QUALITY PROFILE OF RAW MILK SUPPLIED TO HOUSEHOLDS WITHIN HYDERABAD CITY

GHULAM SHABIR BARHAM, ATTA HUSSAIN SHAH

ABSTRACT

OBJECTIVES: To detect the different adulterants in milk supplied to households, to assess the nutritive quality and energy level of milk supplied to households in Hyderabad city Sindh.

STUDY DESIGN: A longitudinal-Cross sectional study.

PLACE AND DURATION: Department of Animal Products Technology, Sindh Agriculture University, Tandojam from 5th April 2015 to 27th September 2015.

METHODOLOGY: 125 milk samples were collected from different marketing agencies, detected for different additives and evaluated for nutritive quality and energy level at the Analytical lab of Department of Animal Products Technology, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University Tandojam, Pakistan.

RESULTS: Of the milk samples examined, 49.6% were adulterated with superfluous water, followed by detergent (28.80%), cane sugar (17.60%), starch (14.40%), skimmed milk powder (16.0%), formalin (12.80%), hydrogen peroxide (12.0%), caustic soda (8.40%), urea (6.40%) and sodium chloride; NaCl (4.0%). Increased values of pH of milk collected from middleman and processor were observed compared to that of milk vender, milk producer and dairy shops. The specific gravity of milk samples obtained from milk producer found comparatively better than the other milk supplying agencies, while the milk received from dairy shops was more acidic compare to that of other agencies. Improved nutritive quality and energy level; fat, protein, total carbohydrates and ash contents of milk were observed received from producer than that of other distributing agencies, though low energetic and cheep quality milk was supplied through dairy shop keeper, middlemen and milk venders to households of Hyderabad city.

CONCLUSIONS: The peoples of Hyderabad city consuming unhygienic and low nutritive quality milk.

KEY WORDS: Quality Assessment, Adulteration, Market Milk, Hyderabad City, Nutritive quality, Hygiene.

INTRODUCTION

The milk and milk products play significant role in daily routine diet in most parts of the world and a considerable part of food expenditure goes on milk and milk products1. Milk is a rich source of nutrients like carbohydrate, protein, fat, vitamins and minerals, which are quite essential for the better nourishment of human body2. On the other hand, majority of health risks to consumers can be associated with milk, due to the presence of zoonotic pathogens, antimicrobial drug residues adulterants, contaminants during and after milking, these agents directly deteriorated the quality of milk3.

Among all top five milk producing countries of world, Pakistan is existed on 4th position, and the current milk production of the country is 52,990 thousand tons4. In contrast to good ranking in milk producing countries the circulation and/or marketing of milk within the country is underdeveloped and informal5. However, the supply of quality milk is compulsory to fulfill the demand of consumer, instead of that, those informal channels diluted the pure milk with unhygienic water, remove the valuable fat and/or cream from milk and spiked the different types of additives and adulterants for to maintain the temporary quality of milk and/or their extra earning margin6. Most of these adulterants are toxic chemicals, may pose adverse effects on milk quality and human health7. Adulterants like polluted extraneous water causes hazardous bacterial and viral infections, ammonium sulfate, sodium carbonate and caustic soda become causes for gastrointestinal problems ulcer, diarrhoea, electrolytes disturbance8, while hydrogen peroxide disturbs antioxidants in the body, salt/sodium chloride disturbs blood pH in the body, addition of boric acid, urea and formalin in milk may cause cardiac problems, kidney failure, vomiting, diarrhoea and abdominal pain9-13. Furthermore, above mentioned adulterants not only create serious human health problems, along with it, these are also deteriorate the quality of milk.

Keeping in view the above said pan picture the study was designed to screen the various adulterants in milk and keeping quality of milk supplied to the households within the Hyderabad city. The objective of study is to detect the different adulterants in milk supplied to households within Hyderabad city and to assess the nutritive quality and energy/calorific values of milk supplied to the households within Hyderabad city.

METHODOLOGY

A longitudinal-Cross sectional study has been designed to evaluate the quality profile of milk supplied to households within Hyderabad city at the Department of Animal Products Technology, Sindh Agriculture University, Tandojam, Pakistan.
Technology, Faculty of Animal Husbandry and Veterinary Science, Sindh Agriculture University, Tandojam from 5th April 2015 to 27th September 2015.

Market milk: A total of one hundred twenty five (125) milk samples; each of 25 from milk producer, milk vender, middleman, processor and dairy shops were collected in sterile milk sample bottles within the Hyderabad city, brought to the Analytical lab of Department of Animal Products Technology, Sindh Agriculture University Tandojam.

In the first phase of study all the collected milk samples (125) from different milk marketing agencies were screen out for various adulterants, while in the next phase the physical, nutritive quality and energy value of similar samples were evaluated.

Superfluous water in milk: The superfluous water in bazaar samples was observed through Cryoscope according to the method as mentioned in Association of Official Analytical Chemists.

All the other adulterants except water in milk were examined with the help of milk adulteration testing (MAT) kit following the procedure of Tipu.

Quality assessment of milk: Physical and nutritive quality variables like specific gravity, acidity and/or pH value, fat, protein, total carbohydrates and ash contents of market milk samples were analyzed.

Specific gravity: The specific gravity of milk was measured by pycnometer, method as described by Association of Official Analytical Chemists.

Acidity: The acidity of milk was determined through titration kit, method as described by Association of Official Analytical Chemists.

pH value: Spiked milk sample was taken into a beaker, and electrode along with temperature probe was inserted to sample. The constant reading appeared on pH meter base was noted and recorded as pH value of milk sample.

Fat content: Fat content was determined by Gerber method as described by James.

Protein content: Protein percent was determined by Micro-Kjeldhal method as mentioned by British Standards Institution.

Total carbohydrates: Total carbohydrates of milk samples were calculated by using following formula as reported by James.

Total carbohydrates % = TS% - (Fat% + Protein% + Ash %)

Ash content: Ash content of milk samples was determined by Gravimetric method by using muffle furnace as described by Association of Official Analytical Chemists.

Energy/calorific value: The energy/calorific values were computed with following formula:

Kcal (per 100g) = [(% protein) (4)] + [(% fat) (9)] + (% CHO) (4)

Following tools were used for data analysis.

- Summary statistics: Mean and Standard error
- Inferential statistics: ANOVA and Post hoc test i.e. LSD (at 0.05 level)

RESULTS

During current investigation it was noted that among all screened adulterants extraneous water (49.60%) was at the top, followed by detergent (28.80%), cane sugar (17.60%) starch (14.40%), formalin (12.80%), skimmed milk powder (12.0%), hydrogen peroxide (10.40%), caustic soda (8.80%), urea (6.40%) and sodium chloride (4.0%), respectively (Figure-I).

Physical quality characteristics of milk supplied through milk supplying agencies:

Results presented in Table-I reveal that physical characteristics of milk have been notably decreased due to the addition of various adulterants by the different milk supplying sources. The specific gravity, acidity percent and pH values of control/pure milk appeared as 1.0320, 0.110% and 6.80, respectively. However, in contrast to pure milk decrease in specific gravity of milk supplied through milk producer, milk vender, middleman, processor and dairy shop was observed as 1.0306, 1.0261, 1.0253, 1.0283 and 1.0211, respectively. Statistical analysis (ANOVA) revealed low specific gravity in milk supplied by shop keepers than all other milk marketing sources, while it was found significantly higher in milk supplied through milk producer. Similarly, the acidity percent and pH values of milk received from milk producer, milk vender, middleman, processor and dairy shop were recorded as 0.124, 0.085, 0.107, 0.096 and 0.170% and 6.83, 6.88, 6.91, 6.92 and 6.65, respectively. Nevertheless, the acidity and pH values of milk from different milk supplying agencies appeared statistically (P<0.05) different from one another, mainly milk supplied through dairy shops contain high level of lactic acid count (acidity).

Nutritive quality characteristics of milk supplied through milk supplying agencies:

In contrast with control/pure milk, the nutritive quality characteristics of milk supplied through different milk supplying agencies to the various households within Hyderabad city was observed (Table-II). Normally pure buffalo milk contained 6.00, 4.40, 4.50 and 0.80% of fat, protein, total carbohydrates and ash contents, respectively. However, significant decrease was observed in fat (5.32, 4.33, 3.89, 4.93 and 3.04%, respectively), protein (3.86, 3.13, 2.82, 3.73 and 2.60%, respectively), total carbohydrates (4.10, 3.33, 2.73, 3.70 and 2.26%, respectively) and/or in ash contents (0.71, 0.57, 0.47, 0.65 and 0.39%, respectively) of milk supplied by milk producer, milk vender, middleman, processor and/or dairy shop. Statistical approach; LSD (0.05) showed significant (P<0.05) variation in the fat, protein, total carbohydrates and ash contents of milk of all these milk supplying agencies, whereas, low nutritive quality of milk was observed supplied by dairy shop keepers, middlemen and milk venders within the Hyderabad city.

Energy/calorific value of milk supplied through milk supplying agencies:

Result reveals that in contrast to control milk there significant (P<0.05) influence of different milk supplying agencies was observed on the energy/calorific values of milk (Figure-II). It was noted that the calorific value of control milk was appeared as 146Kcal/100g. Whereas, against control/pure milk, low energy/calorific values were recorded in milk supplied by milk producer, milk vender, middleman, processor and dairy shop (79.94, 64.79, 57.19, 74.05 and 46.78Kcal/100g). Significant
(P<0.05) difference was observed in energy/calorific values of milk received from all above mentioned milk supplying agencies.

**DISCUSSION**

The main causes of losses in milk quality are the manipulation in pure milk, improper sanitation, undersized preservation technology and lack of chilling conveniences. Public of country consuming raw milk added with water by milk dealers, which has been contaminated and watered down to an extent that there is very little nutritive value left in it, resulting, to an immense level, to general public health concerns and malnutrition. It is quite interesting to know that having fourth position of Pakistan in top milk producing countries of the world, only 3-5% of total milk production is marketed through official agencies, while remaining 95-97% of milk is produced and marketed in raw form by informal agencies around the country. These agencies are directly involved in the deterioration of milk quality and in unscrupulous activity of milk adulteration. Looking upon above facts, current research was conducted to evaluate the quality of milk supplied to the households.

**TABLE I: PHYSICAL CHARACTERISTICS OF MILK SUPPLIED BY DIFFERENT MILK MARKETING AGENCIES TO THE HOUSEHOLDS WITHIN HYDERABAD CITY (n=125)**

<table>
<thead>
<tr>
<th>Physical Characteristics</th>
<th>Milk Supplying Agencies</th>
<th>LSD (0.05)</th>
<th>SE±</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity</td>
<td>Milk Producer 1.030a</td>
<td>0.0094</td>
<td>0.0047</td>
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<tr>
<td></td>
<td>Milk Vender 1.0261c</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Middleman 1.0253c</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Processor 1.0283b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dairy Shop 1.0211d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acidity (%)</td>
<td>Milk Producer 0.124b</td>
<td>0.0986</td>
<td>0.0498</td>
</tr>
<tr>
<td></td>
<td>Milk Vender 0.085d</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middleman 0.107c</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Processor 0.096d</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dairy Shop 0.170a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH values</td>
<td>Milk Producer 6.83a</td>
<td>0.0233</td>
<td>0.0118</td>
</tr>
<tr>
<td></td>
<td>Milk Vender 6.88b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middleman 6.91b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Processor 6.92a</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dairy Shop 6.65d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Means with different letters in same row varied significantly from one another.

LSD= Least significant difference

SE= Standard error

Superscripts; a, b, c, d & e used in Table-I indicate the significant variation among means.

**TABLE II: NUTRITIVE CHARACTERISTICS OF MILK SUPPLIED BY DIFFERENT MILK MARKETING AGENCIES TO THE HOUSEHOLDS WITHIN HYDERABAD CITY (n=125)**

<table>
<thead>
<tr>
<th>Nutritive Characteristics (%)</th>
<th>Milk Supplying Agencies</th>
<th>LSD (0.05)</th>
<th>SE±</th>
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</thead>
<tbody>
<tr>
<td>Fat content</td>
<td>Milk Producer 5.32a</td>
<td>0.1457</td>
<td>0.0736</td>
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<td></td>
<td>Milk Vender 4.33c</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Middleman 3.89d</td>
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<td></td>
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<tr>
<td></td>
<td>Processor 4.93b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dairy Shop 3.04e</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein content</td>
<td>Milk Producer 3.86a</td>
<td>0.1499</td>
<td>0.0757</td>
</tr>
<tr>
<td></td>
<td>Milk Vender 3.13b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middleman 2.82c</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Processor 3.73a</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Dairy Shop 2.60e</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total carbohydrates</td>
<td>Milk Producer 4.10a</td>
<td>0.1124</td>
<td>0.0568</td>
</tr>
<tr>
<td></td>
<td>Milk Vender 3.33c</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middleman 2.73d</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Processor 3.70b</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Dairy Shop 2.26e</td>
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<td></td>
</tr>
<tr>
<td>Ash content</td>
<td>Milk Producer 0.71a</td>
<td>0.0177</td>
<td>0.0894</td>
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<tr>
<td></td>
<td>Milk Vender 0.57c</td>
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<tr>
<td></td>
<td>Middleman 0.47d</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Processor 0.65b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dairy Shop 0.39e</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Means with different letters in same row varied significantly from one another.

LSD= Least significant difference

SE= Standard error

Superscripts; a, b, c, d & e used in Table-II indicate the significant variation among means.
A wide range of milk samples were found to be tainted with hazardous adulterants, which can be injurious for human health. Low nutritive quality and unhygienic milk is supplied by different marketing agents; especially dairy shop keepers, milk vendors and middlemen to households within Hyderabad city.

CONCLUSIONS

- A wide range of milk samples were found to be tainted with hazardous adulterants, which can be injurious for human health.
- Low nutritive quality and unhygienic milk is supplied by different marketing agents; especially dairy shop keepers, milk vendors and middlemen to households within Hyderabad city.

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Contribution of Authors:

Ghulam Shabir Barham: Principal investigator and manuscript writing.
Atta Hussain Shah: Supervisor, statistical analysis results and proof reading.

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