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From Glass To Growth: Analysis Of Common Milk Adulterants On Chidren's Development

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Abstract:

Milk is one of the most widely consumed beverages globally. To meet the high demand, milk adulteration has become prevalent, posing a significant public health concern, particularly affecting the growth and development of children. Common adulterants such as water, detergents, synthetic milk, urea, starch, and harmful preservatives like formaldehyde are frequently added to milk to increase volume and extend shelf-life, thereby compromising its nutritional integrity and safety. Children, especially during critical growth phases, rely heavily on milk for essential nutrients such as proteins, calcium, vitamins, and minerals. The addition of adulterants can dilute these vital nutrients, leading to malnutrition and growth deficiencies. Chemical adulterants like urea and detergents can cause gastrointestinal disturbances, impair nutrient absorption, and introduce toxicity, further exacerbating nutritional deficiencies. Furthermore, harmful chemicals such as formaldehyde in milk can lead to serious health issues, including developmental delays and potential long-term health complications. Exposure to these toxins can impair cognitive development, weaken the immune system, and hinder physical growth, using colorimetric and qualitative analysis methods, this study examines milk adulterants that are common in the Bangalore region. This paper covers the detection of common adulterants used in packaged milk packets and their impact on children's growth in Bangalore region.

Keywords: *Milk Adulteration, Child Growth, Nutritional Deficiencies, Adulterants, Urea, Formaldehyde, Cognitive Development, Public Health.*

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Introduction

Milk has a great nutritional value in a children's life, it provides vital nutrients such carbs, protein, fats, minerals, vitamins, and essential amino acids, making it a fundamental part of the human dietary regimen therefore one kilogramme of milk has the same nutritional and energy content as 0.5 kg of beef or 8-9 eggs and a kilogramme of milk contains 84-90% water, 2-6% fat, 3-4% protein, 4-5% lactose, and <1% minerals. and supplies around 668 Kcal. Therefore, milk is a very significant raw ingredient for the food companies **(Nascimento *et al.*, 2016)** There are predicted to be between 8 and 10,000 different types of Milk and dairy products manufactured around the world although its adulteration is a concern in developing nations that have a larger risk due to shortage of surveillance and regulations around the world. Milk adulteration is one of the critical issues in India's dairy's sector resulting in substantial financial losses. To prevent financial losses from milk spoiling during transit and sale, unethical measures may be used to keep it fresh briefly **(Kartheek *et al.*, 2011)** Generally, to enhance the volume of milk, thickening agents are used such as starch, flour, or skimmed milk powder as well as improve the amount of milk generated, water is added. However, the water may contain diseases, heavy metals, and agricultural chemicals like herbicides, fertilisers, and insecticides, depending on where it comes from in the community (reservoirs and water wells close to agricultural locations). Consumption of such water may result in infectious hepatitis, cholera, bacillary dysentery, typhoid, paratyphoid, and amoebiasis. According to [Haftu Kebede et al. (2018)], milk's physical and chemical features indicate its compliance with hygiene requirements. **(Azad and Ahmed, 2016)** The physical qualities of milk included its specific gravity, viscosity, surface tension, acidity, and ph. These metrics indicated the standard and nutritional quality of milk. Specific gravity, viscosity and surface tension were crucial indicators of the milk adulteration. In addition, adulterated milk may contain other additives such as hydrogen peroxide, cane sugar, formalin, boric acid, caustic soda, benzoic acid, salicylic acid, ammonium sulphate, urea, detergents, and melamine. **(Francis *et al.*, 2020)** These dangerous chemicals have the potential to result in major health issues. Research on the effects of adulterated milk on children's health is still lacking, despite its widespread usage. The purpose of this study is to look into how children's health is affected by adulterated milk and major health issues that can result from milk adulteration, which makes it a serious threat to children's health **(Singh and Gandhi, 2015)** Some of the major issues are Inadequate nutrition and diminished growth, Infections and diseases of the stomach, Damage to the kidneys and renal failure, Hypersensitivity and allergic responses, Long-term health effects, including cognitive decline and developmental delays **(Shaikh *et al.*, 2013).**

Methodology

1. In this research, we gathered several samples of packaged milk that is frequently consumed in the Bangalore area and collected measurements using physical parameters.

2. To guarantee precision and consistency, every measurement was compared to the raw milk standard values.

3. A specific gravity bottle with a precise volume of 25 ml was used to measure the density of the milk samples. Using raw milk as a reference, the mass of each milk sample was computed to determine its density.

4. Ostwald's viscometer was used to determine the milk samples' viscosity. Each milk sample and a blank sample were tested, and the time it took for each liquid to pass through the viscometer was recorded in order to look for differences that might indicate adulteration. **(Shashi *et al.*, 2016).**

5. A stalagmometer was used to measure the milk samples' surface tension. Surface tension variations from standard raw milk were determined by counting the number of drops that formed in both the milk samples and a blank sample of water.

Table No. 1: showing experimental values of various milk samples

Sample no.	Viscosity	Surface tension	density	PH
S1	0.001	0.0	1.03	6
S2	0.001	0.095	1.02	6
S3	0.002	0.059	0.96	6
S4	0.002	0.049	1.02	6
S5	0.001	0.053	1.02	6
S6	0.001	0.044	0.96	6
S7	0.003	0.045	1.02	6

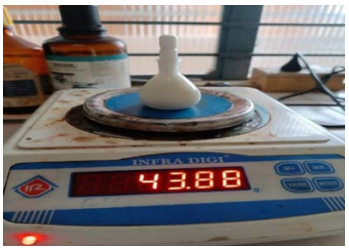

Figure No. 1: specific gravity bottle for the detection of density

Figure No. 2: Viscometer to show the detection of Viscosity

Results & Discussions

Viscosity and surface tension are two key physical properties of liquids that are influenced by their molecular composition. When these properties are altered or adulterated, it can have a significant impact on the behavior of the liquid. Adulteration refers to the addition of substances that change the natural viscosity of a liquid. In products like milk, honey, or oils, substances such as starch or sugar syrup can increase viscosity artificially. Dilution with water or solvents: This reduces viscosity by introducing lower-viscosity substances, making the liquid flow more easily.

Measuring the viscosity of a liquid at controlled temperatures using instruments like viscometers can help detect changes due to adulteration. Unusual values can indicate the presence of foreign substances. **(Kumar et al., 2015).**

Surface tension is the cohesive force at the surface of a liquid that causes it to behave like a stretched elastic sheet. It arises due to the imbalance of intermolecular forces at the surface of the liquid compared to those in the bulk of the liquid. Addition of surfactants (surface-active agents): Detergents or soaps added to water drastically reduce its surface tension by decreasing the cohesion between water molecules. Mixing with other liquids: For example, adding alcohol or oil to water reduces its surface tension, leading to a thinner, more spreadable liquid.**(Das et al., 2016)**

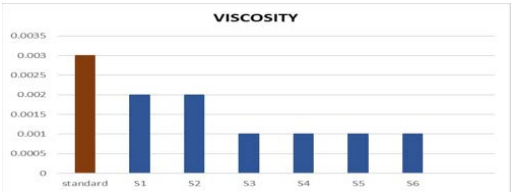

Figure No. 3: Bar graph showing variation of viscosity from different Milk samples

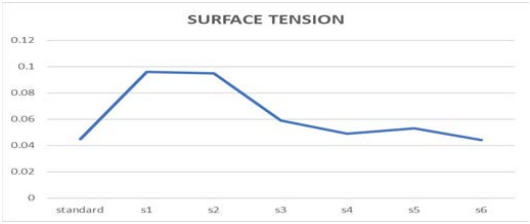

Figure No. 4: Line graph showing the surface tension variations

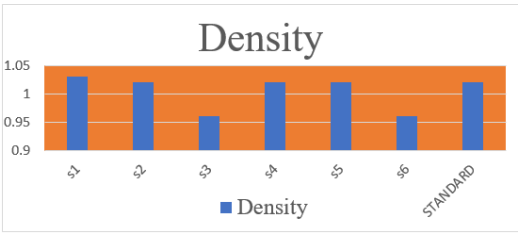

Figure No. 5: Bar graph showing the density variations

Out of 132 responses all over Bangalore, 50 responses from children where all of them are using packaged milk. Out of which 1-10 are facing problems that are related with problems that are commonly seen with milk adulterants. In India synthetic milk is a common problem that is prepared by adding urea, caustic soda, refined oil and common detergents. For those suffering from hypertension and heart ailments, caustic soda contains sodium and serves as a slow poison. Urea adulterated milk is very dangerous to the children, as it accelerates the puberty process. Salicylic acid in Milk can impairs digestibility of milk, can cause irritation in GIT, bleeding, diarrhea and death especially in young children.

Benzoic acid may also cause asthma, urticaria, metabolic acidosis, convulsions and pseudo allergy in humans. In addition, its consumption may cause hyperactivity and behavioral disorders in children **(Ceniti *et al.*, 2023).**

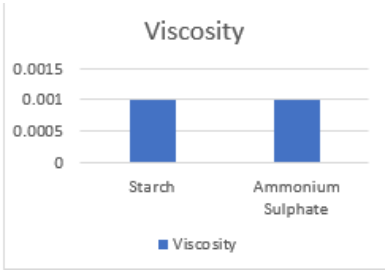

Figure No. 6: Bar graph showing the Viscosity variations

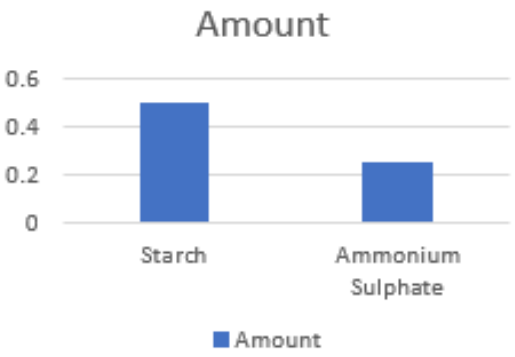

Figure No. 6: Bar graph showing the Amount variations

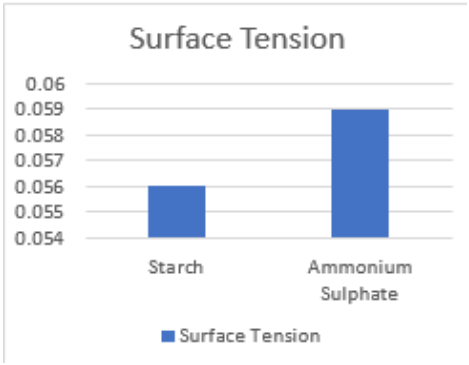

Figure No. 7: Bar graph showing the Surface Tension variations

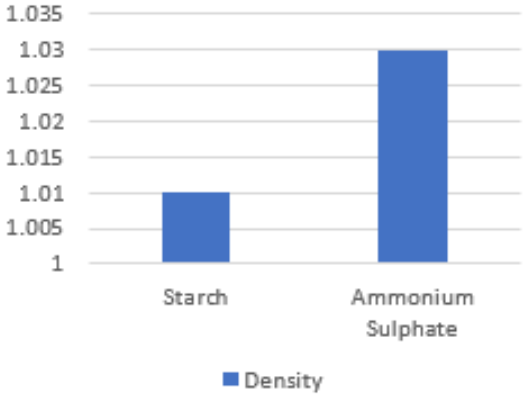

Figure No. 8: Bar graph showing the Density variations

Conclusions

It is found that many milk products obtained from various places in Bangalore was found to be following the standard conditions. Very few samples, though branded was found to be adulterated and showed deviation from standard values. Due to this, Milk consumed by children are found to be suffering from excess of uric acid, early puberty, asthma and many more. As milk is a primary drink in this universal world, consuming healthy plays a major role. Though it is not a major issue at this stage in Bangalore but can become major problem in futuristic world.

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