

Milk Adulteration in Hyderabad, India – A Comparative Study on the Levels of Different Adulterants Present in Milk

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Abstract

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. This study explains in detail the hygienic status of milk supplied to various cafes, small hotels and other public and educational institutions. A total of 50 samples were collected from different localities in Hyderabad, India and tested for determination and extent of adulteration. Qualitative analyses were carried out on 50 milk samples; a standard milk adulteration kit manufactured by Himedia laboratories, Mumbai, India was used. Following are the significant observations of the study: - Sucrose and skim milk powder were present in 22% and 80% of the milk samples respectively. Urea, neutralizers and salt were present in 60%, 26% and 82% of the milk samples respectively. Formalin, detergents and hydrogen peroxide were present in 32%, 44%, and 32% of the milk samples obtained. All percentage values are indicative of presence of these adulterants (trace, moderate and high amounts combined). This qualitative analysis which has unfolded proved that the milk procured did not conform to the legal standards and was adulterated with toxic chemicals which are injurious to health.

Keywords: Milk adulteration; Dairy; Qualitative analysis of milk; Adulteration

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.

Constituent	Buffalo Milk (%)	Cow Milk (%)
Water	84.2	86.6
Fat	6.6	4.6
Protein	3.9	3.4
Lactose	5.2	4.9

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].

The casein micelles and fat globules give milk most of its physical characteristics, and give taste and flavor to dairy products such as butter, paneer, curd, cheese etc. The composition of milk varies considerably with the breed of cow, stage of lactation, feed, season of the year, and many other factors. However, some relationships between constituents are very stable and can be used to indicate whether any tampering with the milk composition has occurred [1-4]. 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.

The nature of adulterants generally encountered in milk and milk products are water, removal of fat, addition of skim milk powder, reconstituted milk, thickening agents such as starch, flour, glucose, urea, salt, chlorine. Preservatives such as neutralizers which usually consists of sodium bicarbonate, sodium carbonate, sodium hydroxide and calcium hydroxide. Some rarities include animal fats, aflatoxins and vegetable oils.

Thus it is obvious that apart from less harmful adulterants, toxic and potentially injurious substances also are being added to milk. 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 [5]. 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 tonnes of milk [6].

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 [7].

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.

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Received January 31, 2014; Accepted February 26, 2014; Published February 28, 2014

Citation: Singuluri H, Sukumaran MK (2014) Milk Adulteration in Hyderabad, India – A Comparative Study on the Levels of Different Adulterants Present in Milk. J Chromatograph Separat Techniq 5: 212. doi:10.4172/2157-7064.1000212

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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 [8]. 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 manufactured by HIMEDIA laboratories, Mumbai, India was used. The tests for adulteration were carried out on 50 milk samples obtained in and around the city of Hyderabad, India. Samples were collected in clean, dry and sterilized glass bottles. The milk samples were tested for the following adulterants – formalin, urea, starch, neutralizers (NaHCO₃, Na₂CO₃, NaOH, Ca(OH)₂ etc.), detergents, sodium chloride, skim milk powder, sucrose, glucose/dextrose, hydrogen peroxide and acidity and heat stability of milk was also tested [9].

Results and Discussion

A total of 50 milk samples were tested in duplicates. All tests were carried out at room temperature (29°C). The results are summarized into 3 categories. Group I shows the presence of carbohydrates; group II shows the presence of salts; and group III is classified as other compounds where peroxides and/or detergents were used.

Determination of the extent of different adulteration in milk samples

The results of group I adulterants is shown in Table 1. As evident from the table all the samples tested negative for both starch and glucose. In these samples the extent of adulteration for sucrose and

ADULTERANTS	Starch	Sucrose	Glucose	Skim Milk Powder
No. of Samples Positive	-	11	-	40
No. of Samples Negative	50	39	50	10
No. of Samples positive (%)	-	22	-	80
No. of Samples negative (%)	100	78	100	20
Cumulative Percent	100	100	100	100

Table 1: Adulteration of Milk Samples (Group I adulterants).

ADULTERANTS	Acidity/Alkalinity*	Neutralizers	Sodium Chloride	Urea
No. of Samples Positive	50	13	41	30
No. of Samples Negative	-	37	9	20
No. of Samples positive (%)	100	26	82	60
No. of Samples negative (%)	-	74	18	40
Cumulative Percent	100	100	100	100

*All samples tested positive only for alkalinity.

Table 2: Adulteration of Milk Samples (Group II adulterants).

ADULTERANTS	Formalin	Hydrogen Peroxide	Detergents
No. of Samples Positive	16	16	22
No. of Samples Negative	34	34	28
No. of Samples positive (%)	32	32	44
No. of Samples negative (%)	68	68	56
Cumulative Percent	100	100	100

Table 3: Adulteration of Milk Samples (Group III adulterants).

skim milk powder were 22% and 80% respectively. This explains that these two adulterants were used to either increase the weight or relative mass of natural milk. Presence of sucrose may indicate that it was used to mimic the natural sweetness of milk [10]. Extent of group II adulterants is summarized in Table 2. As evident from the table all the samples tested positive for Acidity/Alkalinity. In these samples the extent of adulteration with neutralizers, sodium chloride and urea were 26%, 82% and 60%, respectively. These chemicals are used as cheap preservatives which increase the shelf life of fresh milk. Neutralizers such as carbonates and bicarbonates of various alkalis are generally used to mask the pH and acidity values of badly preserved milk passing it off as fresh milk [10]. Sodium chloride is particularly used to interfere with lactometer reading and urea which is a toxic substance is used to give false positive measurements of protein content in milk.

Results of group III adulterants are summarized in Table 3. In this group, 32% of milk samples were positive for both formalin and hydrogen peroxide. Similarly 44% of milk samples were positive for detergents. Peroxide and formalin are generally used to preserve shelf life of milk; detergents on the other hand can be due to low maintenance of milk tanks while preparation or it can be used to mask fat value of milk.

Conclusion

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 were adulterated. The extent of adulteration varied significantly with least percentage for sucrose (22%) and highest for skim milk powder (80%). This portrays that most of the milk samples were prepared with added adulterants during their production and processing or added intentionally according to one's own choice to generate money. 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 or negligence in milk production.

Acknowledgement

The support of Prof. Y. Ashok, Principal, Bhavan's Vivekananda College and Dr. A. Sai Padma HOD Dept of Biochemistry, Bhavan's Vivekananda College are gratefully acknowledged.

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