Presence of adulterants (e.g., water, antibiotics)
Procedures

• Microbiology

• Aerobic Plate Count
  • Diluted milk samples
  • Plated on Plate Count Agar

• Coliforms
  • Diluted milk samples
  • Plated on Violet Red Bile Agar
Procedures

• Composition

• Measured by ultrasound:
  • Fat
  • Protein
  • Lactose
  • Ash
Procedures

• Adulteration

• Measured:
  • Added water
  • Added starch
  • Added CaCO$_3$
  • Antibiotics (tetracycline, penicillins, sulfa drugs)
  • ROSA Antibiotic Strips
## Results

Age and price of milk samples used in this study.

<table>
<thead>
<tr>
<th>Source</th>
<th>&lt; 6 hr</th>
<th>12 – 24 hr</th>
<th>&gt; 24</th>
<th>Mixed</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n = 100)</td>
<td>53.0</td>
<td>44.0</td>
<td>2.0</td>
<td>1.0</td>
<td>28.7</td>
</tr>
<tr>
<td>Bazar (n = 55)</td>
<td>52.7</td>
<td>41.8</td>
<td>3.6</td>
<td>1.8</td>
<td>26.2&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Milk Shop (n = 45)</td>
<td>53.3</td>
<td>46.7</td>
<td>0.0</td>
<td>0.0</td>
<td>31.1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Numbers with different superscripts are significantly different at P < 0.05. Comparisons are between sampling groups (bazars vs. milk shops) and within column.  * = at time of collection.

Milk samples were similar ages at time of collection and analysis.
## Results

Composition of milk samples collected from bazars and milk shops in Herat City, Afghanistan

<table>
<thead>
<tr>
<th>Source</th>
<th>Fat (%)</th>
<th>SNF (%)</th>
<th>Protein (%)</th>
<th>Lactose (%)</th>
<th>Salts (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n = 100)</td>
<td>3.25</td>
<td>8.45</td>
<td>3.33</td>
<td>4.76</td>
<td>0.57</td>
</tr>
<tr>
<td>Bazars (n = 55)</td>
<td>3.0b</td>
<td>8.10b</td>
<td>3.29</td>
<td>4.70</td>
<td>0.56</td>
</tr>
<tr>
<td>Milk Shops (n = 45)</td>
<td>3.5a</td>
<td>8.80a</td>
<td>3.38</td>
<td>4.82</td>
<td>0.58</td>
</tr>
</tbody>
</table>

Numbers with different superscripts are significantly different at P < 0.05; comparisons are between sampling groups (bazars vs. milk shops) and within columns.

**Milk samples from bazars frequently had composition (fat) irregularities.**
Results

Percentage of milk samples with irregularities (fat or water) or adulterants (starch or antibiotic residues).

<table>
<thead>
<tr>
<th>Source</th>
<th>Fat</th>
<th>Water</th>
<th>Starch</th>
<th>Antibiotic Residues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Beta-lactams</td>
</tr>
<tr>
<td>Bazaar</td>
<td>34.5(^a)</td>
<td>32.7(^a)</td>
<td>25.5(^a)</td>
<td>4.0(^b)</td>
</tr>
<tr>
<td>Milk Shop</td>
<td>11.1(^b)</td>
<td>15.6(^b)</td>
<td>2.2(^b)</td>
<td>19.0(^a)</td>
</tr>
</tbody>
</table>

Numbers with different superscripts are significantly different at P < 0.05. Comparisons are within column.

Milk samples from bazars more frequently had adulterations.
Results

75 – 90% of all milk samples had TOTAL BACTERIA concentrations above the international standard (10^5 CFU/mL)
Results

~90% of all milk samples had COLIFORM concentrations above the international standard (100 CFU/mL)
Conclusions

- Milk samples from bazars more frequently had irregularities (e.g., added water, starch, fat irregularities)
- Milk from both sources had high bacterial concentrations
Conclusions

• High bacterial concentrations indicate sanitation and hygiene issues

• Milk shop owners should work directly with their suppliers to make sure they are collecting, storing, and transporting milk using hygienic practices.

• Decreasing bacterial concentrations will increase:
  • Shelf-life
  • Product quality
  • Profit