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Revealing The Dangers: A Brief Review of Milk Adulteration and Its Impact on Public Health

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ABSTRACT
Milk, a nutrient-rich liquid produced by mammals' mammary glands and consumed by humans as a primary source of sustenance, is a versatile and popular beverage crucial for providing the nutrients necessary for development and growth. It contains various components such as protein, vitamins, calcium, and carbohydrates. Due to its widespread consumption across diverse demographics, there is a significant market demand for milk. However, this demand has led to various strategies to meet supply, including adulteration. Milk adulteration is a rapidly growing global issue that poses serious risks to public health and the integrity of dairy products. This review examines the different types of milk adulteration, the common adulterants used, and the significant effects on consumers. Adulterants range from dilution with water to the addition of harmful chemicals or the use of hormones to increase milk production in cattle.
Keywords: - *Milk, Adulteration, Dairy product, Carbohydrate, Health, Disease, Nutrients*

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INTRODUCTION

Milk is a compulsory part of the expectant mom's daily diet as well as growing infants. Due to its unique nutritional value and its important role in human and animal health, milk is very important. In its most easily attackable shape, it has all the substances needed by species. Milk is recommended for young and old people because of its nutritional value [1]. Milk adulteration is a significant concern in food safety, as it can reduce the quality of milk and introduce potentially hazardous substances into the diet of consumers. A detailed review on the detection of adulteration in milk highlights the various methods used to identify such adulterants, focusing on both qualitative and quantitative techniques. The study emphasizes the importance of detecting milk adulteration due to the health risks associated with consuming milk that has been compromised with substances such as water, which can dilute the nutritional content, or harmful chemicals that can pose immediate and long-term health dangers. Another review from Sensor Letters in 2016 provides an overview of different elements used to adulterate milk, including the removal of cream and the sale of skimmed or partially skimmed milk as whole milk, which are forms of milk adulteration [2]. This paper also discusses the various detection methods used to ensure the integrity of milk. Overall, these scholarly articles underline the significance of detecting milk adulteration to safeguard public health and ensure the quality of milk and milk products that reach consumers.

MILK

Due to its abundance of nutrients, milk is a good ideal food for babies, adults, and senior citizens. It is a valuable source of carbohydrate, lipids, vitamins, minerals, and protein for the growth and development of the body. The components of milk vary depending on the breed, nutrition, lactation stage, time of year, and numerous other factors. It is quickly absorbed and digested by the body's tissues. It has the following composition: 87% water, 3.9% fat, 3.3% protein, 5% lactose, and 0.7% ash. It changes according on the animal's breeding, variety, feed, and lactation stage. Along with it, it supplies energy-producing lactose and milk fat, calcium and minerals that make bones, protein that builds muscles, and vitamins that promote health. It provides all of the required amino acids along with some important fatty acids. Due to these properties of milk make it an ideal and important food in the routine diet. India's milk production is

growing by 35.61% during the last 6 years. In 2019-20 it arises about 198.4 million tons [around 5.68% as compared to previous year]. India becomes first among all countries in both production and consumption. Milk is composed of 87.7% water, 4.9% carbs (lactose), 3.4% fat, 3.3% protein, and 0.7% mineral [3].In India, there are numerous methods for producing, preparing, and distributing milk and milk products. The majority of other states, including Punjab, Gujarat, Maharashtra, and Haryana, produce the most milk [4].

MILK ADULTERATION

Adulteration is the process of lowering a product's quality by mixing in a less-than-ideal ingredient, which lowers the milk's true quality [5].In India, there are numerous methods for producing, preparing, and distributing milk and milk products. The majority of other states, including Punjab, Gujarat, Maharashtra, and Haryana, produce the most milk [4]. As per the PFA ACT report, 68% of the milk in the nation is deemed dangerous due to various adulteration methods, such as adding water to the milk or adding detergents containing chemicals including oxytocin, formalin, hydrogen peroxide, melamine, and ammonium sulphate, starch, vegetable oils, urea, and artificial milk [6].A survey conducted by the FSSAI to investigate milk contamination revealed that 52% of the detergents in milk samples were found to be diluted with water. The purpose of these adulterants is to prolong the shelf life of milk. As per the worry of health, the Indian government announces the Food Adulteration Prevention Act of 1954. The first day of June 1955 saw the creation of this act. This law prohibits the sale and distribution of tainted goods, which have a negative impact on health. Water is the most prevalent adulterant. Various laws have been passed to discourage adulteration, yet these activities have not entirely ended, particularly in India [7]. Many health problems arise, particularly in kids between the ages of 5 to 10. They experience numerous health problems, including impaired eyesight, diarrhoea, and stomach disorders that are linked to contaminated milk. Even as adults, they experience health problems such as gastric issues and heart attacks. Adulteration is bad for human health because it can lead to respiratory conditions including stomach issues diarrhoea etc.One common type of food fraud that has grown to be a significant social problem in recent years is milk adulteration. It presents a health risk in addition to social and financial issues [8].

TYPES OF ADULTERANTS IN MILK

WATER-

The most popular adulterant used to boost milk's volume and reduce its nutritious value is water [9].The public who consumes milk is concerned about their health. Diarrhoea, typhoid, rotavirus, and hepatitis A and E are just a few of the diseases that can result due to adulterated water [10].

UREA

To enhance milk's brightness, fluidity, and non-protein nitrogen content—as well as to maintain a proper balance of naturally occurring SNF—urea is added. Urea is also used to make artificial milk. A small quantity of urea can induce cancer, nausea, gastritis, ulcers, and vomiting. For example, urea damages the kidneys, liver, and heart because it makes the renal system work harder to obtain remove urea from the body [11]. Ammonia in milk can cause disability, loss of acquired speech, and visual impairment. Unreliable cow feeding can also lead to an increase in the urea level of milk.

HYDROGEN PEROXIDE

Hydrogen peroxide is used to preserve milk for a longer period of time, although peroxides damage intestinal tract cells, [12] which can lead to cancer. This can cause ulcers and intestinal inflammation. Milk tainted with hydrogen peroxide has been linked to an increase in heart rate and the development of cardiac arrhythmia. It is just an oxidizing and bleaching agent that's colorless and odorless. It's mostly utilized in deodorants, water and sewage treatment, and the manufacture of other compounds. It's comparable to formalin in that it extends the storage life of milk and inhibits bacterial development.

CHLORINE

Chlorine is added to the diluted milk after it has been diluted with water to compensate for its viscosity [1]. Your health could be negatively impacted by oxygenated milk, as it can cause artery blockages and the emergence of heart conditions [13].

MELAMINE

Melamine is used to artificially boost the protein concentration of milk powder. Ifsevere circumstances, it can lead to renal failure and death [14]. Melamine is a combination of cyanamide with 1,3,5-triazine, that is most typically seen as crystal shards in nitrogen. Melamine is often used to produce amino polymers and plastic materials, textiles, nitrogenous pesticides, and other products that are just minimally miscible in aqueous. It is also harmful to one's health. In clinical trials, melamine alone generates urinary blockage, and also creates crystals which can cause kidney stones. As a result, the kidneys are unable to function effectively, resulting in renal failure.

AMMONIUM SULPHATE

Ammonium sulphate, unlike urea, is a chemical manure. It is primarily used to maintain the viscosity of milk while increasing the lactometer value. This can induce discomfort, nausea, vomiting, and diarrhoea. This is also a neurotoxic, which means it can make you confused and modify your behaviour [15].

ANTIBIOTICS

Antibiotic medication is used by 80 % of dairy cows to treat illnesses like lactation. These medicines are found in abundance in milk due to antimicrobial residues. Sometimes, these mixtures are added in the right amounts to lengthen the time that milk can be stored.

The most common antimicrobial medications include beta-lactams, mefloquine, penicillin, and nitro furans, which are antiviral medications. Pasteurization and additional pathogen related techniques. These techniques for controlling temperature are especially effective. The FDA has examined over eighty drug residues in human diets derived from animal products. The antibacterial elements in milk may contribute to the emergence of latent infections, so endangering the well-being of the consumer. Drug residues in milk can damage internal organs, increase the risk of antibiotic resistance, and, in certain situations, be carcinogenic. Anaphylaxis is one medical issue caused by drug residues in milk [2].

FORMALIN (FORMALDEHYDE)

One sort of disinfection that is frequently used to extend the shelf life of liquid milk during transit is formalin. But it's against the law to add any kind of preservative to milk. Primarily utilised for the preservation of biological materials, formalin can be Spend less on electricity and refrigeration. Carcinogens can be induced by formalin. Additionally, it can cause intestinal inflammatory diseases and gut corrosion, both of which increase the risk of renal failure.

MILK POWDER

Fresh milk has occasionally been adulterated with milk powder. This is what a nation does in an attempt to obtain an economic advantage. Possesses an excess of milk powder or is paid for dry milk powder [16]. It prolongs milk's term of storage. It started off as whey powder, dry milk powder, and a variety of other forms. Because milk powder increases milk's density, manufacturers makes more money.

Table- Represents composition of different types of animal milk

Proximate	Water%	Protein%	Fat%	Ash%	Lactose%
Cow	87	3.8	4.4	0.8	4.9
Buffalo	84	3.6	11.5	0.9	5.0
Sheep	82	6.7	8.6	0.1	4.8
Goat	88	3.7	4.5	0.9	4.2
Yak	83	5.9	5.6	0.9	5.9
Camel	88	3.9	5.4	0.9	3.3

Table Source- [2]

Table- Outlining the impact on health by different types of milk adulteration:

Type of Adulteration	Adulterant	Impact on Health
Water Dilution	Water	Reduces nutrient content, lowers protein and fat levels, increases bacterial growth, and decreases milk quality. May lead to malnutrition, especially in infants and young children.
Addition of Chemicals	Formalin, hydrogen peroxide, etc.	Can cause gastrointestinal issues, organ damage, poisoning, allergic reactions, and long-term health problems.
Hormone Injection	Bovine growth hormone (BGH)	May lead to hormonal imbalance, early puberty, antibiotic resistance, and potential health risks, including cancer.
Addition of Urea or Starch	Urea, starch, or other fillers	Can cause digestive issues, toxicity, and long-term health problems.
Adulteration with Detergents	Detergents (like sodium carbonate)	Can lead to gastrointestinal problems, including diarrhea and vomiting.
Addition of Vegetable Oil	Vegetable oil	Reduces the nutritional value of milk, increases fat content, and may lead to digestive issues.

CONCLUSION

Owing to its high nutritional content, milk is regarded as an ideal or comprehensive food and a crucial part of a regular diet. Unfortunately, the rising demand for milk around the world makes it easily falsified. Not only does adulteration of milk change the quality of the milk. As on this basis of above review the adulteration of milk is becoming a serious issue. Although it has also been considered as financial gain is

one of the main reasons for the milk adulteration. There are harmful substances involved, which have a bad effect on health. The government and the dairy sector are becoming increasingly concerned about milk adulteration in the modern day. It may get tampered with on purpose or by mistake. Human-grade milk can be tainted with substances such as water, urea, starch, detergents, and other substances. This can lead to illnesses affecting the heart, liver, kidneys, or even cause cancer.

CONFLICT OF INTEREST

No conflicts of interest are disclosed by the authors

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