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A STUDY ON ADULTERATION AND METHODS OF DETECTION OF LOCALLY AVAILABLE BRANDS OF MILK IN HYDERABAD

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ABSTRACT

Background: Milk is an essential food in daily life. It is a blender of many essential nutrients required by the body. Milk is consumed by people of all ages. To increase the yield, adulterants are added to the milk by the seller. Addition of adulterants not only changes the quality of milk but also few adulterants have harmful impact on health. In order to prevent it, manufacturers must follow the guidelines laid by FSSAI.

Aims & Objectives: To detect adulteration in the locally available milk brands in the area of Hyderabad and Secunderabad. The main objective is to estimate the quality of the milk by detecting the presence of adulterants in the milk.

Methodology: The samples of milk were selected from the market and were subjected to various laboratory tests to check the presence of adulterants. Each sample was detected for ten different adulterants.

Results: The results were analyzed statistically by using ANOVA. The results have shown that at least one product is significantly different from the others.

Conclusion: Overall, the ANOVA results has shown that at least one product is significantly different from others. Adulteration was found among two samples from the selected samples.

Key words: ANOVA, Adulteration, FSSAI, Adulterants, Detection techniques.

INTRODUCTION

Milk is the first food to be consumed from birth since thousands of years and is widely consumed throughout the world. There are many sources of milk, cow's milk is the primary form in our diet. Milk also is consumed in various other forms like curds, buttermilk, paneer, cheese etc. It is the cheapest and complete pack of nutrients and is consumed by all the sectors of population (Dany Paul Baby, 2019).

The production is affected with the changing consumer demand patterns. The price, taste is complimented by health, social impact and experience (Deloitte. 2018). Several factors like genetics, breed, environment, stage of lactation defines the final composition of milk (Enkins TC, 2006)

Composition:

FAT: Each fat globule is surrounded by a thin layer of lipid protein complex and carbohydrates. The lipid portion composites of both phospholipids and triglycerides. Buffalo's milk contains 6.5% fat whereas cow's milk contains 4.1% fat. The fat content depends on the type of milk i.e., toned or doble toned or skim milk.

(Månsson HL, 2008)

PROTEINS: Milk has good quality protein and the biological value is over 90. Milk protein includes proteoses, peptones and milk enzymes. Whey protein constitutes alpha lactabumin and beta lactoglobulin, immunoglobulins, serum albumin and enzymes.

CARBOHYDRATE: Lactose is the chief carbohydrate present in milk. About 5% of milk is composed of carbohydrates.

MINERALS: Citrates, phosphates, sulphates, chlorides and bicarbonates of sodium, potassium, calcium and magnesium are present. Trace amount of zinc, aluminium, iodine and molybdenum are present.

COLOUR: Presence of carotene and riboflavin is the reason for yellowish colour of milk. Reflection of casein, calcium and phosphorus is responsible for whitish colour (Dany Paul Baby, 2019) (3).

NUTRITIVE VALUE:

Nutrients	Buffalo's milk	Cow's milk
Moisture	80.68 g	86.64 g
Energy	449 KJ	305 KJ
Protein	3.68 g	3.26 g
Fat	6.58 g	4.48 g
Carbohydrates	8.39 g	4.94 g
Calcium	121 mg	118 mg
Phosphorus	86.94 mg	96.56 mg
Iron	0.16 mg	0.15 mg
Vitamin A	160 mg	174 mg
Thiamine	0.05 mg	0.03 mg
Riboflavin	0.13 mg	0.11 mg
Niacin	0.07 mg	0.08 mg

Table 1: Nutritiove Value of Milk

Physical properties:

ACIDITY: pH of milk is around 6 - 6.5. Acidity decreases slightly when the milk is exposed to air.

FREEZING POINT AND BOILING POINT: The freezing point of milk is -0.55°C and the boiling point of milk is 100.2°C (Sherbon, J. W.1988), (Zamberlin Š, et al., 2012).

Pasteurisation: Pasteurization improves the quality of milk by killing the harmful micro-organisms (Holsomger VH et al.,1997). Milk is heated in various methods like HTST and UHT

Pasteurisation kills hazardous germs by heating milk briefly and then rapidly cooling it. The HTST method (High temperature short time) method holds the quality of milk by killing the micro-organisms by 99.99% although some vitamins and minerals are lost during pasteurization. In UHT (Ultra high temperature) method, the milk is treated at 72^{o} C for 15 sec.

Adulteration: Food adulteration can be defined as an act of intentionally changing the quality of food offered for sale either by the admixture or substitution of inferior substances or by the removal of some valuable ingredient. The main reasons of milk quantity and quality losses are milk adulteration, poor hygiene, malpractices, a lack of preservation technology, refrigerated facilities, and sanitary conditions. Milk is adulterated to enhance its thickness, and then starch and other reconstituted milk powders are added to boost its viscosity. Frequently used to extend the shelf life of unclean milk ice as well as other chemicals such as hydrogen peroxide, carbonates, bicarbonates, antibiotics, caustic soda, and even the most lethal chemical formalin. Urea-laced milk is extremely hazardous to youngsters since it hastens puberty.

Some adulterants, such as detergents, are used to improve the appearance of milk. When milk is exposed to water, its frothy appearance fades, hence chemical detergents are used to restore the foamy appearance. To give the milk a natural appearance, hair removal powders and urea are used to whiten it. A few grams of urea are all that is

required to restore milk to its former state. When the temperature outside is quite high during the summer, hydrogen peroxide is commonly used to preserve milk. This unethical practice is frequently adjusted to avoid financial losses due to milk deterioration during transportation and sale.

The common adulterants are sugar, water, salt, starch, chlorine, hydrated lime, Sodium carbonate, formalin, ammonium sulphate and non-milk proteins etc. To meet the deficit of milk, some people are preparing synthetic milk by mixing urea, caustic soda and common detergents which has poisonous effect.

MATERIALS AND METHODOLOGY

Study Design: Milk samples of 7 different brands locally available in the area of Hyderabad and Secunderabad were selected. The milk pouches were purchased on the day of experiment and were subjected to laboratory techniques to determine the quality of milk and adulterants present in it.

Sample size: 7 locally available milk samples.

S. No.	Sample / Brand Name	Area	Time of Collection
1	Amul	Ushodaya, Marredpally	9:40am
2	Sid's farm	Ushodaya, Marredpally	9:40 am
3.	Dodla	Ratnadeep, Marredpally	9:30 am
4.	Nandini good life	Ratnadeep, Marredpally	9:30 am
5.	Country delight	Amberpet	6:30 am
6.	Vijaya	General store , Marredpally	9:50 am
7.	Heritage	General store, Marredpally	9:50 am

Table 2: Milk Samples

Materials Required:

Milk, beakers, measuring cylinder, lactometer, test tubes, test tube stand, holder, hot water bath, electronic weighing machine, dropper, bunsen burner, tripod stand.

Fig.1: The milk samples tested

RESULTS AND DISCUSSION

1. Lactometer Test: Test for Water:

Principle: Percentage of water is determined by placing the lactometer in the milk sample.
Procedure: In 200 ml beaker milk sample is taken. Lactometer is dipped in the beaker without touching the sides of the beaker. Readings are noted.
Expected results: If the reading is 30, the milk is not adulterated with water.
If the reading is between 25 to 20, milk is adulterated with 25 % of water.
If the reading is 10, milk is adulterated with 50% of water.
Result: According to the above results, lactometer test shows that all the milk samples were not adulterated with water. Lactometer reading as 30 or above indicates that the milk is pure and not adulterated with water whereas the lactometer reading is 20, it indicates that the milk is adulterated with 25% of water. If the lactometer reading shows 10 then the milk is adulterated with 50 % of water. As the readings are closer to 30, it shows that all the milk samples are free from water adulteration.

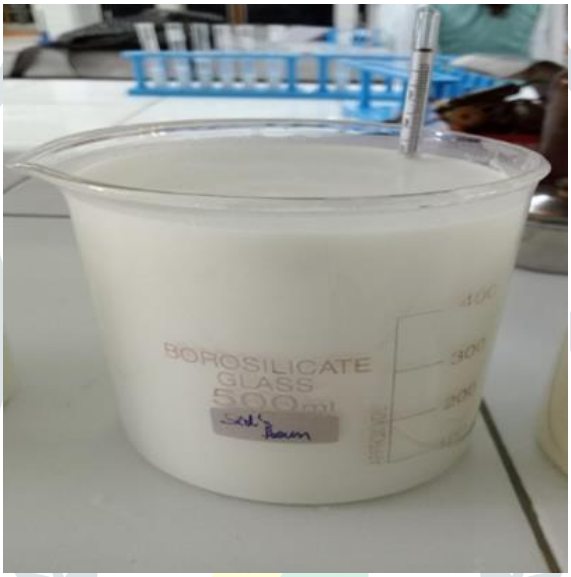

Fig. 2: Lactometer Test

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
reading 1	2	32.50038	16.25019	393.9918
reading 2	2	32.76887	16.38444	370.7671
reading 3	2	33.00132	16.50066	387.9734

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.062843	2	0.031422	8.18E-05	0.0999918	9.552094
Within Groups	1152.732	3	384.2441			
Total	1152.795	5				

Discussion: The latometers used were the small type reported in 1957 by Watson and later shown by (Madden and Brmmer, 1958) to agree closely with the gravimetric method for determining the solids content of milk.

2. Test for starch:

Chemicals required: Iodine solution.
Procedure: Take 2 ml of milk sample in a test tube. Add four drops of iodine to it.
Expected result: Appearance of blue color.

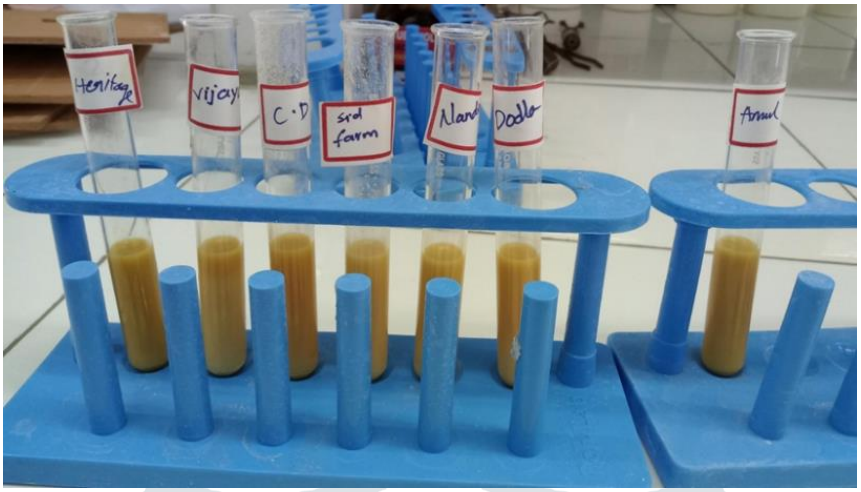

Fig.3: Test for starch

Result: According to the above test, all the milk samples are free from starch. Appearance of blue color indicates the presence of starch. All the samples did not show blue color. Hence, the milk samples are not adulterated with starch.

Discussion: According to (FSSAI, 2016)and (BIS, 1960) the tests were conducted and tested negative for the presence of starch.

3. Test for detergent:

Chemicals required: Bromo cresol purple solution
Procedure: Take 5 ml of sample and add bromo cresol purple solution to it.
Expected results: Appearance of violet color.
Appearance of faint violet colour.

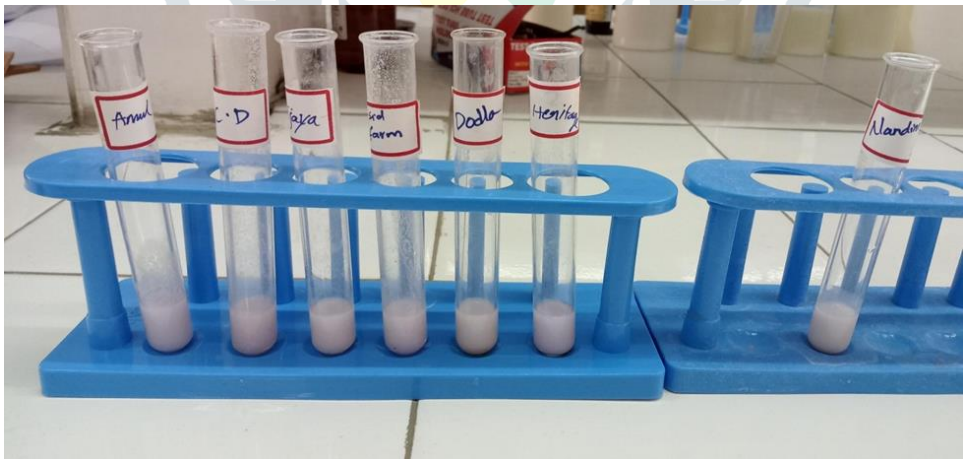

Fig 4: Test for Detergent

Result: According to the above test, all the milk samples were found free from adulteration with detergent. Appearance of dark violet color indicates the presence of detergent. As all the milk samples showed faint trio color, the result was negative for presence of detergent in the milk samples.

Discussion: According to the studies by (singh et al.,2012), (kamtania et al., 2014). Detergents are added to milk for emulsification and for producing characteristic white colour. They enhance cosmetic nature of milk.

4. Test for skim milk powder:

Chemicals required: Nitric acid
Procedure: To 2 ml of sample add 2 ml of nitric acid solution drop by drop.
Expected results: Appearance of dark orange colour

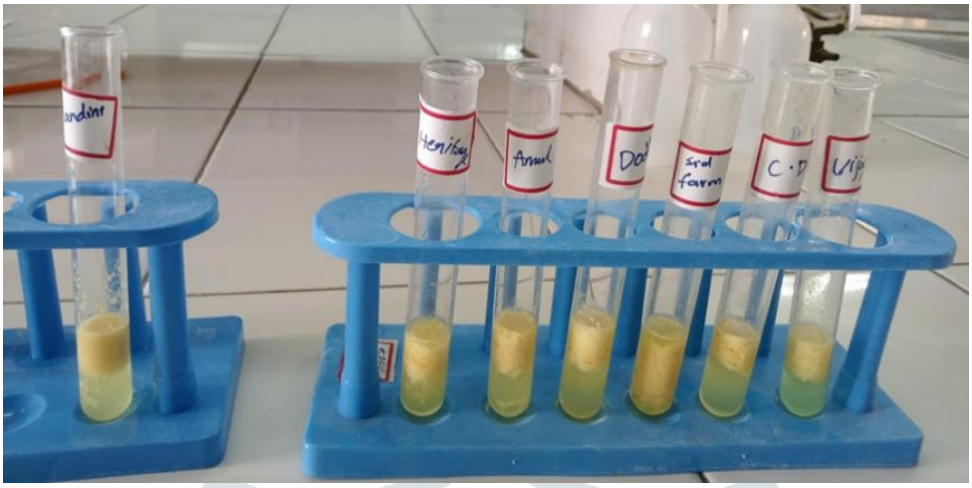

Fig 5: Test for Skim milk powder

Result: According to the above test, the milk samples are not adulterated with skim milk powder. Appearance of dark orange color represents the presence of skim milk powder in the milk. As all the samples didn't show appearance of dark orange color it shows that all the milk samples are free from adulteration with skim milk powder.
Discussion: Skim milk is added to the fresh milk for economic advantage (singh et al.,2012). This also improves the colour and quantity of milk.

5. Test for formalin:

Chemicals required: Sulphuric acid
Procedure: Take 10 ml of sample in a test tube. Add 5 ml of concentrated sulphuric acid from the sides of the tube without shaking.
Expected results: Appearance of violet or blue color.
Appearance of dark color.

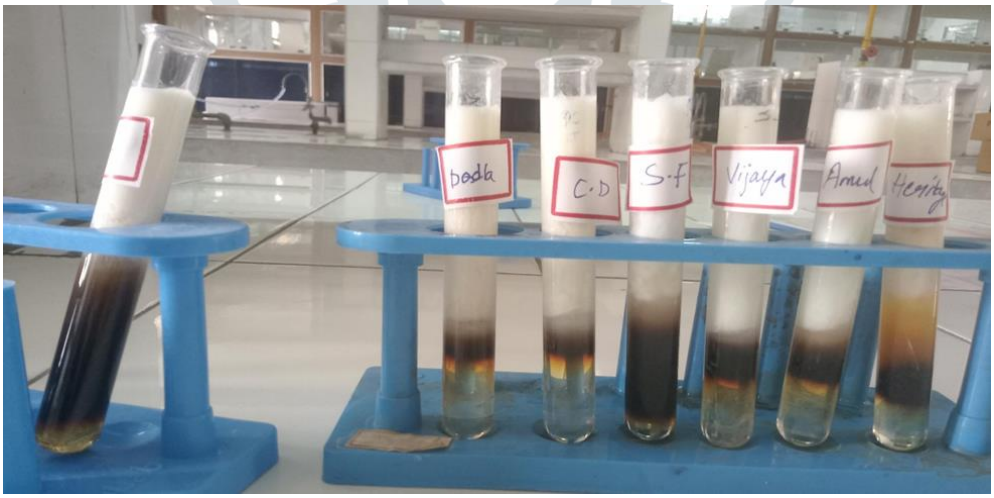

Fig 6: Test for Formalin

Result: Appearance of dark blue/ violet in sample no.2 and sample no.4

According to the above test, milk sample 2 "Sid's farm" and milk sample 4 "Nandini good life" showed positive results. Violet or blue color indicates the presence of 40% formalin. Hence all the milk samples except from Sid's farm and Nandini good life are free from formalin.

Discussion: Appearance of violet or blue color at the junction of two liquid layers indicates the presence of formalin (singh et al.,2012); (kamtania et al., 2014).

6. Test for sugar:

Chemicals required: Concentrated hydrochloric acid, Resorcinol.
Procedure: To 5 ml of sample add 1 ml of concentrated hydrochloric acid and 0.1 g of resorcinol. Place it in hot water bath for five minutes.
Expected results: Appearance of red colour
Appearance of dark color

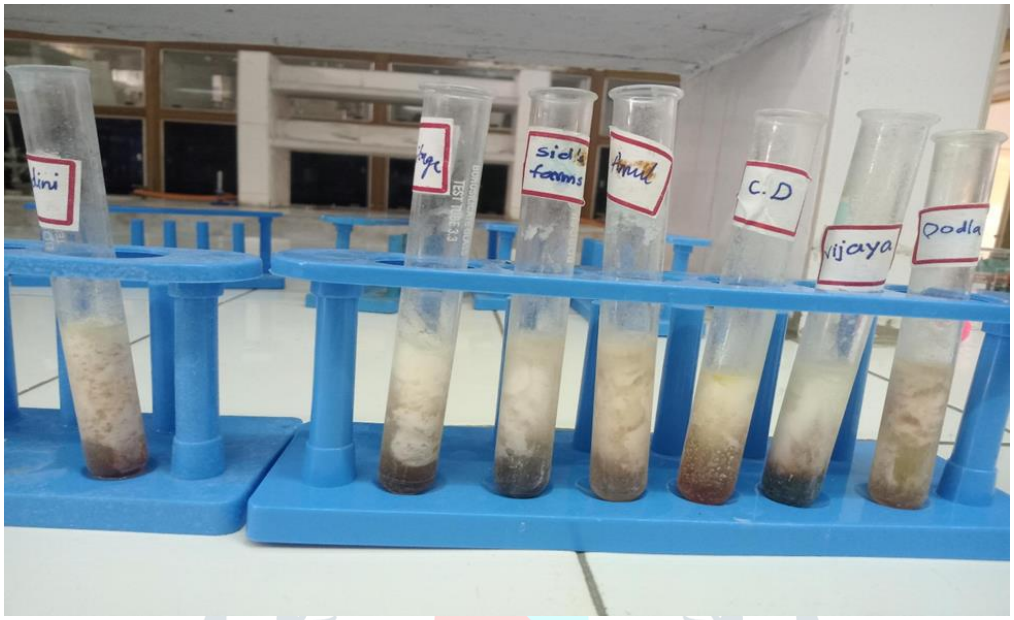

Fig 7: Test for sugar

Result: No change was observed.
According to the above test, the sample which turns red confirms the presence of sugar in milk. No milk sample was changed to red color. However, in sample 4 and 5 slight change was observed. Hence, all the milk samples were not adulterated with sugar.
Discussion: The appearance of red colour indicates the presence of formalin (Dixit, S. 2012), Srivastava, M. K. (2010). The brighter the red colour, higher is the content of formalin.

7. Test for Hydrogen peroxide:

Chemicals required: Potassium iodide reagent.
Procedure: Take 1ml of sample in a test tube. Add 1ml of potassium iodide reagent. Mix it well.
Expected results: Appearance of blue color.

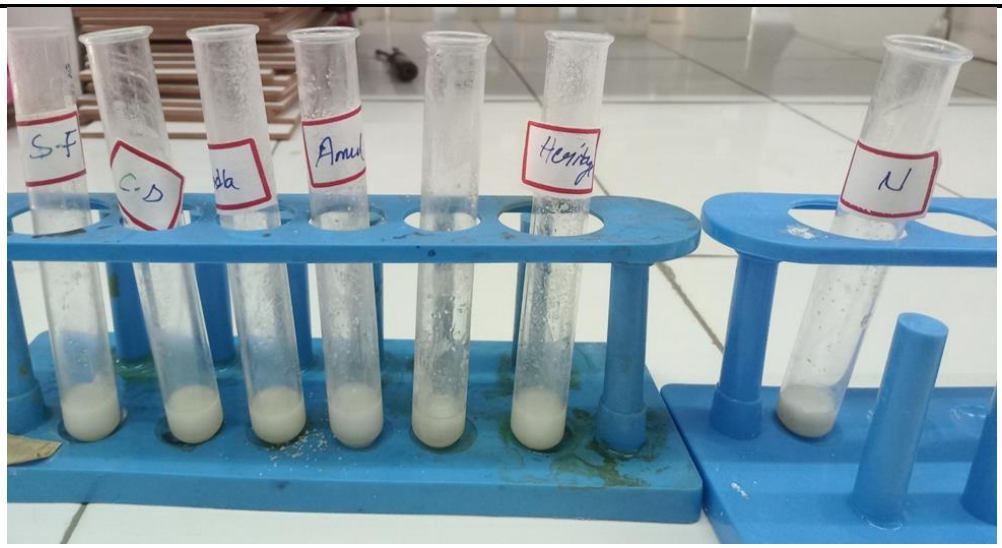

Fig 8: Test for Hydrogen Peroxide

Result: No appearance of blue color

According to the above test results, all the samples are free from adulteration with hydrogen peroxide. As no milk sample changed to blue color it confirms that there is no presence of hydrogen peroxide.

Discussion: Hydrogen peroxide (H_20_2) is commonly used as a food preservative in milk or as a sterilant in packaging materials due to its inherent sporicidal and bactericidal properties. Excess of hydrogen peroxide 15 can bring deleterious effects on the nutritional value of milk such as the degradation of folic acid, which is an essential vitamin to human body. Moreover, the ingestion of hydrogen peroxide at high levels can cause severe gastrointestinal problems. Hydrogen peroxide is not permitted in milk as per the Food Safety and Standards Regulations in India (Draaiyer J et al.,2009); (Luck, H.1962).

CONCLUSION: The above tests were carried out to check for adulteration in milk. The samples collected was available locally in the market. The samples were tested in the laboratory using few equipments and only 2 samples tested positive for formalin tests and all the samples showed negative for all the tests.

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