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RESEARCH ARTICLE

QUALITY EVALUATION OF MILK SAMPLES COLLECTED FROM DIFFERENT INTERMEDIARIES AT THE VICINITY OF CHITTOOR DISTRICT, ANDHRAPRADESH, INDIA

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ABSTRACT

Present investigation was carried out with the aim to investigate the chemical composition, physico-chemical parameters and various adulterants of market milk sold at different intermediaries at the vicinity of Chittoor district, Andhra Pradesh, India. Total of 100 milk samples were collected randomly from different intermediaries, 25 samples each from the milk producers (MP), milk collectors (MC), milk vendors (MV) and retail shops (RS) and were examined for different adulterants like water, urea, starch, sodium chloride, detergents, neutralizers, cane sugar, hydrogen peroxide, formaldehyde and glucose and dextrose. Among the intermediaries, milk obtained from MP was remarkably higher ( $p < 0.05$ ) in fat, solid not fat (SNF), total solids (TS) content and significantly lower ( $p < 0.05$ ) percent added water than that of milk procured from MC, MV and from RS. Based on the results of physico-chemical characteristics, milk samples procured from milk producers showed significantly higher ( $P < 0.05$ ) specific gravity, and lower acidity and pH compared to the samples collected from MC, MV and RS. All examined milk samples collected from MP, MC, MV and RS were free from adulterants like Glucose and dextrose, Hydrogen peroxide and formaldehyde. Samples collected from the MP found completely lower positive percentages for different adulterants like water, urea, starch, sodium chloride, detergents, neutralizers and cane sugar than the samples from other intermediaries.

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INTRODUCTION

Milk is an important natural source of nutrient required for growth in children and also for maintenance of health in adults. Milk in its natural form has high food value. It supplies nutrients like proteins, fat, carbohydrates, vitamins and minerals in moderate amounts in an easily digestible form. Milk contains more than 100 substances that are either in solution, suspension or emulsion in water. The composition of milk varies considerably with the breed of cow, stage of lactation, feed, season of the year, and many other factors. Milk is a perishable commodity and is likely to be spoiled during summer season when weather becomes very hot (Tipu et al., 2007). In order to keep milk temporarily fresh, some unethical activities are usually adapted to prevent the financial losses due to the spoilage of milk during its transportation and sale (Naz, 2000). Milk adulteration is an act of intentionally debasing the quality of food offered for sale either by admixture or substitution of inferior substances or by the removal of some valuable ingredients (Food & Drug Administration 1995).

For instance, the addition of water to increase volume of milk, thickening agents like starch, flour, skimmed milk powder, whey powder or other ingredients to counter the dilution and extend the solids content of the milk (Fakhar et al., 2006);

vegetable oil, sugarcane or urea to compensate the fat, carbohydrate or protein content of diluted milk. Some chemicals such as hydrogen peroxide, carbonates, bicarbonates, antibiotics, caustic soda and even the most lethal chemical formalin to increase the storage period of milk (Tariq, 2001), ice to enhance the shelf life of milk; detergents to enhance the cosmetic nature of milk which diminishes foamy appearance and whitening of milk or calcium thioglycolate/ potassium thioglycolate/ calcium salts of thioglycolic acid and urea for whitening of milk and giving it a genuine look (Walker et al., 2004).

These adulterants, preservatives and drugs in milk cause very serious health related problems and also decrease the nutritive value of milk (Afzal et al. 2011). The extensive consumption of milk and dairy products makes these foodstuffs targets for potential adulteration with financial gains for unscrupulous producers (Nicolaou et al. 2011). Therefore, it is important to protect the consumer by ensuring that adequate control measures are in place, and that the food analyst has suitable methods for the detection of milk adulteration. Keeping in view the above facts, the present study was conducted to detect quality of the milk samples for various common adulterants obtained from different intermediaries at the vicinity of Chittoor district, Andhrapradesh, India.

## MATERIAL AND METHODS

### Experimental Procedure

Present investigation was carried out to evaluate quality of the market milk sold by different intermediaries at the vicinity of Chittoor district, Andhrapradesh, India. Total 100 milk samples were collected randomly (25 samples each from the milk producers (MP), milk collectors (MC), milk vendors (MV) and retail shops (RS)). Milk samples were collected in sterile milk sample bottles were examined at the laboratory of Livestock Products Technology Department, College of Veterinary Science, Tirupati without any delay.

### Specific gravity

Specific gravity of milk determined by using Lactometer. It is a hydrometer (a device for measuring specific gravity) adapted to the normal range of the specific gravity of milk. Specific gravity was calculated by using the following formula,

$$\text{Specific gravity} = 1 + \text{CLR}/1000$$

### Fat Content

Fat content of milk was determined by Gerber method as described by James (1995). Milk sample (11ml) was mixed with 90% sulfuric acid (10ml) and amyl alcohol (1ml) in butyrometer, and closed with rubber cork. The mixture was mixed and centrifuged in a Gerber machine (5 min) at 1100 r. p. m. The fat percentage was noted on the butyrometer scale.

### Solids Not Fat (SNF) Content

Solids not fat (SNF) content was determined by difference as reported by Harding (1995) using the following formula, SNF content (%) = TS percent – Fat percent

**Percent added water:** Percent added water calculated by using the following formula,

$$\% \text{ Added Water} = \frac{\text{Standard SNF} - \text{Sample SNF}}{\text{Standard SNF}} \times 100$$

### Detection of Adulteration

A standard milk adulteration kit manufactured by NICE CHEMICALS Pvt. Ltd., Kerala, India was used. The tests for adulteration were carried out on 100 milk samples obtained in and around the district of Chittoor, India. The milk samples were tested for the following adulterants – formalin, urea, starch, neutralizers, detergents, sodium chloride, skim milk powder, sucrose, glucose/dextrose, hydrogen peroxide, acidity and heat stability of milk was also tested.

### Statistical Analysis

The data were analyzed through computerized statistical package i.e. Student Edition of Statistics (SXW),

## RESULTS AND DISCUSSION

A total of 100 milk samples were randomly collected from different intermediaries at the vicinity of chittoor district viz, milk producers (MP), milk collectors (MC), milk vendors (MV) and retail shops (RS) were examined for their chemical composition, physico chemical properties and different adulterants.

**Chemical Composition:** The chemical composition of milk samples collected from different intermediaries presented in table- I and figure- I. Among the intermediaries, milk obtained from MP was remarkably higher ( $p < 0.05$ ) in fat content than that of milk procured from MC, MV and from RS. The SNF content as observed in this study was even less than the legal standard of SNF content (8.5%) in milk (Farani, 1983). Results indicated that SNF and Total solids content of milk sold by MC, MV and RS was seems to be ( $p < 0.05$ ) lower in SNF content than that of MP and the difference among them were statistically non significant ( $p > 0.05$ ). Milk samples from MP observed lower percent added water ( $p < 0.05$ ) than samples of MC, MV and RS. This might be due to reason that adulteration of extraneous water in milk apparently increases the moisture content of corresponding milk (Paradkar *et al.*, 2000; Hossain *et al.*, 2010; and Mansour *et al.*, 2012). Present findings are in line with that of reported studies of Ayub *et al.*, (2007) and Awis (2013) who reported relatively similar fat content in buffalo dairy farm milk and Abdul aziz soomro *et al.*, (2014) who investigated various adulterations and its impact on chemical characteristics of market milk sold at Badin. These results were supported by Hossain *et al.* (2010) and Mansour *et al.* (2012)

**Physico-Chemical parameters:** The overall mean values of physico chemical properties of milk samples collected from different intermediaries were given in table-II. According to results obtained, the values obtained in this study for milk samples collected by MP were almost similar to those in freshly obtained normal cow's milk, and moreover, milk samples collected from MP showed significantly ( $p < 0.05$ ) higher specific gravity than the milk samples collected from MC, MV and RS. This might be due to addition of more extraneous water in the samples of MC, MV and RS than the MP. Percent acidity and pH values of milk samples sold by MP observed ( $p < 0.05$ ) lower values than the milk samples sold by MC, MV and RS. The average mean values of acidity and pH of milk samples collected from MP are in the normal range that is 0.14 - 0.16 and 6.4 - 6.6 respectively (Sukumar De, 1980). This might be due to fact that the milk sold by the MP was fresh milk and not having any developed acidity. Results of present study are in line with that of Faraz *et al.*, (2013).

**Determination of the extent of different adulteration in milk samples:** The results of different adulterants are shown in table III and figure-II. It is clearly evident that all examined milk samples collected from MP, MC, MV and RS were free from Glucose and dextrose, Hydrogen peroxide, formaldehyde.

**Table 1** Mean + SE (%) values of Chemical Composition of Milk Samples Collected from different intermediaries in the vicinity of Chittoor district

| Constituents  | Samples from milk producers (MP) | Samples from milk collectors (MC) | Samples from milk vendors (MV) | Samples from retail shops (RS) |
|---------------|----------------------------------|-----------------------------------|--------------------------------|--------------------------------|
| Fat           | 3.42±0.09 <sup>a</sup>           | 3.24±0.24 <sup>b</sup>            | 3.18±0.15 <sup>b</sup>         | 3.15±0.02 <sup>b</sup>         |
| Solid not fat | 8.19±0.15 <sup>a</sup>           | 7.62±0.51 <sup>b</sup>            | 7.23±0.21 <sup>b</sup>         | 7.31±0.42 <sup>b</sup>         |
| Total solids  | 11.61±0.17 <sup>a</sup>          | 10.84±0.27 <sup>a</sup>           | 10.39±0.31 <sup>b</sup>        | 10.44±0.02 <sup>b</sup>        |
| % Added water | 3.58±0.09 <sup>a</sup>           | 10.36±0.22 <sup>b</sup>           | 14.88±0.12 <sup>b</sup>        | 14.01±0.32 <sup>b</sup>        |

Means bearing at least one common superscript in the same row and in the same column do not differ significantly (P<0.05).

**Table 2** Mean + SE (%) values of Physico-Chemical parameters of Milk Samples Collected from different intermediaries in the vicinity of Chittoor district

| Constituents     | Samples from milk producers (MP) | Samples from milk collectors (MC) | Samples from milk vendors (MV) | Samples from retail shops (RS) |
|------------------|----------------------------------|-----------------------------------|--------------------------------|--------------------------------|
| Specific gravity | 1.023±0.01 <sup>a</sup>          | 1.012±0.21 <sup>b</sup>           | 1.002±0.09 <sup>b</sup>        | 1.008±0.23 <sup>b</sup>        |
| Acidity          | 0.154±0.08 <sup>a</sup>          | 0.162±0.11 <sup>a</sup>           | 0.183±0.10 <sup>b</sup>        | 0.192±0.22 <sup>b</sup>        |
| pH               | 6.42±0.05 <sup>a</sup>           | 6.55±0.21 <sup>a</sup>            | 6.59±0.16 <sup>b</sup>         | 6.64±0.25 <sup>b</sup>         |

Means bearing at least one common superscript in the same row and in the same column do not differ significantly (P<0.05).

**Table 3** Adulteration of Milk Samples Collected from different intermediaries in the vicinity of Chittoor district

| Adulterants          | Percentage of positives from milk producers | Percentage of positives from milk collectors | Percentage of positives from milk vendors | Percentage of positives from dairy shops |
|----------------------|---|--|---|--|
| Urea                 | 0%  | 4%   | 4%  | 8%                                       |
| Starch               | 0%  | 0%   | 12%                                       | 16%                                      |
| Neutralizers         | 0%  | 0%   | 12%                                       | 20%                                      |
| Detergents           | 4%  | 4%   | 8%  | 24%                                      |
| Sugar                | 8%  | 16%  | 20%                                       | 24%                                      |
| Glucose and dextrose | 0%  | 0%   | 0%  | 0%                                       |
| Sodium chloride      | 0%  | 12%  | 16%                                       | 28%                                      |
| Hydrogen peroxide    | 0%  | 0%   | 0%  | 0%                                       |
| Formaldehyde         | 0%  | 0%   | 0%  | 0%                                       |
| Skim milk powder     | 0%  | 16%  | 24%                                       | 20%                                      |

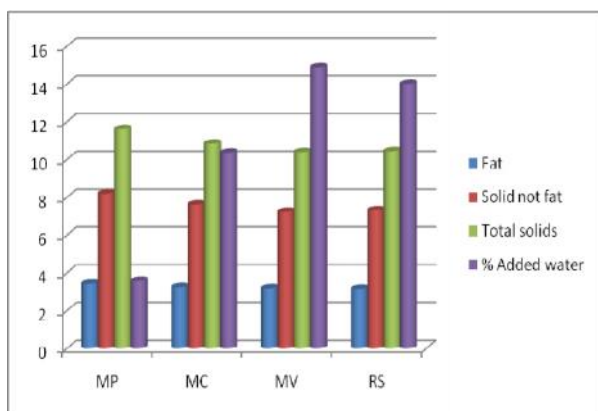
**Starch and sugar adulteration:** Starch and sugar were added to increase the thickness of milk after addition of water. According to the results, all the samples collected from MP and MC were negative for starch, whereas samples from MV (12%) and RS (16%) were showed positive results. Sugar adulteration was observed for all the samples collected from MP (8%), MC (16%), MV (20%) and RS (24%). The results of this study in accordance with the Ramya *et al.*, (2015) Chanda *et al.*,(2012) and Singuluri and Sukumaran (2014).

**Neutralizers' adulteration:** Neutralizers are generally used to mask the pH and acidity values of badly preserved milk passing it off as fresh milk (Faraz *et al.*, 2013). As per the results, 12% and 20% of samples collected from MV and RS respectively were positive for neutralizers and samples collected from MP and MC observed negative results for neutralizers. Similar results were obtained by Chintha siva Swetha *et al.*, (2014), Ramya *et al.*,(2015) and Singuliri and Sukumaran (2014).

**Detergents adulteration:** Detergents are added to emulsify and dissolve the oil in water giving the frothy solution, the characteristic white colour of milk ( Kandapl *et al.*, 2012). According to the results obtained, 4%, 4%, 8% and 24% samples from MP, MC, MV and RS respectively were found positive for detergents. The present study results were correlated with Chintha Siva Swetha *et al.*, (2014), Ramya *et al.*, (2015) and (Kandpal *et al.*, 2012) and in contrast with the results of Singuliri and Sukumaran (2014) and Ghulam Shabir Barham (2014)

**Sodium chloride adulteration:** Sodium chloride was added in milk to mask the higher water content. Milk sample collected from MP (0%), MC (12%), MV (16%) and RS (28%) were found to be positive for sodium chloride. Similar results were observed by Chintha Siva Swetha *et al.*, (2014), Ramya *et al.*, (2015) Singuluri and Sukumaran (2014).

**Skim milk powder adulteration:** Skim milk powder was used to either increase the weight or relative mass of milk. As per the results obtained in the present study, samples from milk producers were negative for skim milk powder adulteration, where as samples from MC (16%), MV (24%) and RS (20%) were showed positive results for skim milk powder adulteration.



**Figure-1** Chemical Composition of Milk Samples Collected from different intermediaries in the vicinity of Chittoor district

Similar results were reported by Ramya *et al.*, (2015) Singuluri and Sukumaran (2014) and Chanda *et al.*, (2012) where as Ghulam Shabir Barham (2014) observed positive results towards formaldehyde and glucose and dextrose adulteration in collected milk samples.

**Urea adulteration:** Urea is added to milk to provide whiteness, increase the consistency of milk and for leveling the contents of SNF as are present in the natural milk (Kandpal *et al.*, 2012). As per the results obtained in the present study, no sample was positive for urea which was collected from milk producers where as samples from MC (4%), MV (4%) and RS (8%) were showed positive results for urea adulteration. The results of this study in correlated with the Chintha siva Swetha *et al.*, (2014), Ramya *et al.*, (2015)

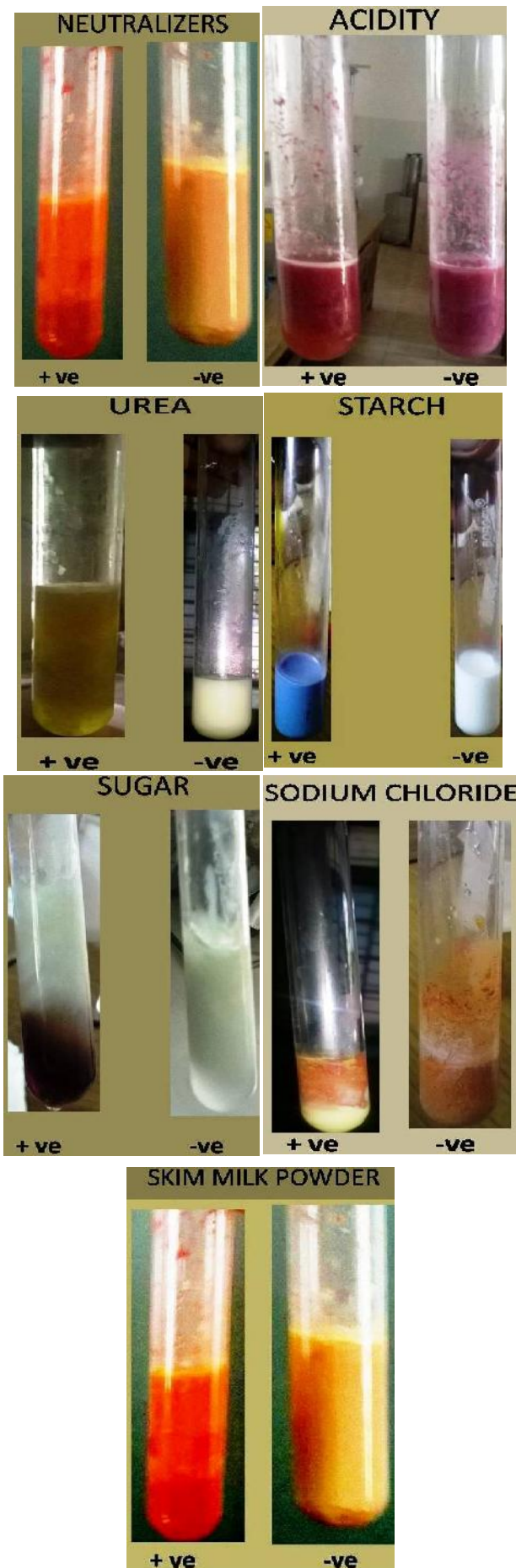


Figure 2 Positive and negative results of different adulterants

Similar results were reported by Shrishti Nirwal *et al.*, (2013) Chinta Siva Swetha *et al.*, (2014), Ramya *et al.*, (2015).

## CONCLUSION

In a country such as India where milk and milk products play an important role in different foodstuffs, this analysis carried out should bring about more awareness to the general public about the malpractices in milk marketing. Based on the results of chemical composition, physico-chemical properties and milk adulteration, it was clearly showed that the milk sold at four different places *viz.*, MP, MC, MV and RS were extensively put to the malpractices such as skimming and adulteration of milk with water, urea, starch, sodium chloride, detergents, neutralizers and cane sugar which was carried out during the handling of milk starting from milking till the receiving by end consumer. It is apparent from the analyses that a large number of samples procured did not conform to the legal standards prescribed by the Food Safety and Standards Authority of India (FSSAI). These results clearly suggest that most of the milk samples collected from different intermediaries in the vicinity of Chittoor district were adulterated. Hence, the milk sold in those places cannot be considered as good nutritive milk. Consumers must aware of this malpractice and they have to be more active against the milk adulteration.

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