Original Research

Studies on the Incidence of Adulterants, Preservatives and Synthetic Milk Constituents Sold in and around Greater Hyderabad Municipal Corporation

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Abstract

Adulteration of food is the process of addition or removal of substances to or from food either intentionally or naturally due to carelessness or lack of infrastructure. Study was undertaken on the incidence of adulterants, preservatives and synthetic milk in the milk samples from cooperative sectors, organized private dairies and milk vendors in and around Greater Hyderabad Municipal Corporation (GHMC). The incidence of water, sugar, starch, gelatin and skim milk powder was 3.33%, 0%, 0%, 0% and 23.33% respectively in milk samples from cooperative sectors, 13.33%, 3.33%, 3.33%, 0% and 30% in samples from organized private dairies where as in milk samples from milk vendors was 90%, 46.67%, 73.33%, 6.67% and 73.33% respectively. The incidence of neutralizers, boric acid, formalin, H_2O_2 and salicylic acid was 1%, 0%, 0%, 0% and 0% respectively in milk samples from cooperative sectors, 2%, 2%, 1%, 0% and 0% in samples from organized private dairies where as in milk samples from milk vendors was 14% ,1% ,2% ,0% and 1% respectively. *The incidence of urea, ammonium sulfate, soap and detergent was 0%, 0%, 0% and 0% respectively in milk samples from cooperative sectors, 2%, 2%, 0% and 0% in samples from organized private dairies where as in milk samples from milk vendors it was 11%, 6%, 5% and 1% respectively. The incidence of adulterants, preservatives and synthetic milk constituents were high in milk from milk vendors followed by organized private dairies and least in cooperative sectors.*

Key words: Adulterants, Cooperative Sectors, Milk Vendors, Organized Private Dairies, Preservatives, Synthetic Milk

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Introduction

Milk is an ideal and wholesome food containing almost all nutrients, vitamins and minerals in sufficient amounts. It is an ideal food for all age groups *i.e.* infants, growing people, adults, adolescents, patients, etc.,

(Neumann *et al.,* 2002). Milk is not only nutritious for human beings but also serves as a good medium for growth of both spoilage and pathogenic microorganisms. India ranks first in the world in milk production producing 165.4 million tons accounting for 19% of the total milk production in the world, but our milk production and distribution system has not improved and only 10% of the milk is handled by organizing sector. As there is rapid growth of population, scattered colonization and urbanization, milk consumption is increased, but not the milk supply (Awan *et al.,* 2014). Milk production is greatly reduced during summer months which provide temptation for its adulteration to increase its bulk (Kandpal *et al.,* 2012).

Milk adulteration can be defined as any change caused in the natural level of milk ingredients. These changes may be brought about by addition of some foreign matter to milk or by removing some more valuable ingredients (example fat) out of it. Water is the most commonly used adulterant to increase volume of milk. To maintain viscosity and specific gravity of milk after addition of water, thickening agents like sugar, starch, floor, skim milk powder, whey powder or any other materials are added (Varley, 1969). Despite the laws governing the quality and sale of milk in India, the adulteration has not been checked completely (Nirwal *et al.,* 2013). Synthetic milk is produced by blending urea, cooking oil, detergents, caustic soda and ammonium sulfate (Bansal and Bansal, 1997) and this milk is mixed with raw milk and sold as fresh. Detergents are added to emulsify and dissolve oil in water phase giving frothy appearance, characteristic white color, cooking oil is substitute of milk fat, starch is added to improve milk thickness, urea is added to increase SNF level and sugar and salts are added to get natural flavor.

Many people are still purchasing milk from milk vendors with the belief that the unpasteurized milk has more nutritive value and vendors maintain good personal relationship apart from paying cash in advance. A national survey in India has revealed that almost 70% of milk sold in India is adulterated and the major adulterant is water, which provides microbial load including pathogens to the milk. Systematic and scientific studies on the adulteration incidence in India are scanty. This proposed work was undertaken to know the incidence of adulteration of milk in and around Greater Hyderabad Municipal Corporation (GHMC).

Materials and Methods

Collection of Samples

30 each milk samples were collected from cooperative sector, organized dairies and private milk vendors in and around GHMC. Milk samples were packed in ice, transported to Veterinary Public Health department laboratory, College of Veterinary Science (CVSc), Rajendranagar and stored under refrigeration till analysis.

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Analysis of Collected Milk Samples

The collected raw milk samples were analyzed for the presence of common adulterants, preservatives and constituents of synthetic milk. The tests were done using chemical methods.

Test for Presence of Added Water

This was checked using lactometer reading.

Test for Presence of Boric Acid

5ml of well mixed raw milk sample was taken in a test tube and 1ml of concentrated HCl was added to it. The contents of the test tube were mixed well and drop of the mixed contents was put on a strip of turmeric paper. The presence of boric acid was indicated by the appearance of red or reddish tinge on turmeric strip, after allowing it to air dry.

Test for Presence of Neutralizers (Carbonates and Bicarbonates)

5ml of well mixed raw milk sample was taken in a test tube and 5ml of 95% C_2H_5OH was added to it. The contents of the test tube were mixed well and 3 drops of 1% Rosalic acid was added to it and mixed. The presence of neutralizers was indicated by appearance of rose red color.

Test for Presence of Formalin

10ml of well mixed raw milk sample was taken in a test tube and 0.5ml of 1% $FeCl_3$ was added. From the wall of test tube, carefully, 5ml of concentrated H_2SO_4 was added so that the acid sinks to the bottom as a separate layer. The presence of formalin was indicated by formation of violet ring at the junction of two layers.

Test for Presence of H_2O_2

5ml of well mixed raw milk sample was taken in a test tube and 2 to 3 drops of Para-phenylene diamine hydrochloride was added to it. Presence of H_2O_2 was indicated by development of blue color.

Test for Presence of Sugar

10ml of well mixed raw milk sample was taken in a test tube and 1ml of concentrated HCl was added to it. The contents of the test tube were mixed and a pinch of resorcinol powder was added. Contents were mixed and the test tube was placed in a boiling water bath for 5 minutes. The presence of sugar was indicated by appearance of red color.

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Test for Presence of Starch

5ml of well mixed raw milk sample was taken in a test tube and boiled over flame and was cooled. 1ml of 1% Iodine solution was added to it. The presence of starch was indicated by appearance of blue or bluish violet color.

Test for Presence of Gelatin

10ml of well mixed raw milk sample was taken in a conical flask. To it 10ml of acid Mercuric nitrate or 10% Acetic acid solution was added. The contents of the flask were diluted with 20ml distilled water and were well mixed. The contents were allowed to stand for 10 to 15 minutes without disturbing. The contents were filtered and the filtrate of 2 to 3 ml was collected. To it same amount of saturated picric acid solution was added.

Interpretation: yellow transparent solution indicates the absence of gelatin. Yellow solution with cloudiness indicates adulteration with gelatin. Yellow precipitate formation indicates high gelatin adulteration.

Test for Presence of Skim Milk Powder

5ml of milk into each of centrifuge tubes was taken, balanced and centrifuged at 3000 rpm for 30minutes. The supernatant was discarded. Residue was dissolved in 2.5ml of concentrated Nitric acid and was diluted with 5ml of distilled water. 2.5ml of liquid ammonia was added and changes were observed. Presence of skim milk powder was indicated by development of orange color.

Test for Presence of Urea

Urea is generally added to raise SNF (Solids-not-fat) of synthetic milk. 5ml of well mixed raw milk sample was taken in a test tube and 5ml of 16% para di methyl amino benzaldehyde was added to it. Presence of urea was indicated by turning of solution color into dark yellow.

Test for Presence of Ammonium sulfate

5ml of well mixed hot milk was taken in a test tube and few drops of concentrated HCl was added. Whey was separated from it and was filtered. Whey was collected into another test tube and 0.5ml of 5% $BaCl_2$ was added to it. The presence of ammonium sulfate was indicated by the appearance of white precipitate.

Test for Presence of Soap

10ml of well mixed raw milk sample was taken in a test tube and hot distilled water was added to it. To it 1 to 2 drops of phenolphthalein indicator was added. The presence of soap was indicated by the appearance of pink color.

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Test for Presence of Detergent

5ml of well mixed raw milk sample was taken in a test tube and to it 0.1ml of Bromo cresol purple solution was added. The presence of detergent was indicated by appearance of violet color.

Results and Discussion

The incidence of various adulterants in the milk was presented in Table 1. The incidence of water adulteration in milk was 3.33% in cooperatives milk samples and highest (90%) was from milk vendors, whereas 13.33% from organized private dairies. The incidence of water adulteration in samples from cooperative sector in present study was less than incidence (27.9%) reported by Barham *et al.* (2014c).

Table 1: Incidence of different adulterants in milk samples (N = 30 samples)

S. No.	Source	Water	Sugar	Starch	Gelatin	Skim Milk Powder
1	Cooperatives	1(3.33%)	0(0%)	0(0%)	0(0%)	7(23.33%)
2	Organized Private Dairies	4(13.33%)	1(3.33%)	1(3.33%)	0(0%)	9(30%)
3	Milk Vendors	27(90%)	14(46.67%)	22(73.33%)	2(6.67%)	22(73.33%)

The incidence of water adulteration in present study was 90% from samples of milk vendors which was slightly higher than the incidence reported by Soomro (2014) in Pakistan (75%) where as 84.2% was reported by Hemanth Singuluri and Sukumaran MK (2014) in Hyderabad. 100% water adulteration in milk samples from traditional vendors in Telangana State was reported by Swathi *and Naazia,* (2015). Faraz *et al.* (2013) and Ahmad (2009) reported higher incidence of 97% and 95% water adulteration respectively. The incidence in samples from branded organized private dairies was 13.33%, which was less than incidence (47.06%) reported by Debnath *et al.* 2015. All the milk samples from cooperatives were negative for starch whereas only 3.33% from organized private dairies were positive. Debnath *et al.* (2015), from Kolkata, Bendale *et al.* (2015), from Thane city, Singuluri Sukumaran (2014) from Hyderabad and Swetha *et al.,* Tirupati reported no incidence from branded organized dairy sector. Incidence of starch from milk vendors is 73.33%, which was well above the incidence of 60%, 29.03%, 18.33% reported by Swathi and Naazia, (2015); Debnath *et al.* (2015) and Barham *et al.* (2014b) respectively. Whereas, very low incidence of 12% and 8% were reported by Barham *et al.* (2014a) from Pakistan and Chanda *et al.* in (2013) Bangladesh and 8% by Ramya *et al.* (2015) Andhra Pradesh.

No sample from cooperatives was positive for sugar, where as 3.33% samples from organized private dairies were positive. No incidence of sugar adulteration observed by Nirwal *et al.*, 2013, whereas 52.9% and 46.6% was reported by Debnath *et al.* (2015) and Geeta *et al.*(2015). The incidence of sugar adulteration from milk vendors was 46.67% in present study which was less than the incidence (97%) reported by Faraz *et al.* (2013) and higher than 40%, 31% and 22% reported by Ramya *et al.* (2015), Barham *et al.* (2014a)

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and Barham *et al.*(2014c) respectively. No sample from cooperatives and organized private sectors were positive for gelatin whereas only 6.67% of samples from milk vendors were positive in the present study.

Table 2: Incidence of different preservatives in milk samples (N = 30 samples)

S. No.	Source	Neutralizers	Boric Acid	Formalin	H_2O_2	Salicylic Acid
1	Cooperatives	1(3.33%)	0(0%)	0(0%)	0(0%)	0(0%)
2	Organized Private Dairies	2(6.67%)	2(6.67%)	1(3.33%)	0(0%)	0(0%)
3	Milk Vendors	14(46.67%)	1(3.33%)	2(6.67%)	0(0%)	1(3.33%)

Table 3: Incidence of synthetic milk (N = 30 samples)

S. No.	Source	Urea	Ammonium Sulfate	Soap	Detergent
1	Cooperatives	0(0%)	0(0%)	0(0%)	0(0%)
2	Organized Private Dairies	2(6.67%)	2(6.67%)	0(0%)	0(0%)
3	Milk Vendors	11(36.67%)	6(20%)	5(16.67%)	1(3.33%)

Skim milk was found in 23.33%, 30% and 73.33% of samples from cooperatives, organized private sectors and milk vendors respectively. Singh *et al.* (2015) reported a lower incidence of 10% in organized private dairy samples which was less than the incidence in present study (30%). The incidence (73.33%) of skim milk powder from milk vendors samples is higher than 67.7% samples reported by Debnath *et al.* (2015) where as 80% incidence was reported by Sukumaran and Singuluri (2014), Hyderabad and very low incidence (14%) was reported by Chanda *et al.* (2013) from Bangladesh. Neutralizers are generally used to decrease acidity passing it off as fresh milk (Faraz *et al.*, 2013). The incidence (46.67%) of neutralizers in milk samples from milk vendors in present study was less than incidence 73.3% reported by Singh *et al.*, (2015), from Delhi. The incidence (6.67%) from organized private dairies was less than incidence (36.3%) reported by Bendale *et al.* (2015) and almost similar reported by Swetha *et al.* (2014). Very low incidence (3.33%) in samples from cooperatives was noticed in present study.

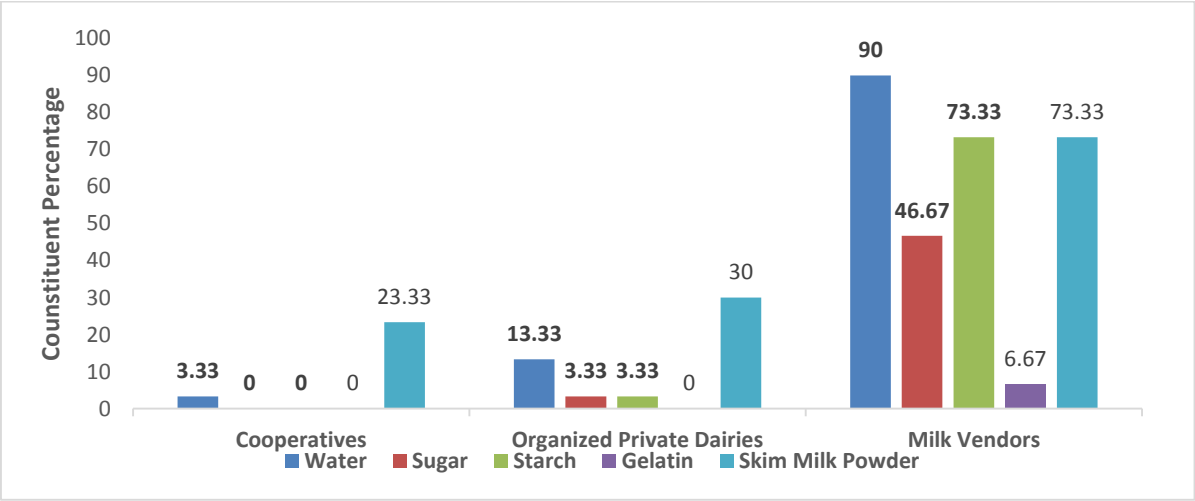

Fig. 1: Incidence of adulterants in milk samples (N = 30 samples)

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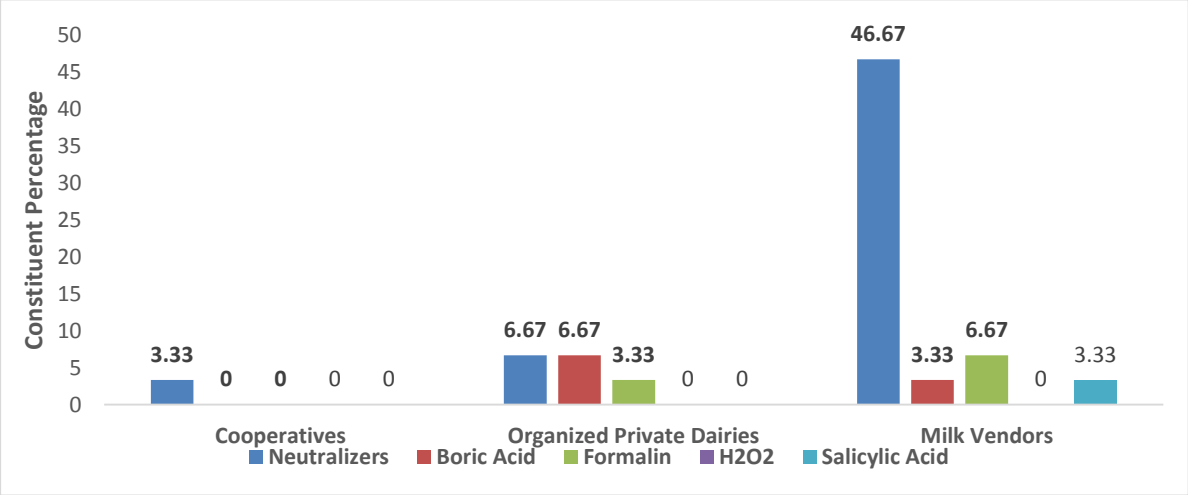

Fig. 2: Incidence of preservatives in milk samples (N = 30 samples)

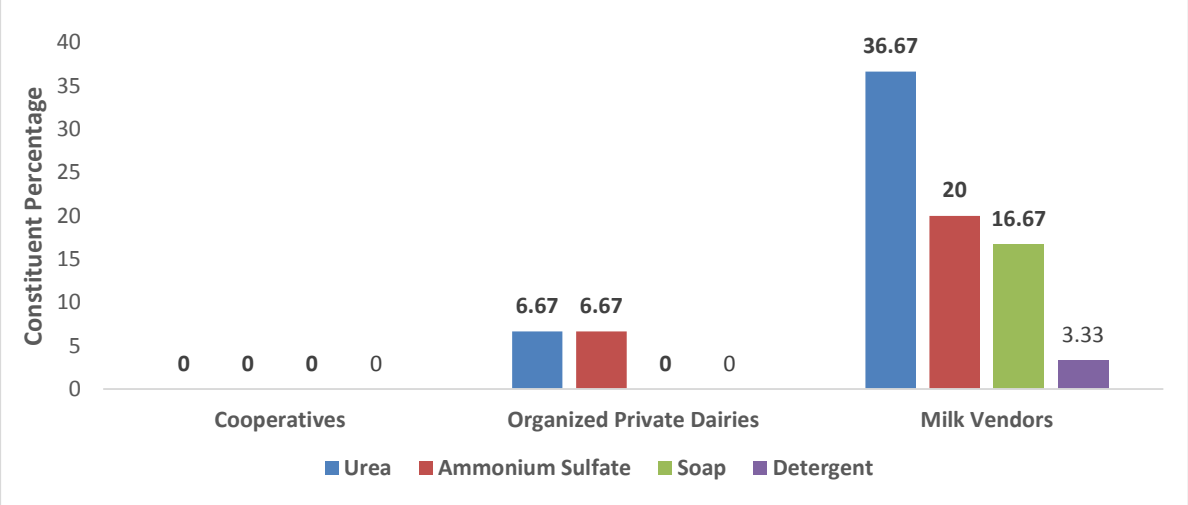

Fig. 3: Incidence of synthetic milk (N = 30 samples)

The incidence (3.33%) of boric acid from milk vendors is almost similar to the incidence of 5% reported by Kamel (2000) from Egypt, where as 8% was reported by Barham *et al.* (2014b). Slightly higher incidence (6.67%) in samples from organized private dairies observed in present study, whereas no incidence was reported by Mabrook and Petty (2003) and Shaikh *et al.* (2013). No incidence of formalin in milk samples from cooperatives was observed in the present study. The incidence (6.67%) in samples from milk vendors was less than 75% and 65% reported by Shaikh *et al.* (2013), from milk samples collected from Hyderabad and outskirts of Hyderabad city respectively. The incidence 6.67% in samples from organized private dairy was more than incidence (2.2%) reported by Swetha *et al.* (2014) and less than incidence reported by Debnath *et al.* (2015). H_2O_2 was not detected in samples from all the three sources in the present study. Debnath *et al.* (2015) reported 29.41% incidence in branded organized private dairies, whereas very low

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incidence (3.3%) reported by Swetha *et al.* (2014). No incidence was reported by Indumathi and Obula Reddy (2015); Geeta *et al.* (2015) and Pandey (2015). Only 3.33% samples from milk vendors were positive for salicylic acid, whereas none of the samples from cooperatives and organized and private dairies were positive for salicylic acid. No incidence was reported by Kamel (2000); Lateef *et al.* (2009); Barham *et al.* (2014b) and Debnath *et al.* (2015), whereas only 4% incidence from milk vendors was reported by Barham *et al.* (2014a) almost similar to the present findings from milk vendors.

The milk samples from cooperative sector were negative for all ingredients i.e., urea, ammonium sulfate, soap and detergents. The incidence of urea in samples from milk vendors in the present study was 36.67% which was less than the incidence 100%, 100% and 60% reported by Kandpal *et al.* (2012); Pandey (2015) and Singuluri and Sukumaran (2014) respectively. The incidence of urea in samples from organized private dairies was 6.67% which was less than the incidence of 35%, 24% and 8% reported by Nirwal *et al.* (2013), Ramya *et al.* (2015) and Indumathi and Obula Reddy (2015) respectively, whereas no incidence was reported by Swathi and Naazia (2015) and Bendale *et al.* (2015). The incidence of 20% of Ammonium sulfate in samples from milk vendors was observed in present study which was less than incidence (96%) reported by Makadiya and Pandey (2015) from Gujarat, where as 13% and 8.3% from Pakistan was reported by Barham *et al.* (2014a&c). No incidence from cooperatives in the present study was similar to reports of Mabrook and Petty (2003) and Lateef *et al.* (2009), from Pakistan. An incidence of 6.67% in samples from organized private dairies in the present study was almost similar to the values of Barham *et al.* (2014b). Whereas, no incidence was reported by Faraz *et al.* (2013) from Pakistan. An incidence of 16.67% soap in the samples from milk vendors was observed in the present study which was lower than the incidence (63 to 83%) reported by Faraz *et al.* (2013), from Pakistan whereas no incidence was reported by Marbook and Petty (2003) and Lateef *et al.* (2009) from Pakistan. No incidence in samples from organized private dairies was found in the present study and similar results were reported by Awan *et al.* (2014) from Pakistan.

Only 3.33% samples from private vendors were positive for detergents which was less than incidence (24%) reported by Indumathi and Obula Reddy (2015), form AP, whereas 100% incidence was reported by Kandpal *et al.* (2012) from Dehradun. No incidence from samples from cooperatives and organized private dairies was observed in the present study which was similar to reports of Faraz *et al.* (2013) and Shaikh *et al.* (2013) from Pakistan.

Conclusion

The incidence of adulterants, preservatives and synthetic milk constituents was less in milk from cooperative sectors and highest in milk from milk vendors. So, it is advised to purchase milk from cooperative sectors and organized private dairies rather than from milk vendors. The milk from milk vendors has adulterants that can cause a negative impact on public health.

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