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Assessment Of Resident Milk Samples For Adulterants And Contaminants

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Abstract

Food adulteration is a global concern and developing countries are at higher risk associated with it due to lack of monitoring and policies. However, this is one of the most common phenomena that has been overlooked in many countries. Unfortunately, in contrast to common belief, milk adulterants can pose serious health hazards leading to fatal diseases. In this study the pasteurized and fresh cow's milk samples were tested for the detection of common adulterants and observed for the results. The adulterants starch, benzoic acid and salicylic acid, soap, formalin, urea and microorganisms were detected with qualitative test. The adulterants benzoic acid and salicylic acid were found to be present in all the tested milk samples. Though the addition of benzoic acid and salicylic acid in meagre amount is permitted as it is a preservative. The other adulterants were found to be absent in all the tested samples. The presence of microorganisms was also detected in the milk samples.

Keywords: Adulterants, Milk, Quality analysis

1. Introduction

Milk and dairy product adulteration came into global concern after breakthrough of melamine contamination in Chinese infant milk products in 2008 (Xin & Stone, 2008). However, history of milk adulteration is very old. Swill milk scandal has been reported in 1850 which killed 8000 infants in New York alone (Arvind Singh, 2012). Milk is considered to be the 'ideal food' because of its abundant nutrients required by both infants and adults. It is one of the best sources for protein, fat, carbohydrate, vitamin and minerals.

Unfortunately milk is being very easily adulterated throughout the world. Possible reasons behind it may include demand and supply gap, perishable nature of milk, low purchasing capability of customer and lack of suitable detection tests (Amrita, 2005). The motivation for food fraud is economic, but the impact is a real public health concern (Muhammad Irfan Khan,2008; Singh & Gandhi, 2015). The situation is significantly worse in

developing and underdeveloped countries due to the absence of adequate monitoring and lack of proper law enforcement.

Qualitative detection of adulterants in milk can be easily performed with chemical reactions while quantitative detections are complex and diverse. Milk adulteration detection techniques need to be very specific and rapid, because defrauders have escaped condemnation claiming less effectiveness of the conventional detection techniques (Tanzia Azad,Shoeb Ahmed, 2006).

2. Materials and Methods

2.1 Collection of Samples

Milk samples of different brands were collected from the nearby grocery shop and transported to the laboratory for the quality detection using various qualitative analysis methods. The collected samples were named as S1, S2, S3 and S4. The farm fresh cow's milk was named as S1. All the samples were processed through six different quality analysis test (Webb.Bet al.,1974).

2.2 Qualitative Detection Methods

2.2.1. Detection of Starch

Milk contains relatively large amount of fat. Addition of carbohydrate to milk increases its solid content. There by reducing the amount of fat present in the milk. Starch is one such component that is added to adulterate milk. The test to detect starch in milk uses iodine solution, addition of which turns the milk solution to blue black color due to the formation of starch –Iodo complex, in the presence of starch. (Sharma.SK, 2011)

2.2.2. Detection of Benzoic and Salicylic Acid in Milk

Take 5 ml of milk in a test tube. Add 3-4 drops of concentrated sulphuric acid. Add 0.5% ferric chloride solution drop by drop and mix well. Development of buff colour indicates presence of benzoic acid and violet colour indicates presence of salicylic acid.

2.2.3. Detection of Soap

Soap is added to milk to increase the foaming of milk and thus to have thick milk. Addition of such chemicals will cause health problem especially related to stomach and kidneys. Soap can be detected by adding phenolphthalein indicator to the adulterated milk. A pink color will be observed if soap is present as the alkali will be neutralized by the acidity of the milk when phenolphthalein indicator is added.

2.2.4.Detection of Formalin

Formalin (40%) although poisonous, can preserve milk for a long time. Take 10 ml of milk in a test tube. Add 5 ml conc. sulphuric acid through the sides of the test tube without shaking. If a violet or blue ring appears at the intersection of the two layers, it shows the presence of formalin. Note violet coloration usually does not appear when relatively large quantities of formaldehyde are present

2.2.5. Detection of Microorganisms

Milk may contain some harmful microorganisms like bacteria along with some potentially beneficial microbes. Microbiological analysis of milk is carried out to determine the degree of bacterial contamination in milk and to understand the chemical changes brought in milk as a result of microbial action. Pasteurization is done to destroy such harmful bacteria. If pasteurization of milk is not carried out properly there will be presence of larger count of bacteria in the milk. Methylene blue Reduction test is used to detect the presence of bacteria in milk. This test works on the principle that the methylene blue indicator is present in an oxidized form, but in the presence of bacteria, leads to the reduction of this indicator in a comparatively short span of time. The blue color developed on addition of the indicator to the milk will change to white color within a short period indicates the presence of bacteria in the milk and thus denotes improper pasteurization.

2.2.6. Detection of Urea

Urea is generally added in the preparation of synthetic milk to raise the SNF value. 5 ml of milk is mixed well with 5 ml paradimethyl amino benzaldehyde reagent. If the solution turns distinct yellow in colour, then the given sample of milk contains urea. Control, normal milk may show a faint yellow colour due to presence of natural urea. Take 5 ml of milk in a test tube. Add 0.2 ml of fresh urease (20 mg / ml). Shake well at room temperature. Add 0.1 ml of bromothymol blue solution. Appearance of blue colour after 10 – 15 min indicates the adulteration milk with urea.

3. Result and Discussion

The milk samples collected from different areas were processed for the quality check. Four samples were tested and the presence or absence of adulterants were analyzed. The adulterant test for starch, benzoic acid, salicylic acid, soap, formalin, urea and microorganism were tested and observed for the results. The results were tabulated in table:1.

The addition of starch in the milk sample was done to increase the solid content of the milk. The iodine solution helps to identify the presence of starch in the milk. The tested samples were found to have no starch adulterant (Fig: 1a).

The benzoic acid and salicylic acid are added in milk as a preservative. The addition of excess of preservative in the milk is termed as adulterant. The presence of these acids in

the collected samples were determined using con.sulfuric acid and ferric chloride. The samples S2 and S3 (Fig: 1b) showed the presence of benzoic acid and the samples S1 and S4 showed the absence of benzoic acid.

The adulteration of soap in milk is tested by the quality check of soap with the addition of phenolphthalein indicator (ReqyiaShehzadi,Irfan Khan, 2016). The presence of soap in the milk turns the pH of the milk in alkaline condition. The tested samples were found to be absent for soap (Fig: 1c).

Table:1 Test for quality check of milk samples S1, S2, S3 and S4

S.No	*Test*	*S 1*	*S 2*	*S 3*	*S 4*
1	*Detection of starch*	✗	✗	✗	✗
2	*Detection of benzoic and salicylic acid*	✗	✓	✓	✗
3	*Detection of soap*	✗	✗	✗	✗
4	*Detection ofFormalin*	✗	✗	✗	✗
5	*Detection of microorganisms*	✗	✗	✓	✓
6	*Detection of urea*	✗	✗	✗	✗

Fig:1 Test for milk samples for different adulterants and contaminants

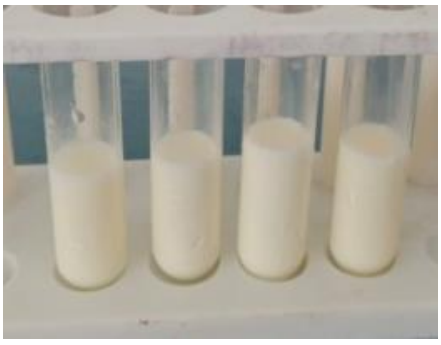


Fig:1a Detection of Starch

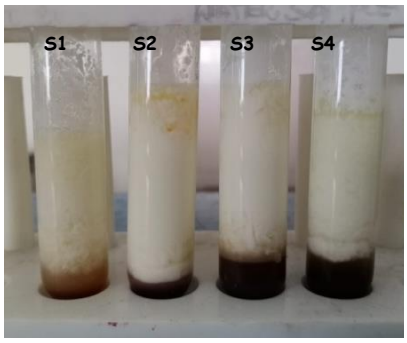


Fig:1b Detection of Benzoic acid and Salicylic acid

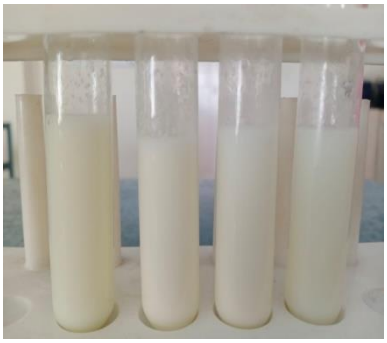
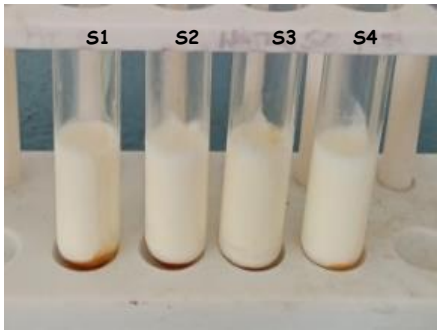
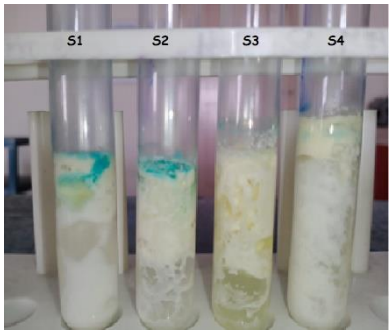


Fig:1c Detection of soap





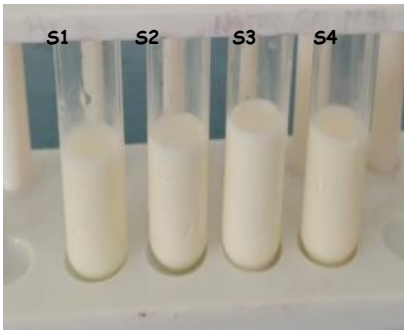


Fig:1d Detection of Formalin

Fig:1e Detection of Microorganism

Fig:1f Detection of Urea

The another most frequently adulterated substance in milk is formalin. The addition of formalin in milk is done to maintain the half life of milk. The samples were tested for the presence of formalin by the addition of sulfuric acid. All the tested samples were found to be absent for the adulteration of formalin (Fig: 1d).

The most common contamination of milk comes from the microorganisms. The four samples were tested the presence of microorganisms by incubation under sterile conditions. The cow's milk and all the other pasteurized milk was found to have the presence of microorganisms. The samples S1 and S2 showed the presence of meagre amount of microorganism and the samples S3 and S4 showed the presence of high amount of microorganism (Fig: 1e). This indicates the contamination of the milk samples.

Another adulterant to be added in the milk often is urea for the maintenance of the consistency of the milk. The presence of urea in the milk samples were identified by using benzaldehyde. The samples showed the absence of urea in the test (Fig: 1f).

All the tests were performed in our laboratory condition. The tested samples were found to be safe for consuming with minimum number of adulterants. The quality of the pasteurized milk samples and the native milk sample were found to be safe for consuming.

4. Conclusion:

Major drawbacks of these techniques are the facts that these are valid for a limited range of concentrations and are not sufficiently precise.However, qualitative detections are advantageous because they are simple, rapid and very easy to perform.Some of the edible compounds are often used as adulterants to improve the taste of the milk.Presence of those in milk can be detected rapidly. Although financial gain is considered to be one of the major reasons for milk adulteration, inadequate supply for the increasing population all over the world has paved the ground for this as well. This problem is more acute in the developing

and under developed countries due to lack of adequate monitoring and law enforcement. Existing common detection techniques are not always convenient and accessible in these countries making it difficult to address the diverse ways of fraudulent adulteration in milk. This calls for combined efforts from scientific communities and the regulatory authorities through the development, implementation and dissemination of better techniques for the detection of milk adulteration.

In addition, awareness and access to information can play vital role in these regions to overcome this issue. Some of these easy detection methods at the consumer level and state of the art techniques at the authority level can bring this problem to an end for the victims, including millions of children in the developing countries.

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