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MILK ADULTERATION: DETECTION AND HEALTH HAZARDS

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ABSTRACT

Milk is considered to be safest food and a complete diet with all essential nutrients. Milk contains vitamins A, D, E, K and rich amount of calcium etc. Since ancient time milk is an essential part of our daily dietary regime. But in present time milk is the most commonly adulterated consumed product in India. Adulteration in milk has been a cause of concern for both the Government and the Dairy Industry. The addition of urea, detergent, sugars and Vanaspati oil etc, to create synthetic milk make it unfit for human consumption. Beside the blind faith of milk as miraculous diet, milk adulteration can pose sever health hazards. It also leads to long term effects upon health, even can cause cancer. This paper presents a detailed review of common milk adulterants as well as different methods to detect the adulterants, and also the common health related problems.

KEYWORDS: *Milk, milk adulteration, synthetic milk.*

INTRODUCTION

An **adulterant** is a substance found within other substances such as food, cosmetics, pharmaceuticals, fuel or other chemicals that compromises the safety or effectiveness of said substance. It will not normally be present in any specification or declared contents of the substance, and may not be legally allowed. The addition of adulterants is called **adulteration.**[1] Milk and dairy product adulteration came into global concern after breakthrough of melamine contamination in Chinese infant milk products in 2008 (Xin & Stone, 2008).[2] Milk is considered to be the 'ideal food' because of the abundant nutrients present in it, which is essential for both infants and adults. It is one of the best sources for protein, carbohydrate, fat, vitamin and minerals. Unfortunately, milk is being very easily adulterated product throughout the world. Possible reason behind adulteration could be the increase in population which elevates the demand for consumption of milk. Increasing demand could not meet by the dairy industry due to lack of dairy farms and quality milk. Manufacturers mix the cheaper substances for the shake of money and make milk unfit for human consumption. Adulteration is done at the level of preparation, storage, and transportation. It is also done to meet the standards laid by FSSAI ((Food Safety and Standards Authority of India) for milk e.g., common parameters that are checked to evaluate milk quality are- fat percentage, SNF (Solid-not-Fat) percentage, protein content and freezing point. Thus, adulterants are added in milk to meet these parameters, thereby increasing the milk quality in wrong way. A 2012 report by the Food Safety and Standards Authority of India said that 68.4% of samples from across the country were found contaminated with various adulterants and fell below required milk quality standards.[3] The most common adulterants added to milk are water, urea, starch, oils and chemicals like sodium carbonate, formalin, and ammonium sulphate. Most of the chemicals added to milk can have long-term hazardous health effects. Long term consumption of these adulterants leads to diseases. Consumption of urea will lead to kidney failure, damages the heart and liver. Treated cattle milk also causes infertility and abortions according to a study.

Some Common Effect of These Adulterants[4]

Water: It get easily mixed and increases the quantity of milk.

Detergents: It is added in milk to emulsify and dissolve oil in water giving a frothy solution, giving characteristic white colour to milk.

Urea: It is added to provide whiteness, increase the consistency of milk and for levelling the contents of solid-not-fat (SNF) as are present in natural milk.

Hydrogen peroxide: It is added to prolong the freshness of milk.

Starch: It provide thickness to milk.

Carbonate and bi-carbonates: They are added to

prevent spoilage.
Sugar and salt: They are added to get the natural taste to milk.

Detection Methods[5]

Sr. No.	Adulterants	Detection Method
1.	Water	The presence of water can be detected by putting a drop of milk on a polished slanting surface. The drop of pure milk flows slowly, leaving a trail behind. Whereas the adulterated milk with water, will flow immediately leaving no marks.
2.	Starch	Add a few drops of tincture of iodine solution. Formation of blue colour indicates the presence of starch
3.	Urea	Take a teaspoon of milk in a test tube. Add ½ teaspoon ofsoya bean or *Arhar* powder. Mix up the contents thoroughly by shaking the test-tube. After 5 minutes dip a red litmus paper in it. Remove the paper after ½ a minute. A change in colour from red to blue indicated the presence of urea in milk.
4.	Detergent	Shake 5-10ml of sample with an equal amount of water. Lather indicates the presence of detergent.
5.	Synthetic milk	Synthetic milk is made using white colour water paints, oil, alkali, urea, detergent, etc. It gives a bitter taste after, and
		gives a soapy feeling on rubbing between the fingers and turns yellowish while heating.
6.	Test for glucose /invert sugar	Take a strip of diabetic strip and dip it into the milk for 30 sec. to 1 min. If the strip changes its colour then it shows that the sample contains glucose.

Laboratory Based Detection Techniques[6]

Sr. No.	Adulterants	Detection Method
1.	Sugar	Take 5 mL milk sample in a test tube. Add 1 mL conc. HCl and 0.1 gm resorcinol solution. Place the test tube in water bath for 5 min. Appearance of red colour indicates he presence of added sugar.
2.	Buffalo milk	Dilute the milk 1/10. Put a drop of diluted milk on the centre of a glass slide. Now place a drops of Hansa test serum (duly preserved) on the drop of milk and mix together with a glass rod or clean tooth pick. Curdy particles develop within half a minute in milk containing buffalo milk.
3.	Colouring matter	Take 10 mL milk sample in a test tube. Add 10 ml diethyl ether. After shaking, allow it to stand. Appearance of yellow colour in ethereal layer indicates the presence of added colour.
4.	Ammonium sulphate	Take 2 ml milk in a test tube and add 0.5 ml NaOH (2%) 0.5 ml sodium hypochlorite (2%) and 0.5 ml phenol (5%) Heat in boiling water bath for 20 sec A bluish colour forms immediately, which turns deep blue afterward. Pure milk shows salmon pink colour which gradually changes to bluish after 2 hours.
5.	Urea	Take 5 ml milk sample in a test tube. Add 5 mL p-Dimethyl Amino Benzaldehyde reagent. Appearance of distinct yellow colour indicates presence of added urea whereas formation of slight yellow colour indicates natural urea in milk.
6.	Hydrogen peroxide	Add to 5 ml of suspected milk sample in a test tube, an equal volume of raw milk and 5 drops of 2% solution of paraphenylenediamine. Appearance of blue colour indicates the presence of hydrogen peroxide as adulterant.

Harmful Effects of Adulterated Milk

The Indian Council of Medical Research, in one of its report states, detergents (including caustic soda) cause food poisoning and gastro-intestinal complications. The other synthetic compounds impair the functioning of various organs of the body like heart problems, cancer, and sometimes death. The immediate effect of drinking adulterated milk containing urea, caustic soda and formalin is 'gastroenteritis', but the long-term effects are known to be far more serious.[7]

Water: Water decreases the nutritive value of milk, which poses health risk especially in infants and children. Contaminated water can also cause additional health problems.

Detergents: It causes gastro-intestinal & kidney complications. It is one of the causes for food poisoning.

Starch: It can cause diarrhoea due to the undigested starch in colon. Its accumulation in the body may prove fatal for diabetic patients.

Urea: It overburdens the kidneys and can even cause kidney failure.

Hormonal(oxytocin) injection to cattle[8]: Milk adulterated with oxytocin should be avoided by pregnant women as it may lead to abortion and babies may be born with deformities. It increases the risk of haemorrhage in mothers after birth and can also inhibit breastfeeding.

Carbonate and bi-carbonates: they disrupt hormones signals that regulate development and reproduction.

Melamine: It causes renal failure and infant death.

Hydrogen peroxide: It causes gastritis and inflammation of intestinal wall.

Formalin[9]: It can increase chances of cancer. It may also cause skin diseases and eye disorders.

CONCLUSION

Rate of milk adulteration is increasing with increasing population and greed to make money. Lack of awareness among general public is also contributing towards progress in this practice. Proper laboratory facilities and detection techniques can help minimise this practice. Government must employ quality control assessments at the very starting level. People must be made aware regarding health hazards and upcoming fatal diseases due to milk adulterants. Many time reasons behind illness remains miscellaneous and reoccurrence continues. A simple campaign regarding awareness and simple detection techniques can help minimise the risk.

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