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DETECTION OF FOOD ADULTERANTS IN DAILY FOOD ITEMS

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ABSTRACT

Milk is one of the most important food items consumed daily by people of all age groups because of its high nutritional value. It is a rich source of essential nutrients, including proteins, fats, carbohydrates, vitamins, and minerals, which are necessary for the growth, development, and maintenance of the human body. However, milk adulteration has become a significant concern regarding food quality and consumer safety. Adulteration involves the addition of unwanted or unauthorised substances to milk, which may affect its nutritional composition, purity, and suitability for consumption.

The project entitled Detection of Food Adulterants in Daily Food Items (Milk) focuses on the study of milk quality and the identification of possible adulterants using basic chemical and analytical techniques. Common milk adulterants include water, starch, detergents, and urea. These substances may be added to increase the volume, alter the consistency, or change the apparent composition of milk. Their presence can affect milk quality and may pose potential health risks to consumers.

The main objective of this project is to understand the importance of detecting milk adulteration and to develop practical knowledge of simple laboratory testing methods. The study involves the examination of three milk samples using pH paper, iodine solution, a foam formation test, and titration with sodium hydroxide to determine titratable acidity. These methods help in studying selected characteristics of milk and screening for certain possible adulterants. A survey of 30 respondents is also included to understand public awareness, purchasing habits, and opinions regarding milk adulteration.

This project aims to create awareness about food safety, the importance of maintaining milk purity, and the role of chemical analysis in detecting possible adulteration.

KEYWORDS: Milk adulteration, food safety, milk quality, chemical analysis, starch detection, detergent detection, pH test, titratable acidity, laboratory testing, consumer awareness *etc*.

INTRODUCTION

Milk is one of the most important and widely consumed food[1] items in our daily diet due to its high nutritional value. It contains essential nutrients such as proteins, fats, carbohydrates, vitamins, and minerals, particularly calcium and phosphorus, which are necessary for the growth and maintenance of the human body. Milk[2] is consumed by people of all age groups and is also used in the preparation of various dairy products. Therefore, maintaining the purity, quality, and safety of milk is essential for protecting public health and ensuring adequate nutrition.

Food adulteration[3] is a major concern in the food industry and involves the addition of unwanted, inferior, or unauthorised substances to food products, which may affect their quality and safety. Milk adulteration may occur intentionally for economic gain or accidentally during collection, transportation, processing, and storage. Common adulterants associated with milk include water, starch, detergents[4] and urea. The addition of water can reduce the nutritional concentration of milk, while starch may be added to increase its apparent thickness. Certain other substances may alter its natural composition and potentially pose health risks to consumers. Hence, detecting possible adulteration is important for ensuring the quality and safety of milk.

Milk is a highly perishable[5] product, and its quality can also change due to improper storage, unhygienic handling, and microbial activity. Therefore, the examination of milk requires suitable chemical and analytical methods to assess its characteristics and identify possible abnormalities.

The present project, entitled Detection of Food Adulteration in Daily Food Items, focuses on the analysis of milk samples using basic laboratory techniques. Parameters[6] such as pH and titratable acidity are studied to evaluate milk quality while specific chemical tests are used to investigate the possible presence of selected adulterants or unwanted substances. The results help develop practical knowledge of chemical analysis, experimental observations, and the interpretation of findings.

LITERATURE REVIEW

2016 – Common Milk Adulteration and Their Detection Techniques

Azad and Ahmed (2016) reviewed common adulterants found in milk and the methods used for their detection. The study discussed adulterants such as water, urea, starch, detergents, and other chemical substances. The authors emphasized that milk adulteration can pose serious health risks and highlighted the importance of qualitative and quantitative testing methods to ensure milk quality and consumer safety.

2017 – Detection of Adulteration in Milk: A Review

Poonia et al. (2017) reviewed various techniques used to detect milk adulteration. The researchers discussed conventional methods and advanced analytical techniques for identifying adulterants in milk. Their study emphasized the importance of reliable detection methods for maintaining milk purity, nutritional quality, and food safety.

2019 – Application of Qualitative Tests for Detection of Adulterants in Sterilized Milk and During Its Subsequent Storage

Aparnathi et al. (2019) investigated the effectiveness of qualitative tests for detecting adulterants in sterilized milk during storage. The study examined substances such as urea, detergents, starch, glucose, formaldehyde, and hydrogen peroxide. The findings indicated that the effectiveness of detection tests varied according to the storage period and the type of adulterant present.

2021 – Milk Adulterant Detection: Conventional and Biosensor-Based Approaches

Nagraik et al. (2021) reviewed conventional and biosensor-based techniques for detecting milk adulterants. The study discussed the identification of substances such as urea, melamine, detergents, formalin, and foreign fats. The authors highlighted the potential of biosensors for rapid, sensitive, and specific detection, emphasizing their importance in improving milk quality monitoring.

2023 – Key Milk Adulterants in India and Their Detection Techniques: A Review

Yadav et al. (2023) reviewed major milk adulterants found in India and the techniques used to identify them. The study discussed the health consequences of adulteration and the limitations of conventional laboratory testing. The authors emphasized the need for affordable, rapid, and effective detection techniques, along with improved monitoring and public awareness, to ensure milk safety.

METHODOLOGY

A) QUESTIONS OF SURVEY DONE ON FOOD ADULTERATION OF MILK:

1. Do you consume milk regularly?

a) Daily
b) 3-4 times a week
c) Occasionally
d) Never

2. Which type of milk do you usually consume?

a) Packaged milk
b) Loose milk from dairy
c) Farm fresh milk
d) Powdered milk

3. Are you aware of milk adulteration?

a) Yes
b) No
c) Somewhat

4. What do you understand about milk adulteration?

a) Adding unwanted or harmful substances to milk
b) Removing cream from milk
c) Boiling
d) I don't know

5. Do you think milk adulteration is a problem?

a) Yes
b) No
c) Not sure

6. Which of the following substances do you think may be added to adulterated milk?

a) Water
b) Detergent
c) Starch
d) All of the above

7. Do you know that water can be added to milk to increase its volume?

a) Yes

b) No

c) Maybe

8. Are you aware that some adulterants can be harmful to human health?

a) Yes

b) No

c) Not sure

9. Do you check the label and expiry date before purchasing packaged milk?

a) Always

b) Sometimes

c) Never

10. What factor influences your choice of milk the most?

a) Price

b) Brand

c) Quality and purity

d) Availability

11. Have you ever suspected that the milk you purchased was adulterated?

a) Yes

b) No

c) Not sure

12. Do you know any simple method to detect milk adulteration at home?

a) Yes

b) No

c) I have heard of some methods

13. Have you ever performed a test to check the purity of milk?

a) Yes

b) No

14. Do you think chemical testing is necessary to identify milk adulteration accurately?

a) Yes

b) No

c) Not sure

15. What steps do you think would help reduce milk adulteration?

a) Regular quality testing

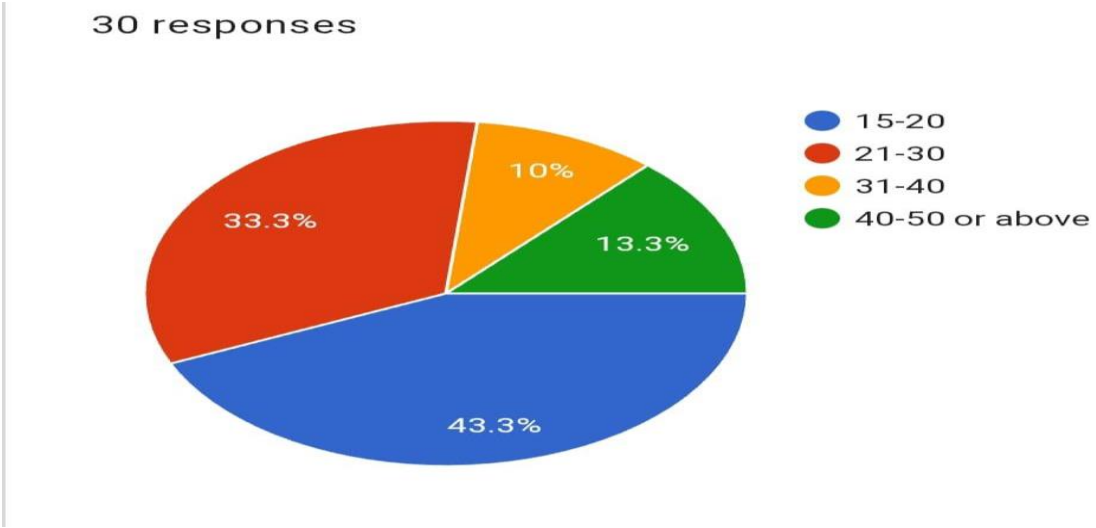
b) Strict legal action against offenders

c) Public awareness programmes

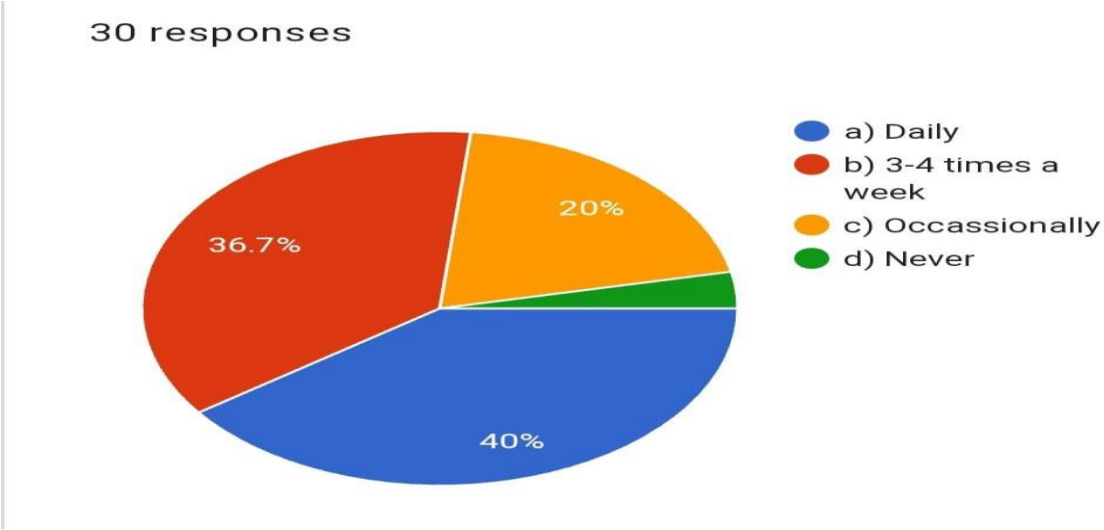
d) All of the above

B) RESPONSES: The total number of responders are 30

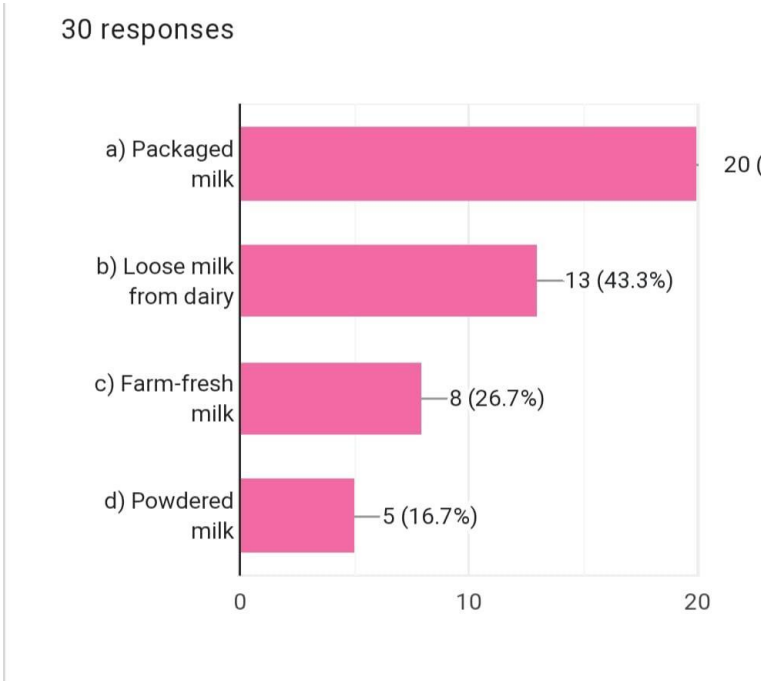
Age Group of Responders



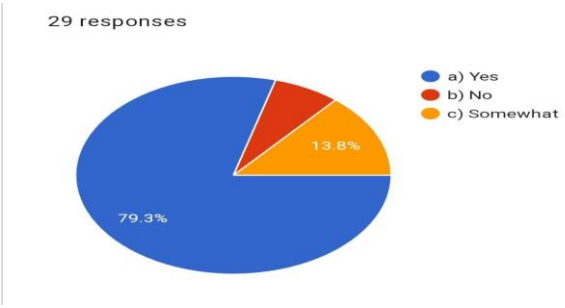
1. Do you consume milk regularly?



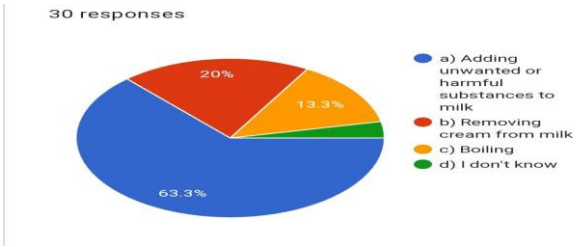
2. Which type of milk do you usually consume?



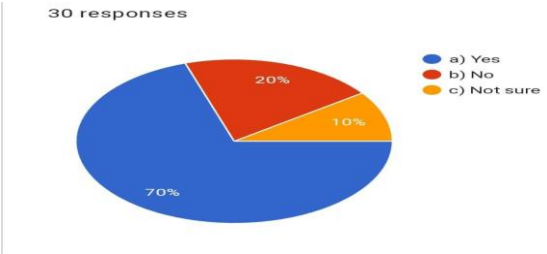
3. Are you aware of milk adulteration?



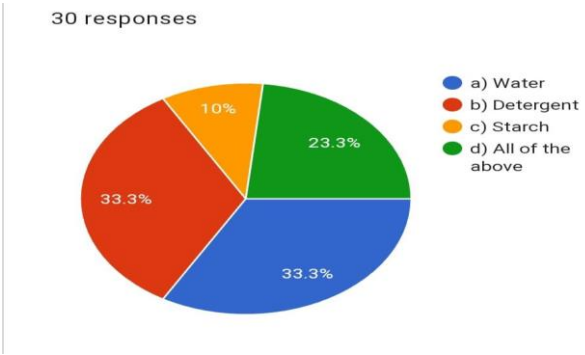
4. What do you understand about milk adulteration?



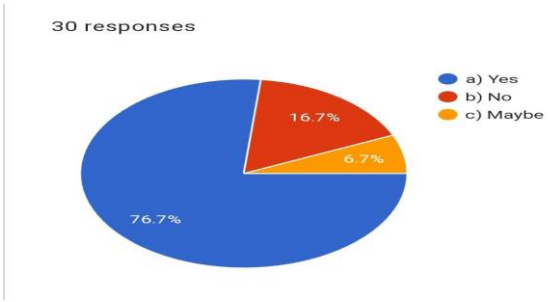
5. Do you think milk adulteration is a common problem?



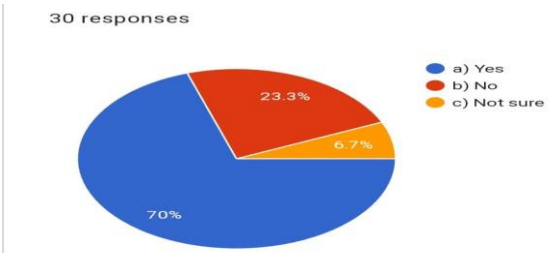
6. Which of the following substances do you think may be added to adulterated milk?



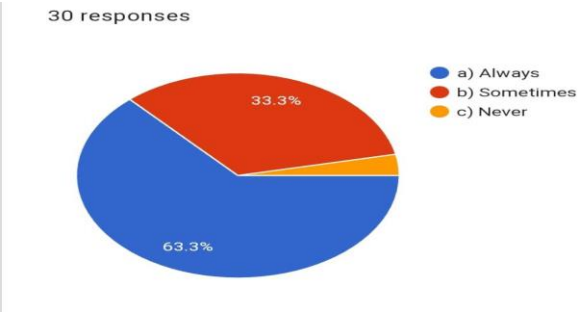
7. Do you know that water can be added to milk to increase its volume?



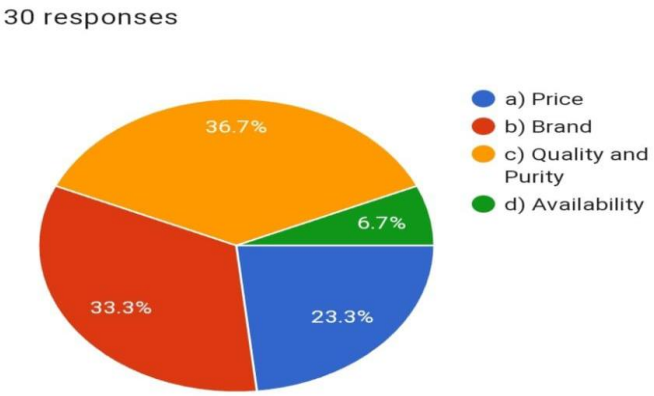
8. Are you aware that some adulterants can be harmful to human health?



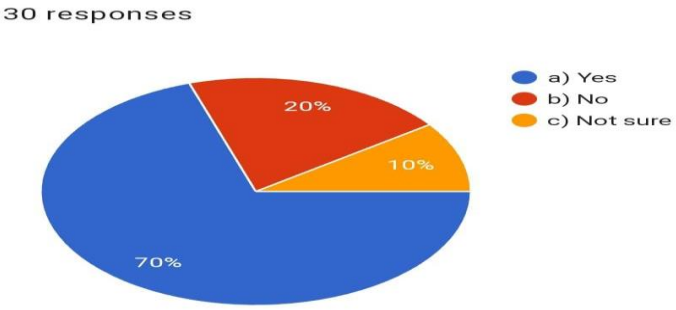
9. Do you check the label and expiry date before purchasing packaged milk?



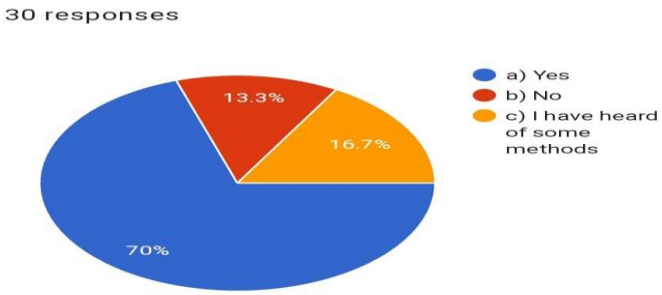
10. What factor influences your choice of milk the most?



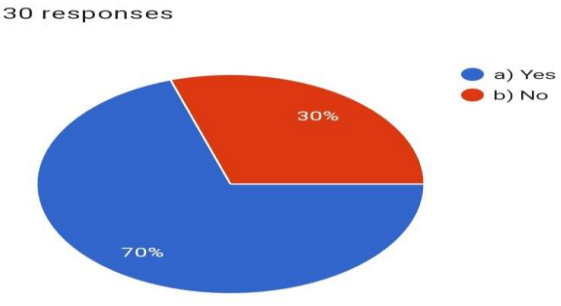
11. Have you ever suspected that the milk you purchased was adulterated?



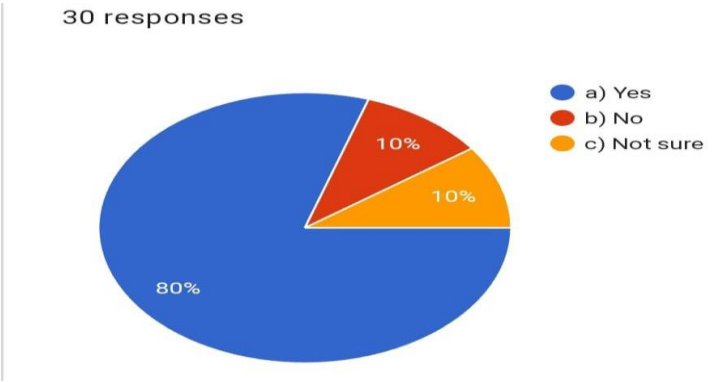
12. Do you know any simple method to detect milk adulteration at home?



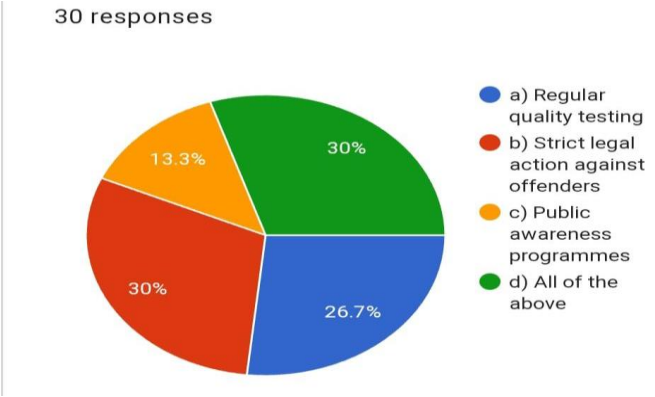
13. Have you ever performed a test to check the purity of milk?



14. Do you think chemical testing is necessary to identify milk adulteration accurately?



15. What steps do you think would help reduce milk adulteration?



C) TESTS DONE ON MILK ADULTERATION

a) Ph TEST OF MILK USING pH PAPER

1. Aim: To determine the approximate pH of three milk samples (Sample 1, Sample 2 and Sample 3) using pH paper and assess their acidity or alkalinity.

2. Requirements: Three milk samples (Sample 1, Sample 2 and Sample 3) ,pH paper or universal indicator paper, Three clean beakers or test tubes, Glass rod or dropper, pH colour chart.

3. Procedure

1.Take 10 mL of each milk sample in separate, clean beakers.

2. Dip a separate strip of pH paper into each sample or place a drop of milk on the paper using a clean glass rod.

3.Observe the colour change in each strip.

4.Compare the colours with the pH colour chart.

5.Record the approximate pH values and observations.

4. Observation table

Sample	Colour observed	Approximate pH	Nature
Sample 1	Green	7	Neutral
Sample 2	Green	7	Neutral
Sample 3	Green	7	Neutral

5. Result: All three milk samples showed a green colour on the pH paper, indicating an approximate pH of 7 and a nearly neutral reaction.

6. Conclusion: The pH paper test indicated that all three milk samples were nearly neutral.

b) Detection of starch in milk using Iodine solution.

1. Aim: To detect the presence of starch as an adulterant in three milk samples using Iodine solution.

2. Requirements: Three milk samples, Iodine solution, three clean test tubes , droppers, measuring cylinder, distilled water.

3. Principle: Starch reacts with Iodine to produce a blue black colour due to the formation of a starch Iodine complex. The appearance of this colour indicates the possible presence of starch in the milk sample.

4. Procedure

1. Take approximately 5 ml of each milk sample in three separate , clean test tubes.
2. Add 2-3 drops of iodine solution to each test tube.
3. Mix the contents gently.
4. Observe the colour change in each sample.
5. Record the observations.

5. Observation Table

Sample	Colour after adding Iodine	Observation
Sample 1	Yellowish	Starch not detected
Sample 2	Yellowish	Starch not detected
Sample 3	Yellowish	Starch not detected

6. Result: No blue black colour developed in any of the three milk samples. Therefore, starch was not detected by this test.

7. Conclusion: The iodine test indicated the absence of detectable starch in Samples 1, 2 and 3. The samples did not show the characteristic blue-black colour associated with starch.

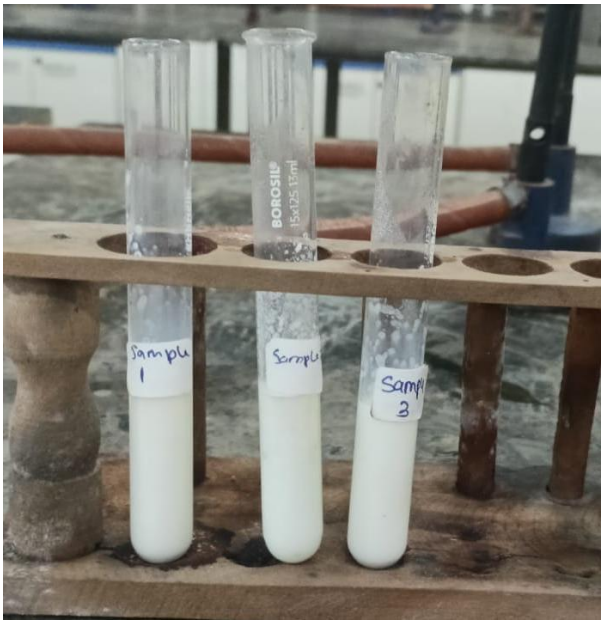


IMAGE OF STARCH TEST DONE ON MILK

c) Screening of milk for possible detergent adulteration:

1. Aim: To screen three milk samples for possible detergent adulteration by observing foam formation and its persistence after shaking.

2. Requirements: Three milk samples, three clean test tubes or transparent glass containers, measuring cylinder, distilled water, stopper.

3. Procedure

1. Take approximately 5 ml of each sample in separate, clean test tubes.
2. Close the tubes with clean stoppers or lids.
3. Shake each sample gently uniformly for a few seconds.
4. Observe the amount of foam formed immediately after shaking.
5. Allow the samples to stand and observe whether foam persist or disappears
6. Record the observations.

4. Observation table

Sample	Observation after shaking	Interpretation
Sample 1	A small amount of foam formed and then faded	No clear evidence of persistent foam
Sample 2	No noticeable foam formed	Detergent not indicated by this screening test
Sample 3	No noticeable foam formed	Detergent not indicated by this screening test

5. Result: Sample 1 showed a small amount of foam that disappeared after some time, whereas Samples 2 and 3 showed no noticeable foam formation.

6. Conclusion: The foam test did not show persistent foam in any of the three milk samples. Therefore, detergent adulteration was not indicated by this preliminary test.

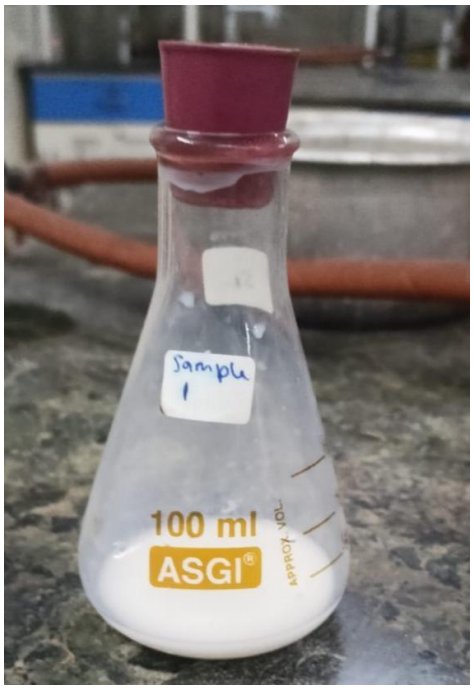


IMAGE OF TEST OF DETERGENT DONE ON MILK

d) Determination of Acidity in milk by NaOH titration.

1. Aim: To determine the titratable acidity of three milk samples by titration with sodium hydroxide (NaOH) solution using phenolphthalein as an indicator.

2. Requirements: Three milk samples (Sample 1, Sample 2 and Sample 3), Standard NaOH solution (0.1 N), Phenolphthalein indicator, Burette, Pipette, Conical flask, Measuring cylinder, Distilled water.

3. Procedure

1.Take 10 mL of each milk sample separately in a clean conical flask.

2. Add approximately 10–20 mL of distilled water.

3. Add 2–3 drops of phenolphthalein indicator.

4. Fill the burette with 0.1 N NaOH solution.

5. Titrate each sample with NaOH while swirling the flask gently.

6. Stop when a faint pink colour persists for about 30 seconds.

7. Record the volume of NaOH used for each sample.

4. Observation Table

Sample	**Volume of milk**	**NaOH used**
Sample 1	**10 mL**	**3.0 mL**
Sample 2	**10 mL**	**2.5 mL**
Sample 3	**10 mL**	**3.0 mL**

5. Calculation

Titratable acidity, expressed as percentage of lactic acid, is calculated using:

%Acidity = V× N × 9/ Volume of milk (mL)

Where:

- V = volume of NaOH used (mL)
- N= Normality of NaOH
- 9 = lactic acid equivalent factor

Assuming 0.1 N NaOH and 10 mL milk:

Sample 1 : 3.0× 0.1× 9/10 = 0.27%

Sample 2 : 2.5× 0.1× 9/ 10 = 0.225%

Sample 3 : 3.0× 0.1× 9/10 = 0.27%

6. RESULT

Sample	NaOH used	Titratable Acidity (% lactic acid)
Sample 1	**3.0 mL**	**0.270%**
Sample 2	**2.5 mL**	**0.225%**
Sample 3	**3.0 mL**	**0.270%**

7. Conclusion: Samples 1 and 3 showed the highest titratable acidity, at 0.270%, while Sample 2 showed a lower value of 0.225%. These results indicate differences in the titratable acidity of the samples. Sample 2 is better than the other two samples based on this test.

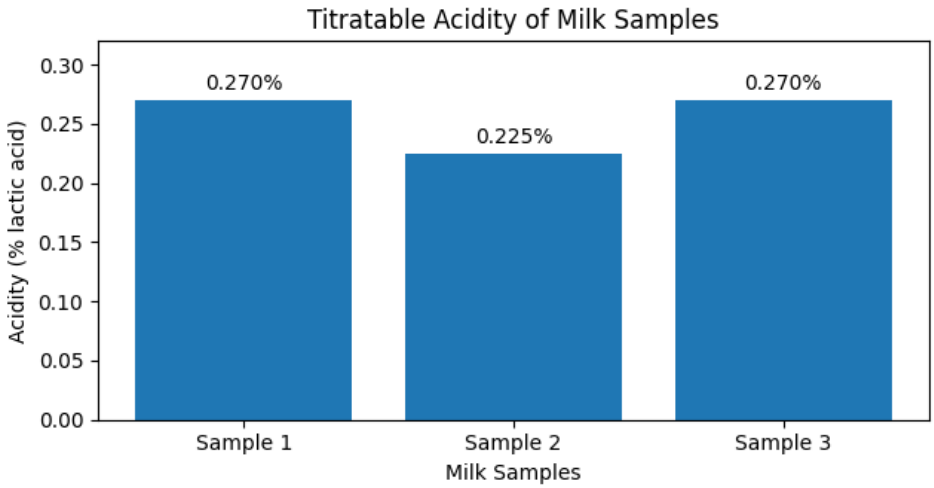
OBSERVATION AND ANALYSIS

The present study was conducted to examine three milk samples using simple chemical tests to assess their quality and check for the possible presence of selected adulterants. The tests included pH determination, detection of starch using iodine solution, screening for detergent through foam formation, and determination of titratable acidity using sodium hydroxide (NaOH) titration.

The pH test showed that all three milk samples had an approximate pH of 7, as indicated by the green colour of the pH paper. This suggested a nearly neutral reaction under the conditions of the experiment. However, pH paper provides only an approximate reading and cannot independently establish the purity of milk.

In the starch detection test, all three samples retained a yellowish colour after the addition of iodine solution. No characteristic blue-black colour was observed, indicating that starch was not detected in any of the samples using this test.

The detergent screening test showed that Sample 1 produced a small amount of foam, which disappeared after some time. Samples 2 and 3 showed no noticeable foam formation. Since persistent foam was not observed in any sample, the preliminary test did not indicate clear evidence of detergent adulteration.



The titration test revealed differences in the titratable acidity of the samples. Samples 1 and 3 required 3.0 mL of 0.1 N NaOH and showed an acidity of 0.270 % expressed as lactic acid. Sample 2 required 2.5 mL of NaOH and showed an acidity of 0.225 %. Therefore, Sample 2 had the lowest titratable acidity, while Samples 1 and 3 had equal values. These differences indicate variation in the acidity of the tested samples but do not, by themselves, prove adulteration or establish which sample is safest.

CONCLUSION

The project entitled Detection of Food Adulterants in Daily Food Items (Milk) was conducted to examine three milk samples using basic chemical tests to assess their quality and detect the possible presence of selected adulterants. The tests included pH determination, starch detection using iodine solution, detergent screening through foam formation, and titratable acidity determination by NaOH titration.

The results showed that all three milk samples had an approximate pH of 7. In the iodine test, no blue-black colour appeared, indicating that starch was not detected in any sample. The detergent screening test showed that Sample 1 produced a small amount of foam that disappeared after some time, while Samples 2 and 3 showed no noticeable foam. Therefore, the tests did not provide clear evidence of starch or detergent adulteration. The titration results showed that Samples 1 and 3 had a titratable acidity of 0.270%, whereas Sample 2 had a lower acidity of 0.225%. These findings indicate differences in the acidity of the samples but do not independently establish their purity or safety.

Based on the findings, it is recommended that milk quality should be checked regularly using appropriate laboratory methods. Consumers should purchase milk from reliable sources, check packaging and expiry dates, and follow proper storage instructions. Awareness programmes should be conducted to educate people about milk adulteration, its possible health effects, and the importance of food safety. Further testing should be carried out to detect other possible adulterants, such as urea and added water, using suitable analytical methods. Future studies should also include a larger number of milk samples from different sources to obtain more representative results.

In conclusion, this project improved practical knowledge of chemical analysis and highlighted the importance of maintaining milk purity and quality. Although the preliminary tests did not indicate detectable starch or persistent detergent-related foam, further confirmatory testing is necessary to establish the overall quality and safety of the samples. Regular testing, consumer awareness, hygienic handling, and strict food safety monitoring are essential to protect public health and ensure the availability of safe and wholesome milk.

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