

Milk and Milk Products's Adulteration Testing and Detection Techniques

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ABSTRACT

Our land, the earth is blessed with various good foods, but to get more profit few selfish manufacturers and sellers are into practice of adulteration in food products. A common consumer may not have sufficient knowledge about purity and quality of food articles he consumes. A total of 30 different samples of milk and milk products have taken from each rural and urban area of Hansi city. Qualitative analyses were carried out on 60 different samples of milk and milk products, a standard milk adulteration kit developed by National Dairy Development Board, Gujarat researcher was used. The milk samples were tested for the following adulterants- water, starch and urea and milk products samples were tested for the following adulterants-mashed potatoes and starch test and vegetable oil. Results revealed that among milk and milk products, out of 60 samples, majority of milk samples 35 (58.33%) were adulterated with water followed by those which was adulterated with starch 10(16.66%) and no adulteration of urea were observed in the

samples of milk and in milk products, 25 samples of paneer (41.66%) were found adulterated with starch. Sixty samples each of butter and curd failed on account of presence of mashed potatoes, starch and vegetable oil respectively. This research paper follows the standards and procedures as prescribed by Food Safety and Standard Authority of India which helps the consumers to detect the common adulterants in milk and milk products.

Keywords Adulterant, Milk and milk products, Samples, Starch, urea.

INTRODUCTION

Milk is a nutrient- rich liquid food which can easily be adulterated. It is one of the best source for protein, fat, carbohydrate, vitamin and minerals. For protecting the health of the consumers, the Government of India promulgated the "Prevention of Food Adulteration Act" in 1954 and came into force from 1st June, 1955 which prohibits the manufacture, sale and distribution of not only adulterated foods but also foods contaminated with toxicants. According to this act -"Milk is the normal mammary secretion derived from complete milking of healthy milk animal without either addition there to or extraction there from. Adulteration is the act of intentionally debasing the quality of food offered for sale either by mixing or substitution of inferior substances or by the removal of some valuable ingredient (Mansuri 2011). There are different methods known for adulteration testing in milk and milk products but the methods discussed

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Table 1. Procedure followed to test the common adulterants in selected milk and milk products.

Food category	Adulterant	Procedure
Milk	Water (through lactometer)	Dip the lactometer in a container having milk. The lactometer reading shall not ordinarily be less than 26
	Starch (through iodine solution)	Boil 2ml of the sample in 10 ml of water. Cool and add 2 drops of iodine solution. Blue color indicates the presence of starch
	Urea (Through Urea Reagent)	Take 2 ml of milk in a test tube and add 2 ml of urea reagent and mix well. Appearance of yellow color indicates the presence of urea
Milk products		
Paneer	Starch (through iodine solution)	Boil 2ml of the sample in 10 ml of water. Cool and add 2 drops of iodine solution. Blue color indicates the presence of starch.
Butter	Mashed potatoes and starch test (through iodine solution)	Take 5 ml of ghee or butter in a test tube and add few drops of iodine solution. Brown color turns to blue in color indicates the presence of mashed potatoes and starch.
Curd	Vegetable oil (through conc. HCL)	Take one tsp full of curd in test tube. Add 10 drops of conc. HCL acid. Mix up the contents shaking the test tube gently. After 5 min., examine the mixture. Appearance of red color indicates the presence of vegetable oil

below are simple but rapid method to detect adulteration. 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. According to National Survey on Milk adulteration conducted by FSSAI (India) in 2018, adulteration and higher than permissible level of antibiotic residues in milk remain a problem in the country. A survey by FSSAI in 2018, revealed that 12 out of 6,432 samples of milk were found unsafe for human consumption due to adulteration. There were 77 samples that had residues of antibiotics above the permissible limits. About 5.7% of the samples, that is 368, out of 6432 samples were also found to be contaminated with aflatoxin M1 residues, a chemical compound that get into the milk through feed and fodder. Among 12 adulterated samples, six were found to contain hydrogen peroxide, while others had the presence of detergent, urea or neutralizers. Nine of the adulterated samples were from Telangana, two from Madhya Pradesh and one from Kerala (Mathew 2019).

The nature of adulterants generally found in milk and milk products are water, removal of fat, addition

of skimmed milk powder and thickening agents such as urea, starch and flour. Water is used as an adulterant in milk to increase the volume of milk which in turn decreases the nutritive value of milk but if contaminated then poses a health risk especially to infants and children. Urea, a chemical fertilizer when added to milk then it provide whiteness, increase the consistency of milk and for leveling the contents of solid-not-fat 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 (Hemanth *et al.* 2000, Kandpal *et al.* 2012). Starch and cereal flour are added to make up the density of milk to prevent detection of added water. If starch when used as an adulterant in milk in high amounts then it can cause diarrhea due to the effects of undigested starch in colon (Navale and Gupta 2016).

According to Food Safety and Standards Authority of India, food adulteration is the process in which the quality of food is lowered or affected by the addition of substances which are injurious to health or by the removal of substances which are nutritious. It is the act of intentionally debasing the quality of food

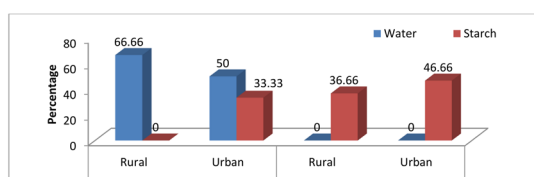


Fig. 1. Adulterants in milk and milk product.

offered for sale either by the admixture or substitution of inferior substances or by the removal of some valuable ingredient. This paper detects various types of adulterants in milk and milk products.

MATERIALS AND METHODS

A standard milk adulteration kit developed by National Dairy Development Board, Gujarat researcher was used. The tests for adulteration were carried out on 30 different samples of milk and milk products have taken from each rural and urban area of Hansicity. Samples were collected in clean, dry and sterilized glass tubes. The milk samples were tested for the following adulterants- water, starch and urea and milk products samples were tested for the following adulterants-mashed potatoes and starch test and vegetable oil. The following table show the procedures to test the common adulterants in selected milk and milk products.

RESULTS AND DISCUSSION

A total of 30 milk and milk products samples were tested in triplicates. The results are summarized into 3 groups. Group 1 shows the presence of water adulterant, Group 2 shows the presence of starch adulterant and Group 3 shows the presence of urea adulterant for milk and for milk products. Group 1 shows the presence of starch adulterant in paneer, Group 2 shows the presence of mashed potatoes and starch adulterant in butter and Group 3 shows the presence of vegetable oil adulterant in curd.

To test the adulteration in selected food products

To study some of the common food adulterants present in milk and milk products, different food items

are tested in laboratory to detect the adulterants (Tables 1-2, Fig. 1. Data pertaining to testing of common adulterants in different food categories has been discussed below :

Milk and milk products

Milk

Adulteration of milk were observed by three different methods

Milk (Water test)

Mixing of water in milk is age old practice followed by milk vendors, total 30 samples milk were collected. The results revealed that out of 30 samples of milk samples, 20 samples (i.e., 66.66%) were found adulterated with water in rural area while 15 samples (i.e., 50.0%) were found adulterated in urban area. Barham *et al.* (2014) in his study revealed that twenty milk samples were taken from each of milk producers, milk collectors, middlemen, processors and dairy shops were examined for various adulterants. Among these adulterants water (73%) was the most common adulterant found in majority of milk samples, followed by starch (12%), formalin (11%), urea and vegetable oil (10%) respectively. A study conducted by Swathi and Kauser (2015) revealed that most of the samples of milk and curd the water content is more, but in few samples urea and starch was also observed and this clearly indicates that milk and milk products from local vendors had adulterated samples.

Milk (Starch test)

The results revealed that out of 30 samples of milk, no adulteration were observed in the samples of rural area while 10 samples (i.e., 33.33%) were found adulterated in urban area.

Milk (Urea test)

The results revealed that out of 30 samples of milk, no adulteration were observed in the samples of both rural and in urban area.

Table 2. Prevalence of adulteration in selected food products.

Samples	Adulteration test			Starch test			Urea test		
	Water test (Through lactometer)			(Through iodine solution)			(Through urea reagent)		
Testing of milk samples	Rural (N=30)	Urban (N=30)	Total (N=60)	Rural (N=30)	Urban (N=30)	Total (N=60)	Rural (N=30)	Urban (N=30)	Total (N=60)
Milk	20 (66.66)	15 (50)	35 (58.33)	0 (0)	10 (33.33)	10 (16.66)	No adulteration were found		
Testing of Milk products samples	Mashed potatoes and Starch test (through iodine solution)			Starch test (Through Iodine solution)			Vegetable oil (through conc. HCl)		
Paneer	No adulteration were found			11 (36.66)	14 (46.66)	25 (41.66)	No adulteration were found		
Butter	No adulteration were found			No adulteration were found			No adulteration were found		
Curd	No adulteration were found			No adulteration were found			No adulteration were found		

Milk products

Paneer

On chemical analysis of paneer samples, results revealed that, out of 30 samples, 11 samples (i.e. 36.66%) were found adulterated with starch in rural area while 14 samples (i.e., 46.66%) were found adulterated in urban area.

Butter and curd

Astonishingly out of 30 samples of both butter and curd, no adulteration were observed in the samples of both rural and in urban area.

CONCLUSION

Adulterated milk and milk products are dangerous to any living being. Knowledge of adulteration of any food is essential for each and every living being. Data elucidates that among milk and milk products, out of 60 samples majority of milk samples 35 (i.e., 58.33%) were adulterated with water followed by those which was adulterated with starch 10 (i.e., 16.66%) and no adulteration of urea were observed in the samples of milk and in milk products, 25 samples of paneer (i.e., 41.66%) were found adulterated with starch. Sixty samples each of butter and curd failed on account of presence of mashed potatoes,

starch and vegetable oil respectively. 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. With the help of easy detection methods and various simple procedures consumer's can bring this problem to an end. To combat the problem of food adulteration there is an urgent need that the policy makers consider food safety as an important priority, strict implementation of the act and stringent punishment measures for the offenders, educating children on safe food handling behavior in schools, creating awareness among the public about adulterants present in food and malpractices followed by the sellers to cheat the consumers. This is the only way to control food adulteration.

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