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Detection of common milk adulterants from the local vendors and dairies in Jaipur city, Rajasthan

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Abstract
Food adulteration has emerged as a global concern, particularly in developing nations, where the risk associated with adulteration is high. Milk, being a vital component of the human diet, is prone to adulteration, posing significant risks to public. The lack of effective monitoring and unhygienic conditions in milk production and distribution contribute to the widespread adulteration problem. The presence of these adulterants in milk has been found to have detrimental effects on human health, ranging from gastrointestinal disorders to cardiovascular problems and central nervous system disorders. Common adulterants such as urea, water, starch, skimmed milk powder, sugar, and detergent have been identified in pure milk samples, indicating a deviation from the expected standard quality. In this study we collected a total of 30 milk samples from the local vendors and dairies in and around Jamdoli area, Jaipur. We detected urea, starch, detergent and sugar from the milk samples with urea being the common adulterant. These all were qualitative detection of adulterants which need to be studied quantitatively for better understanding of the composition and prevalence of adulterants in milk.

Keywords: Milk, adulteration, public health, health hazard

1. Introduction
Milk, along with its derived products and derivatives, holds significant significance as a group of food commodities due to their nutritional value and extensive consumption among a broad range of consumers. India, being one of the largest milk-producing nations globally, faces unique challenges in ensuring the purity of its milk supply. However, the unfortunate reality is that milk adulteration is prevalent worldwide which can be attributed to several factors, including the gap between milk demand and supply, the perishable nature of milk, limited purchasing power of consumers, and the absence of reliable detection methods (Kamthania *et al*., 2014) [1].

Milk adulteration often involves economically motivated practices, such as the addition of vegetable protein, incorporation of whey, and watering (Singh & Gandhi, 2015) [2], which are generally not associated with significant health risks. However, certain adulterants pose serious health hazards and should not be overlooked. Among the major adulterants in milk, those with detrimental health effects include urea, starch, formalin, sodium carbonate, detergents, ammonium sulphate, boric acid, caustic soda, benzoic acid, salicylic acid, hydrogen peroxide, sugars, and melamine (Azad and Ahmed, 2016) [3]. These adulterants not only compromise the nutritional value of milk but also pose significant health risks to consumers. Consumption of adulterated milk has been linked to various ailments, ranging from gastrointestinal disorders to long-term chronic diseases (Ali *et al*., 2011) [4].

A snapshot survey conducted by Food Safety and Standards Authority of India (FSSAI) (Executive Summary on National Survey on Milk Adulteration, India 2018) [5] revealed that around 68.7% of milk and milk products available in the Indian market fail to meet the acceptable quality standards. Milk adulteration commonly involves the addition of water to increase volume, as well as the incorporation of solidifying agents like starch, flour, skimmed milk powder, whey powder, and other substances to enhance viscosity and increase milk solids (Yadav *et al*., 2022) [6]. Adulterants such as vegetable oil, sugarcane, and urea may be used to compensate for diluted milk's reduced fat, carbohydrate, or protein content. Moreover, to prolong the shelf life of milk, various chemicals including hydrogen peroxide, carbonates, bicarbonates, antibiotics, caustic soda, and the highly dangerous formalin are employed (Singh & Gandhi, 2015) [2].

Our study attempted to qualitatively detect common adulterants in milk (11 adulterants) from the in and around Jamdoli area, Jaipur, Rajasthan.

2. Material Method

2.1 Collection of milk samples

The present study was conducted in and around Jamdoli area, Jaipur, Rajasthan in the month of June 2023. In total thirty samples were collected from local vendors and dairies selling milk under this area. The raw samples were collected into clean dry sterilized bottles to prevent any contamination.

2.2 Testing for adulteration of milk sample

The testing of 11 parameters were done by using KO88A ATM (Adulteration testing of Milk) kit's protocol manufactured by HIMEDIA Laboratories, Mumbai. These parameters include alizarine, formalin, urea, starch, neutralizers, detergents, sodium chloride, skim milk powder, sugar, glucose, hydrogen peroxide (Fig. 1).

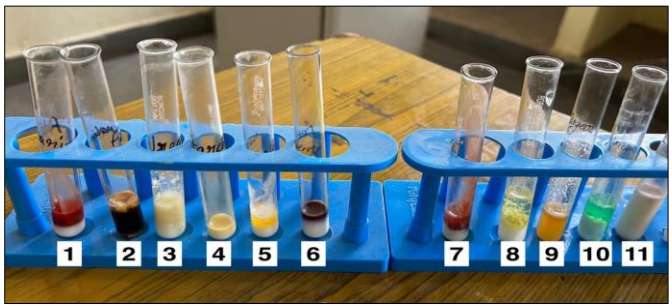

Fig 1: Test is performed on pasteurized milk for negative reference: 1-Alizarine, 2- Formalin, 3-Urea, 4-Starch, 5-Neutralizers, 6-Detergents, 7-Sodium chloride, 8-Skim milk powder, 9-Sugar, 10-Glucose, 11-Hydrogen peroxide

3. Results and Discussion

Out of 30, 5 samples were positive for urea presence (Fig. 2), two were positive for presence of detergents (Fig. 3), three were positive for presence of starch (Fig. 4) and two were positive for presence of sugar (Fig. 5). One sample was positive for both urea and starch. Two samples were suspected for formalin presence but were not showing exact reference colour as mentioned in the kit.

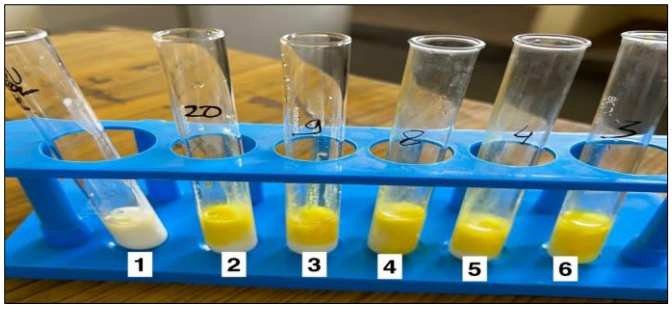

Fig 2: Urea negative-1, Urea positive- 2 to 6 (Total of 5 samples positive out of 30)

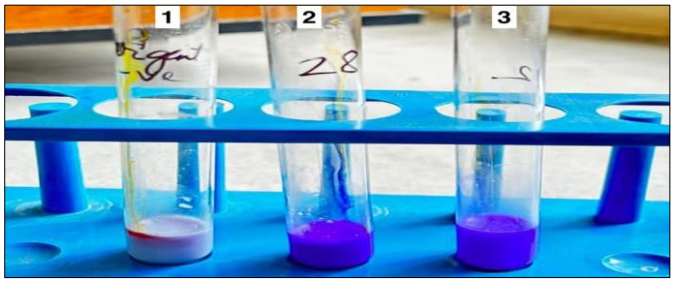

Fig 3: Detergent negative- 1, Detergent positive- 1 to 2 (Total of 2 samples positive out of 30)

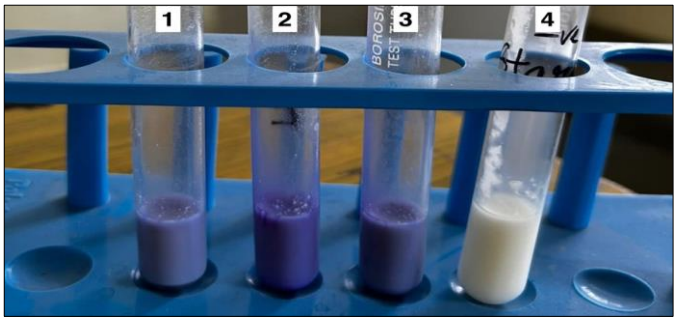

Fig 4: Starch negative-4, Starch positive- 1 to 3 (Total of 3 samples positive out of 30)

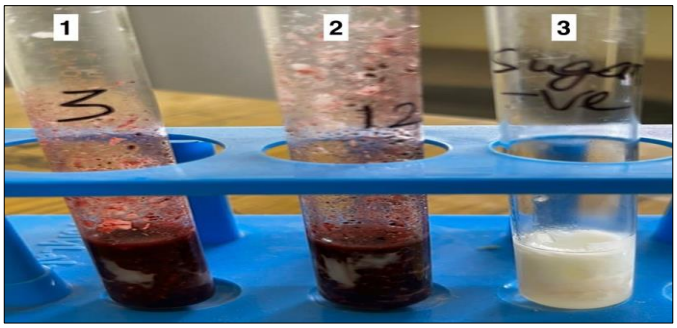

Fig 5: Sugar negative-3, Sugar positive- 1 to 2 (Total of 2 samples positive out of 30)

Urea is often added to milk in India to increase its non-protein nitrogen content, although it already occurs naturally in raw milk. This practice is considered a significant form of adulteration in the country, and the FSSAI has set specific guidelines regarding the acceptable levels of urea in milk (70mg/100ml of milk) Several studies have shown presence of urea in milk (Ali *et al*., 2011; Nirwal *et al*., 2013; Kumar *et al*., 2015) [4, 7, 8]. Increase in urea levels of milk may be associated with congestive heart disease, urinary obstruction, gastrointestinal disorders, as well as renal disease as well it may be due to unbalanced feeding of cows (Renny *et al*., 2005) [9]. A study by Sharma *et al*. (2017) [10] revealed presence of urea, starch, salt and detergent from milk samples collected from different agro-climatic regions of Rajasthan.

Inadequate hygiene and sanitation practices during milk handling and packaging can result in detergents used for cleaning operations not being thoroughly rinsed, leading to their presence in the milk. The addition of starch and starch is to mask the addition of water to milk, thereby increasing its solid-not-fat (SNF) content (Costa *et al*., 2020) [11]. Our study attempted at qualitative detection of adulterants which need to be further studied quantitatively for better understanding of the composition and prevalence of adulterants in milk.

4. Conclusion

India holds the top position in milk production globally, and milk and milk products have a substantial presence in the diets of Indian individuals. Milk is considered a high-risk commodity susceptible to fraudulent activities driven by financial motives, resulting in compromised food safety and diminished nutritional quality. These fraudulent practices often occur under unsanitary conditions, lacking proper preservation and cooling facilities. Adulterated milk not only loses its nutritional value but also poses health risks, as evidenced by recent milk fraud scandals. Consequently, it is crucial to conduct further analysis and raise public awareness regarding malpractices and negligence in milk production.

5. References

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