

A Comparative Assessment of the Quality of Milk-Validation of Standard Brands versus Local Milk Sold in Market



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Abstract

Adulteration is defined as an act of intentionally debasing the quality of food offered for sale either by the admixture or substitution of inferior substances or by the removal of valuable ingredient. Milk is an essential commodity of life as it is a source of calcium and other essential nutrients required by the body. It is available in the market both locally and as a branded commodity. The study was carried out keeping in view the recently emerging concern of adulteration of natural milk with various illegal substances to increase its marketability. The aim of the study was to compare and validate the quality of milk sold locally by vendors against the brands available in market. 5 samples each of FSSAI approved brands and local vendor sold were collected and subjected to various standard tests. A standard milk adulteration kit manufactured by Nice Chemicals Pvt. Ltd, Cochin and India was used to carry out the quality analysis on various samples procured. Thus the comparative analysis of milk samples proved that milk procured from local brands was adulterated when compared to standard.

Keywords: Adulteration; FSSAI, Quality of milk

Introduction

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. Due to its nutritive value, milk is significant to young and old people. Milk contains more than 100 substances that are either in solution, suspension or emulsion in water, the important being casein - the major protein of milk, lactose - milk sugar, whey and mineral salts [1-3]. A national survey in India has revealed that almost 70% of the milk sold and consumed in India is adulterated by contaminants such as detergent and skim milk powder, but impure water is the highest contaminant. According to National Survey on Milk Adulteration conducted by FSSAI (India) in 2011, water is the most common adulterant followed by detergent in milk. A survey by FSSAI in 2012, 68% milk samples was found to be adulterated in which 31% were from rural areas. Of these 16.7% were packet or branded milk and rest were loose milk samples from dairies. In the urban areas, 68.9% milk was found to be adulterated with water, detergent, urea and skim milk powder. In Uttarakhand, 88% milk was found to be adulterated. Despite the laws governing the quality and sale of milk existing in India for decades, the adulteration of milk has not been checked completely [4].

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. 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, 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, 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 [5].

From the view point of protecting the health of the consumer, the Government of India promulgated the 'Prevention of Food Adulteration Act' (PFA Act) in 1954. The Act came into force from 1st June, 1955. It prohibits the manufacture, sale and distribution of not only adulterated foods but also foods contaminated with toxicants. Despite food legislation, adulteration remains uncontrolled, furthermore legal steps laid down in the PFA

Act are extremely difficult to maintain due to inadequate and untrained man power and laboratory facilities [6]. Such is the state in the country where we are one of the largest nations of milk producers. In the year 2010-2011, India was ranked among the top 5 countries in the world producing 121.8 million tones of milk [7].

Here are a few examples of what adulterants can be added to milk in order to maintain its freshness and market value which in turn is harmful to the consumer leaving them clueless of what direct effect these adulterants have on them. Water is an adulterant in milk which is often always added to increase the volume of milk which in turn decreases the nutritive value of milk which if contaminated poses a health risk especially to infants and children. Detergents are added to emulsify and dissolve the oil in water giving a frothy solution, the characteristic white colour of milk. Detergents cause gastro-intestinal complications. Urea is added to milk to provide whiteness, increase the consistency of milk and for leveling the contents of solid-not-fat (SNF) as are present in natural milk. The presence of urea in milk overburdens the kidneys as they have to filter out more urea content from the body [8].

Hydrogen Peroxide is also added to milk to prolong its freshness, but peroxides damages the gastro intestinal cells

which can lead to gastritis and inflammation of the intestine. Starch is also used as an adulterant and if high amounts of starch are added to milk this can cause diarrhea due to the effects of undigested starch in colon. Its accumulation in the body may prove very fatal for diabetic patients. Carbonates and bicarbonates are added to milk too, this can cause disruption in hormone signaling that regulate development and reproduction [9]. Keeping in view the above facts, the present study was conducted to detect various common adulterants in milk samples obtained from public and educational institutions.

Materials and Methods

A standard milk adulteration kit was obtained from Nice Chemicals Pvt. Ltd, Cochin and India. 5 milk samples from various vendors in Hyderabad were collected in sterilized glass containers. Similarly 5 samples of FSSAI approved brands of milk were purchased. Both the locally procured samples and branded samples were subjected to quality tests. The milk samples were subjected to a total of 12 tests for various adulterants.

Method of quality analysis

The following tests were performed to confirm the quality of milk samples obtained (Table 1).

Table 1: confirm the quality of milk samples obtained.

S.No.	TEST	Reagent Used	Test Method	Indication
1	Detection of Urea	Urea reagent - I (UR-I)	2ml of milk sample in test tube + 2ml of UR -I. Mix well	Very distinct yellow color indicates presence of urea. Normal milk gives slight yellow color due to presence of natural urea
2	Detection of Starch	Starch reagent - I (ST - I)	Take 3ml of milk sample and add little water in test tube and boil for few minutes. Cool and add 3 drops of ST - I reagent and mix well.	Blue color indicates the presence of starch in milk.
3	Detection of Neutralizers	Neutralizer reagent - I (NT - I)	5ml of milk sample in a test tube + 4 drops of NT- I reagent. Mix well.	Red color or deep rose red color indicates presence of neutralizers in milk.
4	Detection of Detergents	Detergent reagent - I (DT - I)	5ml of milk sample in a test tube + 5 drops of DT -I reagent. Mix well.	Dark purple color indicates presence of detergents (abnormal milk with increased alkalinity) in milk
5	Detection of Sugar	1. Sugar reagent -I (SI) 2. Sugar reagent - 2 (S-2)	5ml of milk sample in test tube + 2ml of S-I reagent and 4 drops of S- 2 reagent. Mix the contents and place in boiling water bath for 2 minutes.	Red color indicates presence of sugar in milk.
6	Detection of Glucose - Dextrose	1. Glucose reagent -1 (G-1) 2. Glucose reagent -2 (G-2)	1ml of milk sample in a test tube + 1ml of G -1 reagent. Mix and place the test tube in boiling water bath for 3 minutes. Cool and add 1ml of G-2 reagent and mix well.	Dark blue color indicates presence of glucose in milk. Normal milk gives light blue color.
7	Detection of Sodium Chloride (salt)	1. Sodium Chloride reagent - 1 (SC-1) 2. Sodium Chloride reagent -2 (SC-2)	2ml of milk sample in test tube + 2 drop of SC -1 reagent + 1ml of SC -2 reagents. Mix well.	Yellow precipitate indicates the presence of sodium chloride in milk.

8	Detection of Hydrogen Peroxide	Hydrogen peroxide reagent - I (HP-I)	5ml of milk sample in a test tube + 1ml of HP- I reagent. Mix well and wait for 5 minutes.	Distinct yellow color indicates presence of hydrogen peroxide in milk.
9	Detection of Mastitis	Mastitis reagent - I (M-I)	5ml of milk sample in a test tube + 1ml of M - I reagent. Mix well	Normal milk gives an yellow color. Milk from infected udders gives a green to slightly bluish-green color.
10	Detection of Formaldehyde	1. Formaldehyde reagent - I (FR-I) 2. Formaldehyde reagent - 2 (FR-2)	5 ml of milk sample in a test tube + 2 drops of FR- I and mix well + add 1ml of FR-2 very slowly and carefully along the sides of the test tube.	Violet colored ring at the junction of the milk and reagent indicates presence of formaldehyde. Normal milk gives a light brown colored ring at the junction.
11	Detection of Maltodextrin	1. Maltodextrin reagent -1 (MD-1)	10ml of milk in a test tube + 1ml of MD-1 reagent and boil for few minutes. Cool and filter. To 5ml of filtrate, add 2-3 drops of MD-2 reagent and mix well.	Brown color indicates presence of Maltodextrin in milk. Normal milk gives a golden yellow color.
		2. Maltodextrin reagent -2 (MD-2)		
12	Detection of Nitrate nitrogen	Nitrate nitrogen reagent -I (NN-I)	2ml of milk in a test tube + 0.5ml of NN-I reagent along the side of test tube.	Blue color indicates presence of Nitrate nitrogen in milk.

Results and Discussion

Table 2: Results for Local Samples Collected.

S.No.	Test	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	Detection of Urea	Negative	Negative	Negative	Negative	Negative
2	Detection of Starch	Negative	Negative	Negative	Negative	Negative
3	Detection of Neutralizers	Negative	Negative	Negative	Negative	Negative
4	Detection of Detergents	Negative	Slightly positive	Negative	Negative	Negative
5	Detection of Sugar	Negative	Slightly positive	Slightly positive	Slightly positive	Slightly positive
6	Detection of Glucose - Dextrose	Negative	Slightly positive	Negative	Slightly positive	Positive
7	Detection of Sodium Chloride (salt)	Negative	Negative	Slightly positive	Slightly positive	Negative
8	Detection of Hydrogen Peroxide	Negative	Negative	Negative	Negative	Negative
9	Detection of Mastitis	Negative	Slightly positive	Slightly positive	Slightly positive	Slightly positive
10	Detection of Formaldehyde	Negative	Negative	Negative	Negative	Negative
11	Detection of Maltodextrin	Negative	Negative	Slightly positive	Slightly positive	Negative
12	Detection of Nitrate nitrogen	Negative	Negative	Negative	Negative	Negative

Results for Local Samples Collected (Table 2):

Discussion of results for local brands

Detection of urea, starch, neutralizers, hydrogen peroxide, formaldehyde and nitrate nitrogen: All the samples tested negative for presence of urea, starch, neutralizers, hydrogen peroxide, and formaldehyde and nitrate nitrogen.

Detection of detergents: Sample 2 tested slightly positive for the presence of detergents while sample 1, 3, 4 and 5 tested negative.

Detection of sugar: All samples tested positive. Sample 1 tested negative for sugar content.

Detection of glucose-dextrose: Sample 1 and 3 tested negative. Sample 2 and 4 tested slightly positive for presence of Glucose-Dextrose while sample 5 tested positive.

Detection of sodium chloride: Sample 1, 2 and 5 tested negative while samples 2 and 3 tested slightly positive.

Detection of mastitis: All samples except sample 1 tested positive.

Table 3: Results of Branded milk samples.

S.No.	Test	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	Detection of Urea	Negative	Negative	Negative	Negative	Negative
2	Detection of Starch	Negative	Negative	Negative	Negative	Negative
3	Detection of Neutralizers	Negative	Negative	Negative	Negative	Negative
4	Detection of Detergents	Negative	Slightly positive	Negative	Negative	Negative
5	Detection of Sugar	Negative	Slightly positive	Slightly positive	Slightly positive	Slightly positive
6	Detection of Glucose - Dextrose	Negative	Slightly positive	Negative	Slightly positive	Positive
7	Detection of Sodium Chloride (salt)	Negative	Negative	Slightly positive	Slightly positive	Negative
8	Detection of Hydrogen Peroxide	Negative	Negative	Negative	Negative	Negative
9	Detection of Mastitis	Negative	Slightly positive	Slightly positive	Slightly positive	Slightly positive
10	Detection of Formaldehyde	Negative	Negative	Negative	Negative	Negative
11	Detection of Maltodextrin	Negative	Negative	Slightly positive	Slightly positive	Negative
12	Detection of Nitrate nitrogen	Negative	Negative	Negative	Negative	Negative

Detection of maltodextrin: Samples 3 and 4 tested slightly positive while all other samples tested negative.

Results of branded milk samples

Discussion of results for branded samples (Table 2):

Detection of urea, neutralizers, detergents, glucose-dextrose, hydrogen peroxide, formaldehyde, maltodextrin and nitrate nitrogen: All brands tested negative for the presence of urea, neutralizers, detergents, glucose-dextrose, hydrogen peroxide, formaldehyde, maltodextrin and nitrate nitrogen.

Detection of starch: Brand 4 tested slightly positive. All other brands tested negative.

Detection of sugar: Brand 2 tested negative. All other brands tested slightly positive.

Detection of sodium chloride: Brand 1 and Brand 5 tested positive. Brand 2, 3 and 4 tested negative.

Detection of mastitis: Brand 1, 2 and 5 tested negative. Brand 3 and 4 tested slightly positive for presence of mastitis.

Summary and Conclusion

The results clearly suggest that most of the samples collected from local sellers were adulterated with sugars, sodium chloride and mastitis. Sample 1 among all the locally procured samples was devoid of all the adulteration. Few other samples also showed presence of maltodextrin and glucose-dextrose. Sample 2 indicated slight presence of detergent. On the other hand most of the branded samples purchased conformed to the FSSAI

standards. Few of the brands indicated presence of starch, sugar, sodium chloride and mastitis. Among all the brands, Brand 2 conformed to the quality standards.

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