Review Paper

Study Of Adulteration in Milk and Milk Products And Their Adverse Health Effects

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Abstract: Milk is a highly nutritious food that is easily digested and absorbed. It is made up of nutrients that are required for appropriate body growth and maintenance. Milk and milk products are an important part of our diet, and milk and other dairy products account for a major portion of our food budget. In adulteration the nutritious substance removes from the products which is harmful for human health. Due to consumption of adulterated milk lots of respiratory diseases occurs such as gastro intestinal problems diarrhea etc. sometimes adulterate milk to increase their profit margin by several chemicals like urea, starch, flour, cane sugar, vegetable oils, detergents etc. Various preservatives like formalin and some antibiotics are also added in milk to increase its shelf life which result decreases in the nutritive value of milk. These adulterants, preservatives and drugs in milk cause very serious health related problems.

Keywords: Milk; Adulteration; Health; Health Issues.

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1. Introduction

Milk is usually premeditated as a complete food because it is beneficial for human health. Milk is a good source of lots of nutrients which is essential for growth and development of children. Milk contains a rich source of calcium, protein and vitamins which is required for strong bones and teeth muscle movement and nerve signals. It is easily digested by body that's why many people see it as important part of balanced diet India producing about 187 million tonnes of milk every year (Tipu et al., 2007; Javaid et al., 2009).

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 (Slovák, 2021; Olika, 2021; Tyasi et al., 2015; Sheryl & Setiadi, 2020). It changes according on the animal's breeding, variety, feed, and lactation stage. Proteins of various sorts can be found in milk (Bidaliya et al., 2021). Whey proteins including alpha-lactalbumin, beta-lactoglobulin (Marciniak et al., 2018), Bovine serum albumin, and immunoglobulins and also alpha, kappa, and beta caseins are examples of milk protein (Alonso et al., 2012).

In terms of states, UP is the most milk-producing state in India, around 17% of total production. In India, around half of milk is transformed into coagulated goods (channa and paneer), cultured products (dahi and lassi), and fat-rich products (ghee and makkhan) (Swathi and Kauser, 2015). About 7% of milk is often used to make western products like protein powder, yogurt, butter, powder milk, and other dairy products (Sharma et al., 2011). Milk and milk products are produced, prepared, and distributed in India in a

variety of ways. Most of other states like, Haryana, Maharashtra, Punjab, Gujrat has highest milk production (Arora et al., 2004).

2. Milk Adulteration

Adulteration is the process of reducing the quality of product by adding some another inferior substance in it due to which the actual quality of milk loses (Afzal et al., 2011; Gupta et al., 2020). It is the process in which volume of milk increases due to which sale ability of milk improving and producers gets more profit and production and consumption of milk increases (Mota et al., 2003; Haasnoot et al., 2004; Saad et al., 2005).

According to the report of PFA ACT 68% of milk in country are unsafe milk is adulterating in different ways by adding watering of milk, adding different chemicals (Oxytocin, formalin, hydrogen peroxide, Melamine, Ammonium sulphate) detergents, urea, starch, vegetable oils, synthetic milk (Singh, 2012). Contaminated agents such as starch, glucose, formalin mixed with detergents increases the thickness of milk. Due to which producers earns more profits from consumers (Jurica et al., 2021; Jha et al., 2016; Thangaraju et al., 2021).

According to a FSSAI survey was organized to check the contamination in milk, it was noted that milk samples contain 52% of detergents was found diluted with water. Theses adulterants are used to enhancing the shelf life of milk. According to concern of health, the government of India notify the `prevention of Food Adulteration Act 1954. This act came into existence in 1 June 1955. This act inhibits the distribution and sale of adulterated products which causes adverse health effect. The most commonly found adulterant is water. Different types of acts promulgation to inhibit the practices of adulteration but they are not stopped completely in India especially (Kamthania et al., 2014).

According to a survey about 80% of milk sold and consumed in India is adulterated. Out of theses 31% from rural areas and 17% from urban areas, and 16% from packet. Adulteration of milk widely found in developing countries – Pakistan, Brazil, India and China (Xiu and Klein, 2010; Faraz et al., 2013; Shaikh et al., 2013; Mu et al., 2014; Singuluri and Sukumaran, 2014).

Different types of health issues occur especially in children about age of 5-10 age. They suffer a lots of health issues such as weak eye sights, diarrhoea, stomach disorder, which is related with adulterated milk. Even in adults they also suffer from health issues, such as cardiac attack, gastrointestinal problems. Adulteration is harmful for human health cause respiratory disease such as gastro intestinal problems diarrhoea etc.

Adulterated milk usually loses its colour due to inferior substances; it can be tested that pure cow milk has thick yellowish colour and the colour of adulterated milk is whitish. It is observed in a survey of NDDB [NATIONAL DAIRY DEVELOPMENT BOARD], which is located in Gujrat.

Milk adulteration is a prevalent form of food deception that has become a major social issue in recent years. It not only raises social and financial concerns, but it also poses a health risk (Esteki et al., 2019). Kidney and dermatological illnesses, eye and heart problems, and cancer are only a few of them. As a result, preventing the detection of milk adulteration is critical.

The infusion of water alters the specific gravity of the milk, destroying its original appearance. Lactometers are commonly used scientific instruments to detect water in milk. It is calculated the change in bulk density. To accommodate for the specific gravity, various kinds of sugar and salt are used. A modest amount of food colouring is

sometimes used to keep the colour of the food. The colouring substance has been applied. maltodextrin is a taste enhancer and cost-cutting agent used in dairy foods.

The inclusion of liquid buttermilk (by-product of Greek yoghurt production) is basically another popular adulterant from milk. For a higher profit, some businessmen use low-cost materials. To prepare whey, muriatic acid is used, which is harmful to one's health. Adulterated milk is a problem that requires detection immediately.

2.1 Types of Adulterants in Milk

2.1.1 Water

Water is the most common adulterant used to increase the volume of milk, lowering the nutritional value of the product (Francis et al., 2020). Contaminating milk with polluted water is a serious issue. 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 (Bhuiyan and Noor, 2020). Water represents a health concern to consumers if it is contaminated with pesticides and heavy metals.

2.1.2 Urea

Urea is added to milk to improve brightness, fluidity, and nonprotein nitrogen content, as well as to balance the amounts of SNF in a correct proportion, that has been produced naturally. Artificial milk is also generated with urea. Vomiting, nausea, gastritis, ulcers, and cancer can all be caused by a modest amount of urea. Urea is damaging to the heart, liver, and kidneys, in particular, because the renal have to work even harder to get rid of urea from body (Kandpal et al., 2012). Impairment, loss of acquired speech and visual impairment are all symptoms of ammonia in milk. The urea content of milk may also increase as a result of cow nutrition that isn't consistent. Productivity in dairy cows is caused by unstable urea components in milk. It's also used for a variety of other things such as consistency of heat. This necessitates the relevance of urea detection in milk.

2.1.3 Detergent

Cleanser is used to dissolve & disperse the water in oil, resulting in a foaming mixture with a milk-like white colour (Singuluri and Sukumaran, 2014). Milk has cosmetic nature which is improve by detergent. Detergent induces gastrointestinal problems. Detergents are mostly used to make milk thicker and more viscous. Dioxane, sodium lauryl sulphate, and phosphates are found in detergent, all of which are hazardous to human health. Dioxane is a carcinogen. Conjunctivitis, liver damage, cytotoxicity, endocrine disruption, mutation, & cancer are all caused by sodium lauryl sulphates, and Nausea, diarrhoea, and skin irritation are among symptoms of phosphates.

2.1.4 Starch

The influence of unprocessed starch in the intestine might cause diarrhoea when large amounts of starch are added to milk to promote solid-not-fat (SNF). It builds up in the body of people with diabetes and can be harmful to their health (Singuluri and Sukumaran, 2014). Flour from wheat, grains, maize, and corn starch are common starch adulterants used to boost fat content and hide adulteration. Starch is mostly used to stiffen milk and protect it from curdling. It is used to alter the pH of both synthetic and natural milk uniformity.

2.1.5 Hydrogen Peroxide

Milk is treated with hydrogen peroxide to keep it fresher longer, but peroxides harm the cells in the gastrointestinal tract (Lindmark-Månsson and Åkesson, 2000), which can lead to cancer. This can cause ulcers and intestinal inflammation. The antioxidants in the body are disrupted by H2O2, causing the natural balance to be disrupted. As a result, ageing is accelerated. 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. Milk tainted with hydrogen peroxide has been linked to an increase in heart rate and the development of cardiac arrhythmia.

2.1.6 Synthetic Milk

Synthetic milk isn't really milk, but rather a completely different component that has been heavily adulterated in order to enhance the quantity of liquid and thus the income. It's commonly made up of a combination of liquid cleanser or soap, caustic soda, vegetable fats, sodium, and ammonia, among other ingredients. It's a product that looks and tastes like milk but lacks the nutrients found in real milk. Around 15 years ago, milkmen in Kurukshetra developed synthetic milk technology. Later on, the technology spread to other countries. According to one assessment, 1.10 crore litres of synthetic milk are produced and sold every day in various states across the country. Synthetic milk, according to doctors, causes considerable harm to the human psyche, including eye inflammation and liver and kidney complications. Aside from that, artificial milk is dangerous for pregnant mothers and anyone with high blood pressure. Urea and sodium carbonate are extremely toxic to the heart, liver, and kidneys, and turn the human body into disease breeding grounds (Francis et al., 2020).

2.1.7 Chlorine

After adding water, to counteract for the viscosity of the diluted milk, chlorine is added after it has been diluted (Reddy et al., 2017). Oxygenated milk might be harmful to your health, blockage of arteries and the development of a cardiac condition (van der et al., 2021), are major health related issues occurs. The alkaline ratio and the pH of blood is disrupted by chloride in milk.

2.1.8 Melamine

Melamine is used to artificially boost the protein concentration of milk powder. If severe circumstances, it can lead to renal failure and death (Cheng et al., 2010). 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.

2.1.9 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 (Singh and Gandhi, 2015).

2.1.10 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. These

combinations are sometimes added in proportion to increase the storage period of milk. Penicillin, mefloquine, and nitrofurans antiviral drugs, as well as certain beta-lactams, are the most prevalent antimicrobial drugs. Pasteurization and other methods for pathogens and temperature control strategies are particularly successful. Around 80 medication residues in human diets produced from animals have been evaluated by the United States (FDA). The Antibacterial components in milk might assist to root dormant infection, due to which the customer's safety is jeopardised. Drug residues in milk cause medical problems such as anaphylaxis and a rise in antimicrobial resistance, as well as harm to internal organs and the potential for carcinogens in some cases. Moreover, it also has the potential to harm tissue. It disrupts the bacterial chemical reaction, leading to significant losses in produced good. Incredibly low Urticaria can be caused by a large amount of penicillin residual (Das et al., 2016).

2.1.11 Formalin (Formaldehyde)

Formalin is a type of disinfectant that is widely use to enhance the storage life of liquid milk, during transportation. However, applying any form of preservative to milk is illegal. Formalin is primarily used to conserve biological specimens, and its use can help save money on refrigeration and electricity. Formalin can induce carcinogen agents. It can also induce gut corrosion, which can lead to ulcers and intestinal inflammatory illnesses, all of which can lead to renal failure.

2.1.12 Milk Powder

In some cases, milk powder has been used as an adulterant in fresh milk. When a country seeks to gain an economic edge, this is done. Has an oversupply of milk powder or receives a reimbursement for dried milk powder (Guan et al., 2005). It increases the storage period of milk. It is originated in different forms dry milk powder, whey powder and many other forms. Milk powder increase the density of milk due to which producers gets more profits.

2.2 Physical Properties of Different Types of Milk

Milk consumed by human obtained from different species of mammals as cow, buffalo, sheep, goat, camel, yak etc. milk from different species have different nutrition value shown in Table 2.1.

Table 2.1: It 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

SouSource: (Al haj Omar et al., 2010)

2.2.1 Cow Milk

Cow milk, according to Vedic, is nutritious and beneficial to the essential organs. Cow milk is essential for the growth and development of children. It requires low calories than buffalo milk and seems to be high in minerals, vitamins, and proteins. It moreover contains a lot of calcium and phosphorus. It promotes brain health, oral health, control rising obesity, protection, from cardiovascular health. This can be used to manufacture dairy products including, yoghurt, desserts, and butter. When compared to milk from Bovine, Jersey cows' milk had substantially larger amounts of total solids, owing to larger amounts of protein components (around 19%), both casein and whey proteins, and fat (by around 50%) (Ojha et al., 2018). Lots of traditional products are manufactured, such as chenna, khoa, different types of sweets which is prepared from cow milk. It contains a very low amount of fat but high amount of protein which is beneficial for both infant and adult Cow milk includes 3.7% fat, 4.8% lactose, 12.7% total solids, 3.4% protein, 0.7% ash, 86% water, casein 2.8%, it varies from breed to breed and species to species.

2.2.2 Buffalo Milk

Buffalo milk is also playing an essential role in human diet. Buffalo milk contains high amount of fat, protein and iron which is also essential for healthy heart or healthy brain. Buffalo is the world's second-largest milk-producing mammal (Medhamma et al., 2012), India generating the most buffalo milk. Buffalo milk has played a crucial role in human diet, especially in underdeveloped countries, Poor nutrition is a huge problem in these countries. Besides that, White tone with a silky texture It is just a nutrient-dense food. i.e., high in fat, lactose, protein, casein, and ash content. Buffalo milk contains 50% higher protein, 40% extra calories, approximately 40% higher calcium, and a high quantity fat than cow milk. It also contains natural antioxidant tocopherol Buffalo milk has a reduced fat content that`s because it has a reduced cholesterol level and is good for your heart. Unlike cow's milk, buffalo milk has less allergens. The milk from buffalo is smooth and rich. Buffalo milk has a complex variety of 75 volatile chemicals, with 50% of them being phthalates, 14% being aromatic hydrocarbons, 13% being ammonia compounds, 9% being acetone, 5% being hydrocarbon 2.5 % being aliphatic, and 4% being sulphate compounds. Buffalo milk has a consistency that is normally higher than other milk. The pH of buffalo milk lowers more gradually than the pH of cow milk during acidification due to higher enzymatic activity caused by its high casein and inorganic phosphate content. Buffalo milk protein molecules are thicker and more mineral-rich than cow milk casein micelles, and they can be destroyed by alkali at higher pH values. Buffalo milk proteins and cow milk proteins had a lot of sequence similarities, although buffalo milk protein s1-casein and s2-casein had lower levels of activation (El-Salam et al., 2012). The freezing point of milk, also known as the cryoscopy index, is connected to its aqueous components (lactose and soluble salts) and therefore is commonly used to identify water in milk.

2.2.3 Goat Milk

Goat milk has a comparable composition as cow milk. Goat milk is frequently turned into various indigenous goods in various regions and Latin America, but it is frequently consumed unprocessed or acidified in Africa and South Asia. India features some of the best milk breeds, including Jamunapari, Beetal, Shortbread, and Barbari, despite being the world's second-largest goat population. In compared to cow or human milk, goat milk has better digestion, ph., absorption rate, and specific therapeutic qualities in medicine and human nutrition (Yadav et al., 2016). Probiotic bacteria (Lactococcus lactis lactis, Lactococcus lactis cremoris, Lactobacillus, Leuconostoc) are present in goat milk (Perin, L. M., and Nero 2014). In goat milk, total potassium content (linked to lipid peroxides) was 65 %, compared to 29 % in human and 27 % in cow milk. If a new born baby is only nourished with goat milk, the new born is saturated in protein, calcium, phosphorus, vitamin A, thiamine, riboflavin, and other nutrients, which is necessary for their development and

healthy body, brain and heart (Cunsolo et al 2015). Goat milk consists 87.5% water, 4-4.5% fat ,2.6% casein, 4.6% lactose,0.8% ash and energy 70% (Lima et al., 2018).

2.2.4 Sheep Milk

Sheep milk contains more carbs and protein than goat and cow milk, with only bison and yak milk having more fat. Sheep milk also contains more lactose than cow's milk, buffaloes, or goats. Sheep milk is ideal for creating cheese and yoghurt because of its high protein and overall SNF content. Sheep's milk is quite significant in the Mediterranean region, where it is generally produced into cheeses, like mozzarella and ricotta etc. 82.0 % water, 7.2 % fat, 3.9 % casein, 0.7 % whey protein, 4.8 % lactose, and 0.9 % ash help compensate sheep milk (Molina, 2003). Sheep milk contains a lot of essential nutrients such as high amount of fat, vitamins, iron. It`s market value is also high as comparison to other milk. It's production and consumption are high in other countries.

2.2.5 Yak Milk

Yak milk seems to have a lovely odour and a delicious flavour. Yak milk includes 18 % solids, 5.6% of fat, & 4.4 % protein, providing it a high protein, fat, and SNF concentration than other milks. Shepherds & their families drink milky tea made from raw milk. Yak milk may be converted into a range of milk goods, such as ghee, paneer, yoghurt, & flavoured and cultured items. This milk is also beneficial for human health. It is mostly originated in China, Bangladesh.

2.3 Different Techniques to Detect Adulterants

Adulteration in milk has made food safety and regulatory officials nervous and concerned. A great range of technologies and procedures have been developed which can be employed for the identification of various milk adulterants (Nirwal and Rai 2013; Poonia et al., 2017; Reddy et al., 2017). Some procedures listed in Table 2.2**.**

Table 2.2: Different techniques used to detect adulterants in milk

S. No.	Types of adulterants	Methods to detect the adulterants	Reference
1.	Colour	Colour Capillary Electrophoresis	(Das et al., 2016)
2.	Water	Frequency admittance measurement Electrical conductivity E - NOSE Ultrasonic Transmitter Receiver system NIR: Near Infrared Reflectance [measurement] Freezing Point Osmometry	(Musa and Yang 2021).

		FPC: Freezing Point Cryoscopy Method	
3.	Urea	Potentiometric biosensor Biosensors used Field effect transistor Calorimetric technique Manometric [biosensor] Ion selective electrode used 4 sensitive CHEMFET based sensor	(Das et al., 2016)
4.	Chlorine	Potentiometric detection Sequential Injection Analysis(SIA) Flow Injection Analysis (FIA) Conductometric Sequential Injection Analysis	(Das et al.,2016)
5.	Antibodies	Electrical Conductivity BRT Test (Test kit) Spot test Liquid chromatography mass (LCM) Spectroscopy Somatic Cell Count (SCC) Screening test Biosensor assay based on surface plasmon resonance (SPR) E-Nose	(Das et al., 2016)
6.	Low value milk	optical biosensor (BIACORE 3000) tool Duplex polymerase chain reaction Electronic chromatography and polymerase chain reaction technique Enzyme linked immunoassay and polymerase chain reaction techniques	(Das et al., 2016)

		HPLC Method Sandwich IgG ELISA	
7.	Whey	RP High performance liquid chroma-tography [CE] Capillary Electrophoresis Enzyme linked immunoassay tech-nique [FDS] [BM] technique Phosphor Partition Near infrared spectroscopy [I C] Assay	(Recio et al., 2000)

2.3.1 To Detect Colour in Milk

As a result, a slew of flavouring agents is added, many of which are hazardous to one's health. For the purpose of investigation, capillary electrophoresis (CE) is used, due to which food synthetic dyes are separated. A minor sample, density and visual path is expanded using the CE technique. This technique is widely used in India and other countries for detection purposes. Amount of harmful chemicals which is hazardous to health is easily detected (Das *et al.,* 2016). Technique Used for color detection is Capillary Electrophoresis (CE).

2.3.2 To Detect Water

Water is the which is mostly found in milk. It enhances the density of milk due to which producers earns a huge amount adulterant of profit. But it causes harmful impact on human`s health. It causes a lot of harmful disease such as cardiovascular disease, and effect heart and brain as well. The technique which are widely used for detecting the water -

- FAM: Frequency admittance measurement
- EC: Electrical conductivity
- E – NOSE: Electronic Nose
- UTRS: Ultrasonic Transmitter Receiver system
- NIR: Near Infrared Reflectance
- FPO: Freezing Point Osmometry
- FPCM: Freezing Point Cryoscopy Method

2.3.3 To Detect Urea in Milk

Urea is a prominent milk adulterant used to extend the storage life of the product. Aside from that, urea is often utilized to make synthetic milk (Swetha et al., 2016). Each urea content of milk may also increase as a result of this the nutrition content is ensure which may causing hazardous effect to young ones. It's also utilized for a variety of many other things such as intensity of heat. Urea is also very harmful for health it causes kidney related diseases and effects proper functioning of kidney. Due to presence of urea many other health related problems occurs, inflammation, urine infection etc (Mihai et al 2018). For the assess mint of urea a technique is used, called Calorimetric Method. This technique is widely used for detection not in India but for many other countries.

Different techniques are used -

- Potentiometric biosensor
- Biosensors
- Field effect transistor
- Calorimetric technique
- Manometric biosensor
- Ion selective electrode used
- 4 sensitive CHEMFET based sensor (Das et al., 2016**).**

2.3.4 To Detect Chlorine in Milk

Chlorine is mainly added in milk to increase the thickness and volume of milk (Handford et al., 2016). It also causing severe diseases to health but especially in India it is widely used practice to earns profit. Chlorinated milk causes blockage of heart, and also effect muscle tissues. It also responsible for renal failure etc. Moreover, a method called as SIA analysis techniques for titration with silvery ions is used to detect chloride in milk (Lima et al., 2004). Furthermore, chlorine identification in milk is carried out in the same way, via titration and colorimetric determination. Some other techniques are following

- Potentiometric detection
- SIA analysis technique
- FIA analysis
- Conductometric analysis

2.3.5 To Detect Antibiotics -

The occurrence of antimicrobial components in milk could expose users to hidden threats (Verraes et al., 2017). Medication residues in milk are toxic which causes major health risks, such as allergies and an increase in the resistance to antibiotics causes harm to the intestines flora and some of them may include carcinogens. Additionally, it has the potential to induce cell damage. It inhibits bacterial production and results in the loss of fermentation process. The most practical approach for identifying antibiotic residues in

milk is Somatic cell count [SCC]. Furthermore, the existence of an antibacterial residue can be detected via a biochemical reagent. A different type of techniques and methods used for detection of antibiotics are-

- Electrical Conductivity
- BRT Test (Test kit)
- LCM Spectroscopy
- SCC: Somatic Cell Count
- ST: Screening test

2.3.6 To Detect Low Value Milk

Milk gets tainted by the addition of extremely low value milk to relatively high milk. For e.g., goat milk is frequently contaminated with bovine milk in order to maximize the profit. The risks associated with this procedure is none clearly explain (one's had an allergy to bovine milk), but not to trading or packaged milk. From an ethical standpoint this is a major area of distress in the food sector (Das et al., 2016). Low value liquid milk destroys the nutritional value of milk, and also reduces the quality. Due to lose of nutritional value it is not beneficial for new born baby. To detect low value milk ELISA and PCR techniques are used, it detects the inferior substances which is present in milk. Some widely used techniques for detecting the low value milk-

- BIACORE 3000 tool [optical biosensor]
- DPCR Technique
- EC and polymerase chain reaction technique
- GC Technique
- Enzyme linked immunoassay and polymerase chain reaction tech
- HPLC method
- RP HPLC
- Sandwich IgG ELISA (Das *et al.*, 2016)**.**

2.3.7 To Detect Whey in Milk

Whey is added in milk to enhancing the storage period of milk. It affects the quality as well as quantity of milk. Addition of whey, the colour of milk changes, it become whitish in colour. It is thick and smooth in texture (Chawla et al., 2011). To detect whey different methods are used such as - HPLC Method, ELISA and different techniques are used to detect whey in milk. Whey, rennet whey solid, as well as other whey products are frequent (Recio et al., 2000). Technique are **-**

- RP high performance liquid chromatography
- CE: Capillary Electrophoresis

- Enzyme linked immunoassay technique
- FDS
- BM technique
- Phosphor Partition
- Near infrared spectroscopy
- I C Assay

3. Conclusion

Based on the findings of this study, we may assume that milk adulteration is becoming a severe public health issue. Although economic benefit is one of the big factors of milk adulteration, a lack of supply due to the world's growing population has prepared the way for it as well. Despite the fact that the highest %age of milk distributed to consumers does not meet Food safety and standards guidelines. Because of the harmful effects of chemicals, drinking tainted milk can cause major health problems in humans and causing serious health issues on human being. As a result, having an effective and dependable quality control system, such as HACCP, that analyses the combined efforts of scientific communities and regulatory bodies on a regular basis. The technology interaction, as well as knowledge and information access, can all play a role in eliminating milk adulteration. The World Health Organization (WHO) has warned the Indian government that if adulteration of milk and milk products is not addressed quickly, 87 % residents will be suffering from catastrophic diseases such as cancer, renal failure and some other severe health related issues. And after some time, it become major issue for world. So different methods of testing are adapted for adulteration free milk.

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