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Determination of the Percentage of Fat in Milk

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ABSTRACT : The Fat content of milk is of economic importance because milk is sold on the basis of fat. Milk fatty acids originate either from microbial activity in the rumen, and transported to the secretory cell through the blood and lymph, or from synthesis in the secretory cells. The main milk lipids are a class called triglycerides which are comprised of a glycerol backbone binding up to three different fatty acids. The Fatty acids are composed of a hydrocarbon chain and a carboxyl group.

KEYWORDS: Triglycerides, Fatty acids, Glycerol, Hydrocarbon chain, Carboxyl group.

I. INTRODUCTION

The role of milk in nature is to nourish and provide immunological protection for the mammalian young. Milk has been a food source for humans since prehistoric times, from human, goat, buffalo, sheep, yak, to the focus of this section –domesticated cow milk. Milk is the only articles of diet whose sole function in nature is food. It is not surprising, therefore, that the nutritional value of milk is high.[1][2] Milk is also a very complex food with different molecular species found.

Composition of milk

Water-87.3%

Fat-3.9%

Solids not fat-8.8%

Protein-3.25%

Lactose-4.6%

Minerals-0.65%

Acids-0.18%

The Fat content of milk is of economic importance because milk is sold on the basis of fat. Milk fatty acids originate either from microbial activity in the rumen, and transported to the secretory cells the blood and lymph, or from synthesis in the secretory cells. [4]The main milk lipids are a class called triglycerides which are comprised of a glycerol backbone binding up to three different fatty acids.[3] The fatty acids are composed of a hydrocarbon chain and a carboxyl group. The major fatty acids found in milk are:

Long chain

1.C14-Myristic 11%

2.C16-Palmitic 26%

3.C18-Stearic 10%

4.C18:1-Oleic 20%

Short chain

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- 1.C4-Butyric
- 2.C6-Caproic
- 3.C8-Caprylic
- 4.C10-Capric

Butyric fatty acid is specific for milk fat of ruminant animals and is responsible for the rancid flavour when it is cleaved from glycerol by lipase action. Saturated fatty acids such as unmyristic, palmitic, and stearic make up two thirds of milk fatty acids. Oleic acid is the most abundant unsaturated fatty acid in milk with one double bond. While the cis form of geometric isomer is the most common found in nature, approximately 5% of all unsaturated bonds are in the trans position as a result of rumen hydrogenation.[5] Triglycerides account for 98.3% of milk fat. The distribution of fatty acids on the triglyceride chain, while there are hundreds of different combinations, is not random. The fatty acid pattern is important when determining the physical properties of the lipids. The small amounts of mono-diglycerides and free fatty acids in fresh milk may be a product of early lipolysis or simply incomplete synthesis. Other classes of lipids include phospholipids which are mainly associated with the fat globule membrane, and cholesterol which is mostly located in the fat globule core.

II. EXPERIMENTAL METHODS

Samples of milk were collected from different places, like Panakudi, Rosemiapum, Veerapandian, Vadalivilai, Mavadi, Thirukkurankudi, Kalakkad, Kaduvetti, Nanguneri, Padalayarkulam, Earvadi were collected and their percentage of fat were analysed by using Fat Test (Gerber's test)[6]

2.1. APPARATUS REQUIRED:

1. Butyrometer stand – 1
2. Butyrometer – 1
3. 10.75 ml pipette – 1
4. 1 ml pipette – 1 (Tilted Measure)
5. 10 ml pipette – 1 (Tilted Measure)
6. Lock Stopper-1
7. Stopper Khee – 1

Chemicals required:

1. Diluted Sulphuric Acid (10 ml)
2. Amyl Alcohol (1 ml)

2.2. PROCEDURE:

(i) Transfer 10 ml of Sulphuric Acid into the butyrometer using 10 ml pipette keeping care not to wet the neck of the butyrometer with acid.

(ii) Prepare the milk sample by warming on a water bath to 27°C for fresh milk and gently pouring the milk into another clean dry vessel and back to the original. Repeat this process of pouring back and forth until the milk is mixed thoroughly yielding a homogeneous fluid. Allow the mixed sample to stand for 3-4 minutes so that any trapped air bubble may escape. Finally, mix the milk by gently inverting the sample bottle 3 to 4 times and remove 10.75 ml of the same with the specific pipette.[7]

(iii) Deliver 10.75 ml milk as pipetted under the proceeding step into the butyrometer containing 10 ml H₂SO₄. The milk is added very carefully and slowly by touching the tip of the pipette jet to the base of the neck of the

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butyrometer and slanting the pipette so that its delivery tube tests on the lower end of the neck of the butyrometer. In this position the pipette stands at 45° angle to the vertical axes of the butyrometer. Holding the pipette thus, gently release the index finger closing the tip of the pipette so that the milk flows gently along the inner wall of the butyrometer and rests on top of the layer of H_2SO_4 without mixing with the acid as far as possible. When the outflow of milk has ceased, wait for 3 seconds and raise the pipette tip from the butyrometer taking care not to wet the neck of the butyrometer with milk. Again lower down the tip of the pipette and touch the inside of the butyrometer neck momentarily, to release the last drop of milk from the tip of the pipette.

(iv) Add 1 ml of amyl alcohol using 1 ml pipette so that the neck of the butyrometer remains dry.

(v) Close the neck of butyrometer firmly by inserting the stopper fully so as not to disturb the contents inside.

(vi) Carefully shake the contents of the butyrometer by applying gently swirling motion. When the contents are thoroughly mixed without any charring, the curd is completely dissolved without leaving any suspended white particles. Finally mix the contents again by gently inverting the butyrometer a few times.

(vii) Transfer the butyrometer to a water bath maintained at $67^{\circ}C$ and allow into stand with the bulb uppermost in water bath for not less than 5 minutes. The water level in the bath shall remain sufficient to cover the top of the fat column in the butyrometer.

(viii) Remove the butyrometer from water bath, dry it with a cloth and transfer it to the centrifuge, taking care to place two butyrometers diametrically opposite so as to balance the rotating shaft. Centrifuge for 4 minutes at the maximum speed.

(ix) After the centrifuge has stopped, gradually transfer the butyrometer from centrifuge with stopper downwards and place again into water bath at $65^{\circ}C$.

(x) Remove the butyrometer from water bath, not before 3 minutes and not after 10 minutes of placing it in the bath.

(xi) Hold the butyrometer vertically with the graduated end upward and at eye level. Take the reading of the butyrometer from the two markings on the scale which correspond to lowest pint of the clear fat meniscus and to fat acid interphase. Before taking the butyrometer reading, adjust the position of the fat column by manipulating the stopper. So that the lower end of the fat column is brought within the graduation mark. The difference between the two scale readings gives the percentage of fat in the milk. Read the butyrometers of the nearest half of the scale division, that is, within precision of 0.05% fat.[8]

TABULATION:

Milk sample	Temperature	% of Fat
1.panakudi	29	3.9
2.Rosmiapuram	29	4.2
3.Veerapandian	29	3.8
4.Vadalivilai	29	4.1
5.Mawadi	29	4.2
6.Thirukkurankudi	29	4.3
7.Kalakkad	29	3.9

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8.Kaduvetti	29	4.5
9.Nanguneri	29	3.5
10.Padalayarkulam	29	4.7

III.RESULT AND DISCUSSION

The fat content in the cow's milk samples taken from various places, namely, Panakudi,Rosemiapuram, Veerapandian, Vadalivilai, Mawadi, Thirukkurankudi, kalakkad, Kaduvetti, Nanguneri and Padalayarkulam ranges from 3.7% to 4.4%.Fat test is helpful for determining the amount of fat %present in the milk sample

IV.CONCLUSION

Samples of milk from different places of panakudi,Rosemiapuram,Vadalivilai,Mawadi,Thirukkurankudi,Kalakkad,Kaduvetti,Nanguneri,Padalayarkulam,Ear wadi were collected and their % of fat were analysed by using Gerber test.Fat test is used to note the percentage of fat present in the milk sample.Reagents such as dilute sulphuric acid and Amyl alcohol is used for this test.The percentage of fat is 3.7% to 4.9%

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