

Adulteration in Local Available Milk Samples of Jabalpur Regions –A Comparative Study



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Abstract

Milk adulteration has been a significant problem in developing countries which lack strict vigilance by food safety authorities. It leads to market distortions and poses a serious threat to consumer's health. Milk adulteration is done for financial gain, but it can also be adulterated due to unhygienic conditions. Water is used as the most common adulterant which decreases the nutritional value of milk. To compensate it inferior cheaper materials are added such as reconstituted milk powder, urea, sugar and even more hazardous chemicals including melamine, formalin, caustic soda and detergents. These additions have the potential to cause serious health-related problems. The present qualitative analysis was conducted to detect the presence of common adulterants in milk supplied to different regions/areas of Jabalpur. 27 samples were tested for alkalinity, SMP (skimmed milk powder), Urea, starch, detergents, NaCl, Sugar, Formalin, Neutralizers, H₂O₂, Cellulose, maltose ammonium sulphate, boric acid, nitrate, and protein. Most milk samples were found to be alkaline and tested positive for neutralizers, detergents and NaCl. In addition some samples also tested positive for glucose, Urea, SMP, Ammonium Sulphate and nitrate. Protein was found to be in the range of 3-4 % in most number of samples. Surprisingly starch, boric acid, maltose cellulose and H₂O₂ was found to be absent in all the samples tested.

Keywords: Adulteration, Alkalinity, SMP, Urea, Starch, Detergents, Sugar, Neutralizers, Ammonium Sulphate, Nitrate and Protein.

Introduction

Adulteration refers to all non accidental preventable changes to dairy and dairy products /processes that reduce quality or create avoidable risks. Milk adulteration also refers to marketing a product as milk, while the product does not comply with the legal definition of milk. Deliberate adulteration is motivated by economic greed. For obvious reasons milk adulteration negatively affects the consumer and the industry. The most common practice of adulteration is addition of water to increase the volume to meet the growing demand. Use of contaminated water for dilution not only reduces the nutritive value of milk but also poses serious health problems. (Brototy et.al.2017). Other common adulterants of milk are urea, starch, formalin and boric acid. (El-Loly, et. al. 2013). Kandpal, et.al. (2012), Swathi and Naazia (2015), Pandya et.al. (2013) have also reported presence of various adulterants in milk samples indifferent regions of India. Milk as a natural source of nutrients is an important component of daily diet of human beings. Milk provides a good quality of carbohydrates (in the form of lactose) vitamins, minerals importantly calcium and water. (Bylund.G.1995). Nutrients present in milk are in readily assimilable form and are easily absorbed hence it forms a significant part of our meal. Although India is the largest milk producer country in the world but consumption of milk outweighs its production. National Dairy Development board (NDDB) has estimated that by 2021-22 demand of milk would increase to 200MT (Million Tonnes) (Times of India, May 2016) To meet this ever increasing demand adulteration has become more and more prevalent in India Recently there have been many case reports of milk adulteration from different parts of India.

Aim of the Study

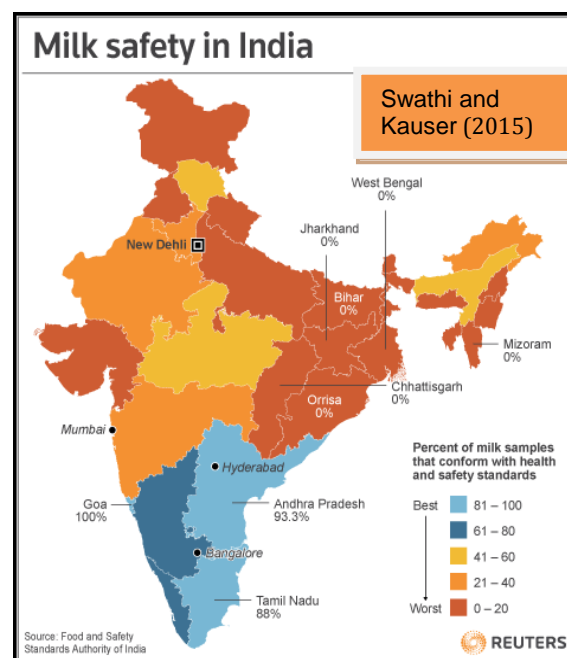
The present study was undertaken to qualitatively assess milk samples supplied in different areas of Jabalpur to determine the presence of some of the most hazardous adulterants.

Review of Literature

Adulteration of milk with water or/whey is not the only fraudulent practice, under-filling and selling milk with substandard cream content is also included in it. Milk adulteration has been widely reported in developing countries such as Pakistan, Brazil, India, and China (Xiu and Klein 2010; Faraz et.al. 2013; Shaikh et.al. 2013; Mudgil et.al. 2014; Singuluri and Sukumaran 2014). Either a more expensive ingredient is substituted with a cheaper one or a valued component is (partially) removed in the hope that the consumer does not notice the difference. So diluting with water or skimming of the cream is a good example of this long-standing process. To compensate for specific gravity of milk, salts, chemical substances and sugar is added. Other common milk adulterants used are starch, chlorine, hydrated lime, sodium carbonate, formalin and ammonium sulphate etc. Synthetic milk is prepared by mixing urea, caustic soda refined oil and common detergents. Apart from ethical and economic issues determination of adulteration of milk is important for preventing health hazards like renal and skin disease, gastrointestinal disorders, eye and heart problems and cancer too. (Nirwal et.al. 2013 Baumgartner, et.al. 2005, and Singh et.al.2011). Adulterated milk can have threatening consequences for growing children, pregnant women, developing foetus and patients who are the primary consumers of milk. Hence, it is important that the consumer has an access to unadulterated pure milk. A study conducted by FSSAI (2012) in 33 states across India reported that 68.4% of samples from across the country were found contaminated with various adulterants like detergent, fat and even urea, in addition to common dilution practice with water. . West Bengal, Jharkhand, Bihar, Odisha and Mizoram were the worst where 100% of randomly collected milk samples were adulterated. In contrast, Goa and Pondicherry were the only states where milk samples conformed to required standards. Seventy per cent of milk sample collected from Delhi were found adulterated (Times of India 2012). Problem of Milk adulteration is not only a persistent practice in India but other developing countries like Pakistan and Bangladesh are also facing it from decades (Afzal et.al. 2011, Hossain and Dev 2013).

Methodology

27 milk samples were randomly collected from different regions of Jabalpur in 50 ml Falcon tube under aseptic conditions. These samples were qualitatively tested for alkalinity and adulterants such as SMP (skimmed milk powder), Urea, starch, detergents NaCl, Sugar, Formalin, Neutralizer, H₂O₂, Cellulose, maltose ammonium sulphate boric acid, pond water/nitrate, protein using Milk Adulteration kit supplied by HIMedia Laboratories Mumbai. Each test was carried out in duplicates. The tests were carried out at room temperature (25°C).



Results

Out of 27 samples tested 81% of milk samples were found to be alkaline. 62.96% tested positive for neutralizers, 59.25% for NaCl and 44% for detergents. 22% were found adulterated with Urea and Ammonium Sulphate. Nitrate was reported in 25% of samples under investigation. In addition SMP (Skimmed milk powder) was detected in 14.81% samples and 11.11% samples tested positive for glucose. Protein was found to be in the range of 3-4 % in 10, 2-3% and 1-2% in 8 samples. Surprisingly starch, formalin, boric acid, maltose cellulose and H₂O₂ was found to be absent in all the samples tested. These results obtained in the present study are illustrated in table 1 and 2 and in the form of bar diagram and graphs (Fig 1 and Fig 2).

Table 1: Percentage of Milk Samples Adulterated with Common Adulterants.

Components Found in Milk Sample	Percentage of Components In Milk
Alkaline	81.48%
Urea	22%
Neutralizer	62.96%
Detergents	44%
NaCl	59.25%
SMP	14.81%
Glucose	11.11%
Ammonium Sulphate	22%
Nitrate	25.92%

Fig 1: Percentage of milk samples showing various adulterants. 27 samples from Jabalpur region were tested for the presence of adulterants. The number of samples that tested positive was calculated as percentage of the total number of samples (n) analysed.

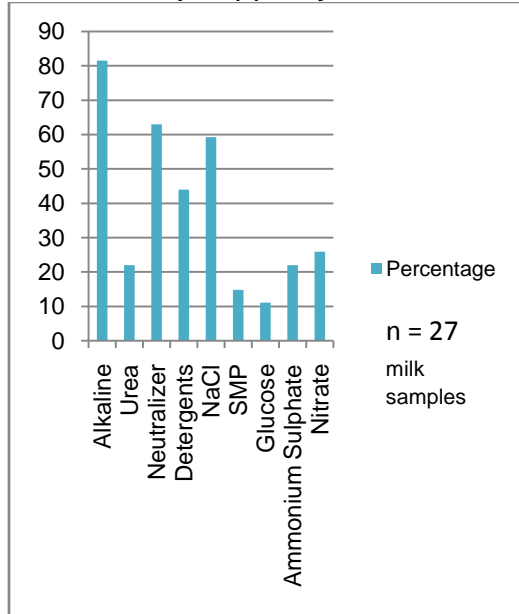
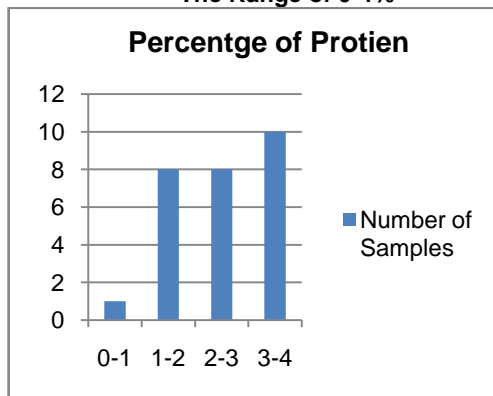


Table 2: Percentage of Protein in Milk Samples

S. No.	Range %	Number of Samples
1	0-1%	1
2	1-2%	8
3	2-3%	8
4	3-4%	10

Fig 2: Percentage of Protein in Milk Samples in The Range of 0-4%



Discussion

In our study it is evident that the milk samples collected from different areas of Jabalpur were found to be adulterated with, detergent, neutralizers, urea, SMP, NaCl, Ammonium Sulphate, nitrate and protein, apart from dilution with water. Alkalinity generally results from adulteration of milk with neutralizers/stabilizers. Usually neutralizers are added to prevent curdling and thereby, increase the shelf life of milk. In the present study nearly all milk samples were found to be alkaline and tested positive for neutralizers, detergents and NaCl. Adulteration

with detergents is usually a matter of negligence during cleaning of the utensils by milkman. However at times it is intentionally added to dissolve oil in water to give characteristic frothy appearance and white color of the milk. Detergent was found to be reported at maximum 40% in samples collected from Faridabad (Delhi) (Brototy et.al. (2017) and in milk samples of other regions such as Dehradun (Kandpal, et.al. 2012) and Hyderabad (Singuluri and Sukumaran 2014). Swathi and Naazia (2015) in their investigation have also reported presence of detergents in samples collected from local vendors in Hyderabad.

Milk primarily contains lactose sugar (Pandya et.al. 2013). Lactose gives milk its sweet taste. However, in 11% of the samples tested, presence of glucose was observed. Usually, sugars other than lactose are added to give diluted milk its characteristic sweetness and also increase the thickness of milk to adjust the lactometer reading Poor quality glucose has been reported in many studies (Nirwal et.al. 2013 and Barham, et.al. 2014).

Addition of skimmed milk powder (SMP) to pure milk is an offence. Cheap skimmed milk powder is usually added to increase the SNF (solid not fat) value of diluted milk. 10% samples tested positive for the presence of SMP. Roy et.al. have reported that milk samples from Gurgaon, Noida and West Delhi were found to be adulterated with SMP.(J Singh, et.al. 2015) Recently, a snap shot survey was conducted by FSSAI (Food Safety and Standard Authority of India) reported that 44.69% samples were found to contain skimmed milk powder (2014). Starch is another common carbohydrate adulterant that has been reported in milk samples from different places (Ahmed, H. 2009 and Barham, 2014). High amount of starch may cause diarrhea and its accumulation may be problematic in patients detected with diabetes. However, adulteration with starch was not observed in any samples in the present study. Absence of starch in samples collected from Hyderabad, (Singuluri, and Sukumaran. 2014) Delhi and NCR (Singh et.al 2015) India has also been reported.

Urea and ammonium sulfate (fertilizers) are used to increase the consistency, whiteness and lactometer reading of milk diluted with water. Present study reported presence of Urea and ammonium sulphate in 22% of the samples tested. Awan et.al. (2014) also reported presence of urea in tetra pack milk samples. Similarly Brototi et.al. (2017) reported presence of ammonium sulphate in a considerable number of milk samples in the study conducted in Delhi and nearby regions. Presence of urea has been reported harmful and it may lead to problems of eyesight headache and diarrhoea in children (Singh et.al. 2011).

Common parameters that are checked to evaluate milk quality are- fat percentage, SNF (Solid-not-Fat), protein content and freezing point. Adulterants are added in milk to increase these parameters, thereby increasing the milk quality in dishonest way. For example, cane sugar, starch, sulfate salts, urea and common salts are added to increase solid-not-fat. Commercial urea is added to

milk to increase non-protein nitrogen content (Sharma et al. 2012). Similarly, melamine is added to increase protein content falsely (Liu et al. 2012). Virginia et al. (2013) reported that increase in milk protein content indicate milk adulteration because it directly corresponds with a similar increase in whey protein, which is indicative of the addition of soluble nitrogen compounds to milk; In the present study maximum 3-4 % Protein was found in 37% of the milk samples. High percentage of protein is known to cause increased bowel movements; nausea, thirst, blotting cramps, reduced appetite, tiredness and headache. The fact that production cost of soy milk is 70% lesser than normal milk and soya bean protein is much more cheaper than milk protein, incites manufacturers to adulterate milk with soy milk (Tanzina Azad and Shoeb Ahmed 2016). Caroline et.al. (2016) reported that milk, milk powder and other dairy products are often adulterated by low priced non-milk proteins such as soy, pea and soluble wheat proteins (SWP). In the present investigation another common adulterant, nitrate was reported in 25% of the samples. Physician and public health professionals have known that exposure to high levels of nitrate causes "blue baby syndrome," a condition caused by lack of oxygen in infants. (FAO/WHO 1996, Mudgil and Barak 2013). Therefore determination of adulterant is important for preventing health hazards like renal and skin disease, eye and heart problem, cancer and gastrointestinal disorders. Thus it was found that all the collected milk samples had varied proportions of common adulterants which might be detrimental to human health. Surprisingly other adulterants like formalin, boric acid, maltose, cellulose and H₂O₂ was found to be absent in all the samples tested.

Findings and Suggestion

In this preliminary study, most of the milk samples collected was found to be non-conforming to the standards laid down by FSSAI. The samples were found to be adulterated with hazardous chemicals like detergents, neutralizers, Urea, ammonium sulphate, nitrate, SMP etc. These chemicals are known to cause various diseases like gastrointestinal disorders, renal and skin disease, eye and heart problem and even cancer.

The present study brings light to the persistent problem of milk adulteration. Government must take effective measures for combating this malpractice by enhancing punishment for adulteration of food and drinks. The legal steps laid down in PFA act are difficult to maintain due to untrained man power and lack of laboratory facilities. Additional effective remedy is to aware the common man for the legal course they can take against the traders.

Conclusion

A national survey in India has revealed that almost 70% of the milk sold and consumed in India is adulterated by contaminants such as detergent and skim milk powder, and impure water is the highest contaminant. According to National Survey on Milk Adulteration conducted by FSSAI (India 2012) in rural and urban areas, 68% milk samples were found to be adulterated in which 31 % were from rural areas. Of

these 16.7 % were packet or branded milk and rest were loose milk samples from dairies. In the urban areas, 68.9 % milk was found to be adulterated with water, detergent, urea and skim milk powder. In Uttarakhand, 88% milk was found to be adulterated. Although the government of India has framed strict laws against the malpractice of adulteration of milk but it has not been checked completely and is still a persistent problem of the country. Therefore it is an urgent need to deal with this issue seriously and judiciously to curb the menace and create awareness among consumers regarding their rights.

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