A Study on status of milk adulterants using in milk of district Varanasi

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Abstract

Fifty milk samples were collected from Godaulia and Pandeypur milk mandi of Varanasi district. A standard milk adulteration kit manufactured by HIMEDIA laboratories, Mumbai (India) was used for present study. The milk samples were tested for adulterants used and these were grouped in three classes i.e. Group I: Starch, Sucrose, Glucose and Skim Milk Powder, Group II: Acidity/Alkalinity, Neutralizers, Sodium Chloride and Urea; Group III: Formalin, Hydrogen Peroxide and Detergents. Under group first, all the samples tested were found negative for glucose, while 20% samples were positive for starch. In second group, 80% of the samples tested were found positive for Acidity/Alkalinity. In these samples the extent of adulteration with neutralizers, sodium chloride and urea were 28%, 80% and 60%, respectively. In third group, 30% of milk samples were positive for formalin and 36% for hydrogen peroxide. Similarly, 44% of milk samples were positive for detergents. Peroxide and formalin were generally used to enhance shelf life of milk. Detergents found may be due to low maintenance of milk tanks. The results of this investigation are concluding that milk marketed for public consumption is produced and handled under neglected sanitary measures. The relaxing milk control measures may give chance to greedy retailers and producers to adulterate produced milk to increase their gain.

Keywords: Milk adulterants, formalin, urea, starch, neutralizers, detergents, sodium chloride.

Paper Cited: Kumar, A., Goyal, S.K., Pradhan, R.C. and Goyal, R.K. (2015). A study on status of milk adulterants using in Milk of District Varanasi. South Asian J. Food Technol. Environ. 1(2): 140-143

Milk is very valuable food, readily digested and absorbed. It consists of more than 100 nutrients 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, which are needed for proper growth and maintenance of body. Milk and milk products form a significant part of the diet and a substantial amount of our food expenditure goes on milk and other dairy products. Milk is transported from the point of production to consumers and processing plants by middlemen. Thus, they don't maintain proper hygienic conditions during this transport, which leads to increase the total viable bacterial count. They also adulterate milk to increase their profit margin by several chemicals like urea, starch, flour, cane sugar, vegetable oils, detergents etc. Various preservatives like formalin and some antibiotics are also added in milk to increase its shelf life. This addition decreases the nutritive value of milk. These adulterants, preservatives and drugs in milk cause very serious health related problems (Ali *et al.*, 2011). With growing international trade, food safety has emerged as an important global issue (Sudershan *et al.*, 2009).

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 (Kandpal *et al.*, 2012). Adulterated food is dangerous for health as it may contain various toxic chemicals, it may be deprived of nutrients required for proper growth and development of human body (Awan *et al.*, 2013). Milk used by the people for consumption is adulterated to such an extent that there is very less nutritive value in it and may also be toxic for public health their profit margin by three ways dilution, extraction of valuable components like milk fat which is removed as cream, addition of cheap substances like starch to increase the value of total solids up to a level which is acceptable by the consumers. 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.

Milk adulteration, poor hygiene, malpractices, lack of preservation technology, cooling facilities and sanitation conditions are the main causes of losses in quantity and adulteration of milk is the most pressing public health issue. Adulteration of milk is done to increase its volume and then starch and other reconstituted milk powders are added to increase its viscosity. To increase the shelf life of milk, dirty ice and some chemicals like hydrogen peroxide, carbonates, bicarbonates, antibiotics, caustic soda and even the most lethal chemical formalin is also being used. Urea adulterated milk is very harmful to the girls as it hastens up the process of puberty (Altaf and Siddique, 2007).

Thus, it is obvious that apart from less harmful adulterants, toxic and potentially injurious substances also are being added to milk. 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.

Nirwal *et al.*, (2013) made a study having aim to analyze the milk quality, adulteration and mastitis infection in milk sold at different regions of Dehradun. Hundred random raw milk samples were collected from dairy owners from 30 different regions of Dehradun. A total number of 100 samples were analyzed for physical appearance, quality, adulterants and mastitis infection. 90% milk samples were white in color and 10 % were yellowish white. pH ranged between 6.7 – 6.9. Analysis of milk quality showed that 15 milk samples were of very poor quality, 73 samples were of fair quality, 10 were good and only 02 samples were of very good quality. Out of 100 milk samples analyzed for adulteration, adulterants found were glucose (80%), skim milk powder (58%), salt (51%) and urea (35%) while found negative for formalin, salicylic acid, boric acid, starch, soap and ammonium sulphate. All the samples were free from mastitis infection. The adulterants decrease the nutritive value of milk and may also cause serious human health related problems.

National Survey on Adulteration of Milk was conducted by FSSAI (2011) with the objectives to identify milk's common adulterants in rural and urban areas and to identify the common adulterants in

loose and packed milk. Results showed that approximately 32% of the samples analyzed conformed to Indian food laws. The remaining 68% failed. The study concludes that Water is milk's most common adulterant. Water reduces the nutritional value of milk and may also spread water-borne illnesses. The second highest parameter of non-conformity was skim milk powder (SMP) in 548 samples, (out of total 1791 samples or 44.69%). Of the 548 SMP-positive samples, glucose was present in 477 out of 548 samples (87%). Detergent is present in milk. Consumption of detergent-adulterated milk is a health hazard and indicates a lack of hygiene and sanitation in milk handling.

Materials and Methods

Experiments (tests) for adulteration were carried out on 50 milk samples obtained from Godaulia and Pandeypur milk mandi of Varanasi (U. P.), India. The samples were collected in clean, dry and sterilized screw capped glass bottles. All the possible precaution will be took to avoid external contamination at the time of collection of samples and during processing. After collection the samples will be brought to the laboratory for further analysis. A standard milk adulteration kit manufactured by HIMEDIA laboratories, Mumbai, India was used. The milk samples were tested for the following adulterants – formalin, urea, starch, neutralizers (NaHCO_3 , Na_2CO_3 , NaOH and Ca(OH)_2 etc., detergents, sodium chloride, skim milk powder, sucrose, glucose/dextrose, hydrogen peroxide and acidity and heat stability of milk.

Period of study

Collection of milk samples and their analytical study for detecting milk adulterants were made during 1st February, 2013 to 30th June, 2013.

Milk sampling and analysis

About 50 milk samples (100 ml each) were collected to detect the various milk adulterants during period of study. The samples were subjected to various physico-chemical analyses for various adulterants. The adulteration tests were done using the HiMedia Adulteration Testing Kit protocol. Tests included were urea test, salt test, soap test, skim milk powder test, glucose test, formalin test, starch test, hydrogen peroxide and acidity/alkalinity test. Adulterants to be detected were grouped into three classes for analysis as given below:

Group I: Starch, Sucrose, Glucose and Skim Milk Powder

Group II: Acidity/Alkalinity, Neutralizers, Sodium Chloride and Urea

Group III: Formalin, Hydrogen Peroxide and Detergents

Data obtained after analytical tests of present study were analyzed and interpret for extent of adulteration of various milk adulterants.

Results and Discussion

A total of 50 milk samples were tested in triplicates. All tests were carried out at average 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 are given in Table-1. As evident from the table that all samples tested were found negative for glucose while only 20% samples were positive for starch. It means starch is usually used as thickening agent in adulterated milk with water. In these samples the extent of adulteration for sucrose and skim milk powder were 24% and 82%, respectively.

Table 1: Adulteration status of milk samples using group-I adulterants

S. No.	Adulterants	Starch	Sucrose	Glucose	Skim Milk Powder
1	No. of Samples Positive	10	12	-	41
2	No. of Samples Negative	40	38	50	09
3	No. of Samples positive (%)	20	24	-	82
4	No. of Samples negative (%)	80	76	100	18
5	Cumulative Per cent	100	100	100	100

Table 2: Adulteration status of milk samples using group-II adulterants

S. No.	Adulterants	Acidity/Alkalinity*	Neutralizers	Sodium Chloride	Urea
1	No. of Samples Positive	40	14	40	30
2	No. of Samples Negative	10	36	10	20
3	No. of Samples positive (%)	80	28	80	60
4	No. of Samples negative (%)	20	72	20	40
5	Cumulative Per cent	100	100	100	100

(*All samples tested positive only for alkalinity.)

Table 3: Adulteration status of milk samples using group-III adulterants

S. No.	Adulterants	Formalin	Hydrogen Peroxide	Detergents
1	No. of Samples Positive	15	18	22
2	No. of Samples Negative	35	32	28
3	No. of Samples positive (%)	30	36	44
4	No. of Samples negative (%)	70	64	56
5	Cumulative (%)	100	100	100

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. Extent of group II adulterants is summarized in Table-2. It is clear from the Table-2 that 80% of the milk samples tested was positive for Acidity whereas all samples were found positive for alkalinity test.

In these samples the extent of adulteration with neutralizers, sodium chloride and urea were 28%, 80% and 60%, respectively. These chemicals are used as cheap preservatives which may 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. 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.

In group-III, 30% of milk samples were positive for formalin and 36% for hydrogen peroxide. Similarly, 44% of milk samples were positive for detergents. Peroxide and formalin are generally used

to enhance shelf life of milk. Presence of detergents found in milk samples may be due to low maintenance of milk tanks / containers.

Conclusion

It is obvious from the study 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). Most of the milk samples were found adulterated. The extent of adulteration varied significantly with least percentage for starch (20%) and highest for skim milk powder (82%). 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 India, where milk and milk products play an important role of daily human lives through different processed food products, the findings of this study may bring more awareness to the general public about the malpractices or negligence in milk production.

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