

## **Evaluation of Adulterants Commonly Found in Milk Samples**

**Neha Gheek Batra\*, Ameeta Sharma, Ankita Saxena and Anjali Garg**

*Department of Biotechnology, The IIS University, Gurukul Marg,  
SFS, Mansarovar, Jaipur 302020, (Rajasthan) India.*

*\*Corresponding Author*

### **Abstract**

Milk provides essential nutrients and is an important source of dietary energy, high-quality proteins and fats. Milk can make a significant contribution to the required nutrient intakes for calcium, magnesium, selenium, riboflavin, vitamin B12 and pantothenic acid. Animal milk can play an important role in the diets of children in populations with very low fat intakes and limited access to other animal source foods. However, the high nutrient content of these milks, which includes proteins, fats, carbohydrates, vitamins, minerals and essential amino acids, all at a near neutral pH and at a high water activity, provides an ideal environment for the growth of many microorganisms. These microorganisms enter milk from a variety of sources and once in milk, can play a number of roles, such as facilitating dairy fermentations (e.g. *Lactococcus*, *Lactobacillus*, *Streptococcus*, *Propionibacterium* and fungal populations), causing spoilage (e.g. *Pseudomonas*, *Clostridium*, *Bacillus* and other spore-forming or thermophilic microorganisms), promoting health (e.g. *Lactobacilli* and *Bifidobacteria*) or causing disease (e.g. *Listeria*, *Salmonella*, *Escherichia coli*, *Campylobacter* and mycotoxin-producing fungi). Also, now a day's, milk is one of the product which can easily adulterated in many ways affecting the quality of milk and further dairy products. Adulterants like urea, water, starch, formalin, detergents are toxic substances which are added to gain profit and to increase the weight and amount of the substances. Such adulterated food causes severe health problems like stomach ache, body ache, anemia, paralysis and increase in the incidence of tumors, pathological lesions in vital organs, abnormalities of skin and eyes. The presence of these bacteria

and adulterants in milk often emerge as a major health concern. This review concentrates on information concerning various sources of adulteration and microbial contamination in milk samples.

**Keywords:** adulteration, microorganisms, milk

## **INTRODUCTION**

Milk and milk products are nutrient-dense foods and their consumption can add diversity to plant-based diets. For humans, milk and dairy products make a significant contribution to meeting our bodies' needs for calcium, magnesium, selenium, riboflavin, vitamin B<sub>12</sub> and pantothenic acid (vitamin B<sub>5</sub>) and therefore play a key role in our development [1]. Buffalo and cow milk contains 7.6 and 4.5% fats, 3.8 and 3.8% protein, 4.9 and 4.9% lactose, 0.78 and 0.72% ash, 17 and 13.9% general solids respectively [2]. However at the same time, milk is one of the product that's pretty vulnerable to bacterial contamination [3]. Quality deterioration of milk begins just after milking, when it is performed in unhygienic situations. The primary resources that affect the quality of milk at farm are animal mishandling, unhygienic milking, transportation equipment and terrible garage situations [4].

## **MILK ADULTERATION**

An adulterant is a chemical substance which should not be contained within other substances (e.g. food, beverages, and fuels) for legal or other reasons. The addition of adulterants is called adulteration [5]. Adulterated food is impure, unsafe, or unwholesome food. Food is declared adulterated if:

- A substance is added which depreciates or injuriously affects it.
- Cheaper or inferior substances are substituted wholly or in part.
- Any valuable or necessary constituent has been wholly or in part abstracted.
- It is an imitation.
- It is coloured or otherwise treated, to improve its appearance or if it contains any added substance injurious to health.
- For whatever reasons its quality is below the standard.

Milk is one of the product which can be easily adulterated in many ways due to which the quality of milk is reduced which in turn affect the quality of further processed dairy products [6]. Possible reasons behind it may include- demand and supply gap, perishable nature of milk, low purchasing capability of customer and lack of suitable detection tests [7]. The vendors used adulterated milk to gain maximum profit [8]. Starch and different substituted milk powders are added to boom its volume and

viscosity. Some chemical compounds like hydrogen peroxide, carbonates, bicarbonates, antibiotics, caustic soda or even the most deadly chemical formalin is likewise used to increase the shelf life of milk [9]. Urea and other substituted powders are added for milk whitening [10]. Hydrogen peroxide is used to preserve the milk and is typically used in summer season when the environmental temperature is high [11]. Some adulterants like detergents are used to intensify the cosmetic nature of milk. While water is added in milk its foamy look diminishes, so to offer milk a foamy look artificially detergents are added in it. Hair removing powders and urea are added for whitening milk and giving it authentic look [10].

### **Bacterial contamination of raw milk**

The unprocessed and unchilled raw milk has very short shelf life and generally gets sour within four to six hours due to bacterial growth. Bacterial contamination of raw milk can occur from air, milking gadget, feed, soil and so forth. Various factors including animals and equipment cleanliness, season feed, animal health and many others [12] could contribute to bacterial contamination. Rinsing of milking equipments and machines with dirty water is one of the foremost reason for the presence of variety of microorganisms including pathogens in raw milk [13]. The microorganisms enter milk from a variety of sources and once in milk, can play a number of roles, such as facilitating dairy fermentations (e.g. *Lactococcus*, *Lactobacillus*, *Streptococcus*, *Propionibacterium* and fungal populations), causing spoilage (e.g. *Pseudomonas*, *Clostridium*, *Bacillus* and other spore-forming or thermophilic microorganisms). Clean milk manufacturing, managing and transport are thus very important. Further it is essential that animal, specially its udder and teats are wiped clean earlier than milking and milkman washes its hands, cleaning of utensils used in milking, garage and transport are of extreme significance in clean milk production and delivery.

### **Health problems caused by adulteration**

The detergent in milk can cause food poisoning and other gastrointestinal complications. Its high alkaline level can also damage body tissue and destroy proteins. Other synthetic components can cause impairments, heart problems, cancer or even death. While the immediate effect of drinking milk adulterated with urea, caustic soda and formalin is gastroenteritis, the long-term effects are far more serious. Formalin causes vomiting, diarrhea and abdominal pain. Larger doses may cause decrease in body temperature, shallow respiration, weak abnormal pulse and subconsciousness. It additionally influences the optic nerve and may induce blindness. It is one of the effective cancer causing agents [14]. It produces pathological lesions in vital organs, abnormalities of skin and eyes. Hydrogen peroxide damages the

stomach cells and may perpetuate bloody diarrhea. Urea causes pain in lower abdomen, irregular heartbeat, chills and shivering fever [15]. Starch may cause diarrhea and its accumulation in body may be fatal [16]. Many researches had been conducted to check the quality of milk whether it is adulterated or not. The aim of these researches were to identify the adulterants and various microorganisms like bacteria, coliforms; etc which generally contaminate milk and milk products. One of the research was conducted in the surrounding area of Nagpur and Wardha district where in raw milk samples, coliform colonies were high in number and bacteriological identification revealed a definite dominance of *E. coli* and *E. aerogene* sp. and *Salmonella typhi* [17]. Another study was conducted to evaluate the quality of milk sold at different regions of Dehradun for which random raw milk samples were collected from dairy owners. Samples were 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 etc [18]. In another study 50 samples collected from different localités in Hyderabad were subjected to qualitative analysis. Milk procured was adulterated with toxic chemicals such as sucrose (22%), skim milk powder (80%), urea (60%), neutralizers (26%) and salt(82%) respectively [19].

## CONCLUSIONS

The principle contributory elements for poor quality of milk are animal mishandling, poor feeding, unhygienic milking, transportation and bad storage situations. Further they are adulterated via non milk proteins, vegetable oils and a few poisonous chemicals like urea, formalin, detergents, boric acid. Ingestion of this lower quality milk is very dangerous for human fitness. Although financial gain is considered to be one of the major reasons for milk adulteration, inadequate supply for the increasing population all over the world has paved the ground for this as well. This problem is more acute in the developing and under developed countries due to lack of adequate monitoring and law enforcement. Existing common detection techniques are not always convenient and accessible in these countries making it difficult to address the diverse ways of fraudulent adulteration in milk. This calls for combined efforts from scientific communities and the regulatory authorities through the development, implementation and dissemination of better techniques for the detection of milk adulteration. In addition, awareness and access to information can play vital role in these regions to overcome this issue. Some of the easy detection methods at the consumer level and state of the art techniques at the authority level can bring this problem to an end for the victims, including millions of children in the developing countries.

## REFERENCES

1. Neumann, C. G., Harris, D. M. and Rogers, L. M., 2002, "Contribution of animal source foods in improving diet quality and function in children in the developing world," *Nutr. Res.*, 22, pp. 193–220.
2. Khan, B.B., Yaqoob, M., Riaz, M., Younas, M. and Iqbal, A., 2005, "Livestock Management Manual". Department of Livestock Management, University of Agriculture, Faisalabad, Pakistan.
3. Kim, H., Hardy, J., Novak, G., Ramet, J.P. and Weber, F., 1983, "Off-tastes in raw and reconstituted milk". *FAO Animal Production and Health Paper*, 35, p. 2.
4. Rizvi, S.A., 2002, "Boosting dairy and meat production". [http://www. Pakistan economist](http://www.PakistanEconomist.com). Accessed Feb, 2011.
5. Lakshmi, V., LABS, R.V, Guntur and Pradesh, A., 2012, "Food adulteration". *IJSIT*, 1(2), pp.106-113.
6. Kumar, R., Singh, D.K. and Chawla, N.K., 1998, "Adulteration/contamination of milk demystified", *Indian Dairyman.*, 50, pp. 25–33.
7. Kamthania, M., Saxena, J., Saxena, K. and Sharma, D.K., 2014, "Methods of Detection and Remedial Measures", *Int. J. Engg. Tech. Res.*,1, pp.15–20.
8. Lateef, M., Faraz, A., Mustafa, M.I., Akthar, P. and Bashir, M.K., 2009, "Detection of adulterants and chemical composition of milk supplied to canteens of various hospitals in Faisalabad city", *Pak. J. Nut.*, 9, pp. 139-142.
9. Tariq, M.A., 2001, Subject: A close look at dietary patterns [http://www.dawn.com/2001/11/05/ebr13. Htm](http://www.dawn.com/2001/11/05/ebr13.Htm). Accessed Feb, 2011.
10. Walker, G.P., Dunshea, F.R. and Doyle, P.T., 2004, "Effects of nutrition and management on the production and composition of milk fat and protein", *Austr. J. Agric. Res.*, 55, pp. 1009-1028.
11. Naz, W. (2000). Subject: The dairy sector. [http://www. Pakistan economist.com](http://www.PakistanEconomist.com). Accessed Feb. 2011
12. Coorevits, A., De Jonghe, V., Vandroemme, J., Reekmans, R., Heyrman, J., Messens, W., De Vos, P. and Heyndrickx, M., 2008, "Comparative analysis of the diversity of aerobic spore-forming bacteria in raw milk from organic and conventional dairy farms". *Syst. Appl. Microbiol.*, 31, pp.126-140.
13. Chatterjee, S.N., Bhattacharjee, I., Chatterjee, S.K. and Chandra, G., 2006, "Microbiological examination of milk in Tarakeswar, India with special reference to coliforms". *Afr. J. Biotechnol.*, 5, pp.1383 – 1385.

14. Gwin, M.C., Lienert, G. and Kennedy, J., 2009, "Formaldehyde exposure and asthma in children. A systematic review", *Environ. Health Perspect.*, 118, pp. 313-317.
15. Baumgartner, M., Flock, M., Winter, P., Lu, W. and Baumgartner, W., 2005, "Evaluation of flow injection analysis for determination of urea in sheep's and cow's milk", *Acta. Vet. Hung.*, 50, pp. 263-271.
16. Rideout, T.C., Liu, Q., Wood, P. and Fan, M. Z., 2008, "Nutrient utilization and intestinal fermentation are differentially affected by the consumption of resistant starch varieties and conventional fibres in pigs", *Br. J. Nutr.*, 99, pp. 984-92.
17. Aaglave, P.P. and Wadatkar, C.M., 2012, "Microbial examination of milk sample from Nagpur region with reference to coliform", *Food Science and Technology Letters*, 3(1), pp. 24-26.
18. Nirwal, S., Pant, R. and Rai, N., 2013, "Analysis of milk quality, adulteration and mastitis in milk samples collected from different regions Of Dehradun", *International Journal of Pharm Tech Research*, 5 (2), pp. 359-364.
19. Singuluri, H. and Sukumaran, M.K. 2014, "Milk Adulteration in Hyderabad, India- A comparative study on the levels of different adulterants present in milk", *Journal of Chromatography Separation Technique*, 5(1), pp. 313-317.