



Analysis of Contents and Contaminants in Milk and Milk Products

O. Suhru Latha, R. Jasmin Sajini*, K. Chitra and Dipti. S

Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai-600116

Received: 10 Mar 2019 / Accepted: 9 Apr 2019 / Published online: 1 Jul 2019

*Corresponding Author Email: karthikjasmin0214@gmail.com

Abstract

Milk is the secreted fluid of the mammary glands of female mammals. Since the initial times, mankind has used the milk of goats, sheep, and cows as food. Milk plays an important part in human life as its calcium, protein and fat content and this is necessarily needed food for infant and children. Milk is usually viewed as nutritious food with lots of vitamins, minerals, and fats, proteins etc with all these nutrients. Sometime milk and its products are contaminated by various substances via manure, drugs used in infectious state of cow, and insecticide. The aim of present study is to evaluate contents of milk products like milk, Cheese, Curd, Butter, Ghee and also to Analyse the presence of contaminants substance by qualitative and quantitative determination.

Keywords

Milk, Fats, Contents, Contaminants

1. INTRODUCTION:

Milk is composed of lactose and proteins, fats and minerals. In total composition around 31 % of fat present in milk which provides more energy. These fat contents make milk in soft texture and creamy taste. The variety of milk products are consumed by humans like cream, butter, yogurt, ice cream, and cheese. Milk and milk products are rich in nutrients, contain high moisture and have neutral pH. Based on the above characteristics, milk easily helps for growth and multiplication of many bacteria. Even pasteurized or refrigerated milk has tendency to be contaminated with many bacteria. The various sources of these contaminations from air, milking equipment, feeds, soils, faeces and housing will cause diseases like tuberculosis, brucellosis, listeriosis, and different kinds of gastrointestinal disorders. Moulds such as *Aspergillus flavus* and *Aspergillus parasiticus* have a capability to produce toxic substance aflatoxins which were introduced

through cattle feed. Aflatoxins are a group of highly toxic secondary metabolic products produced from these types of fungi. Pesticides have a capability to produce health risk in human.

2. COMPOSITION OF MILK:

V. GANTNER et al, 2015 estimated milk and fat composition from different species and also discussed similarities and comparison to women's milk with some milk species. As we know majority of milk contains carbohydrate (lactose), fat, protein, mineral its composition varies based on different factors such as type of species, animals feed and the stage of lactation. In the same species also, it depends on genetics composition will vary.

3. POSSIBLE CONTAMINATION IN MILK:

Contamination of milk occurs from various sources which are:

A. Contamination due to External Factors:

a) On the Farm:

- After the milking process, the milk is contaminated by various environmental bacteria due to improper storage.
- Various environmental sources include soil, water or the manure used.
- Undesirable bacteria from these sources include lactic streptococci, coli form bacteria, micrococci, enterococci, which are found in the soil manure.

b) In Transit at the Manufacturing level:

- Various tanker trucks, transfer pipes, sampling utensils and vessel at the milk mart contaminate the milk.
- Unclean hands and arm of employees also is the major source of information as pathogen may be present.

B. Contamination from cow:

a) From the udder Interior:

- Many bacterial species are present in the udder of the cow, which may enter into the milking tracts of the cow.
- As it enters the teats, it contaminates the milk of the cow.
- In spite of aseptic milking 100 to 10,000/ml counts have been reported.

b) From the Exterior udder:

- The udder gets in contact with the soil, and the bacteria from soil contaminate the milk.

c) Coat of the milk:

- The coat of the cow being directly exposed to the environment can contaminate the milk.
- Bacillus species contribute to the ropiness of the milk.

II. Quantitative analysis:

- Estimation of casein in different branded milk and given sample Id as A, B, C, D, E

Procedure:

- 100ml of milk was taken then it was treated with Dil. Acetic acid. The precipitation of protein was observed, this precipitate protein was filtered, and it was dried in the oven for 24hrs to remove any adhering moisture. Then the amount of casein was weighed, and its percentage was calculated.

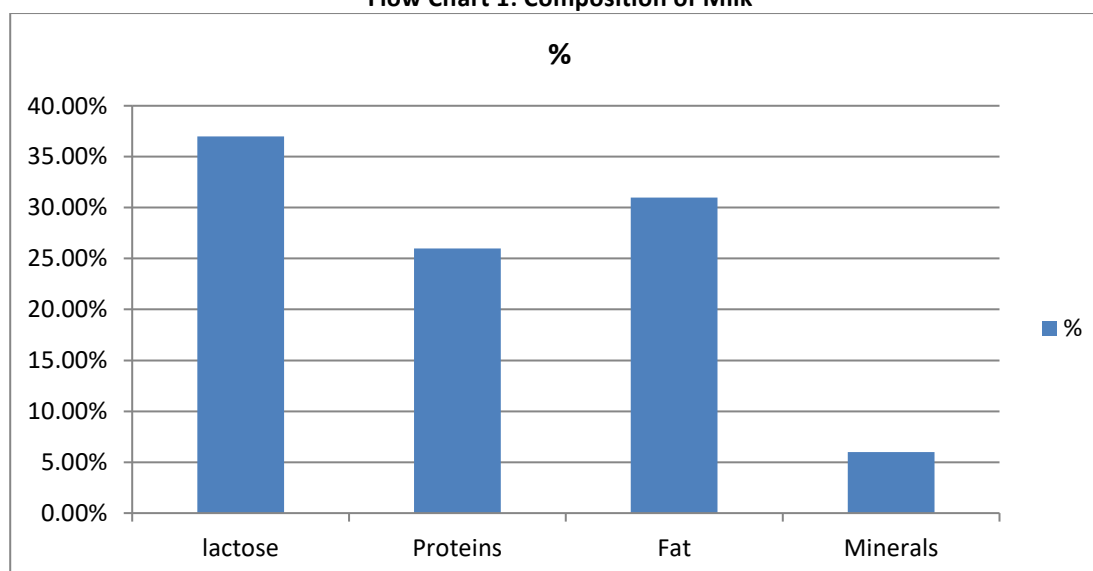
II. Quantitative analysis:

- Estimation of casein in different branded milk and given sample Id as A, B, C, D, E

Procedure:

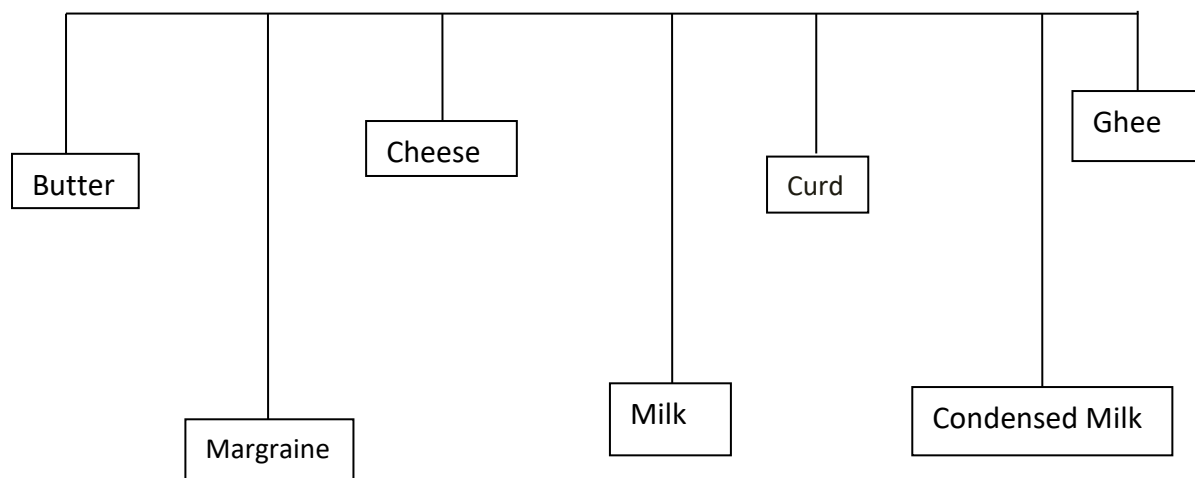
- 100ml of milk was taken then it was treated with Dil. Acetic acid. The precipitation of protein was observed, this precipitate protein was filtered, and it was dried in the oven for 24hrs to remove any adhering moisture. Then the amount of casein was weighed, and its percentage was calculated.

Flow Chart 1: Composition of Milk

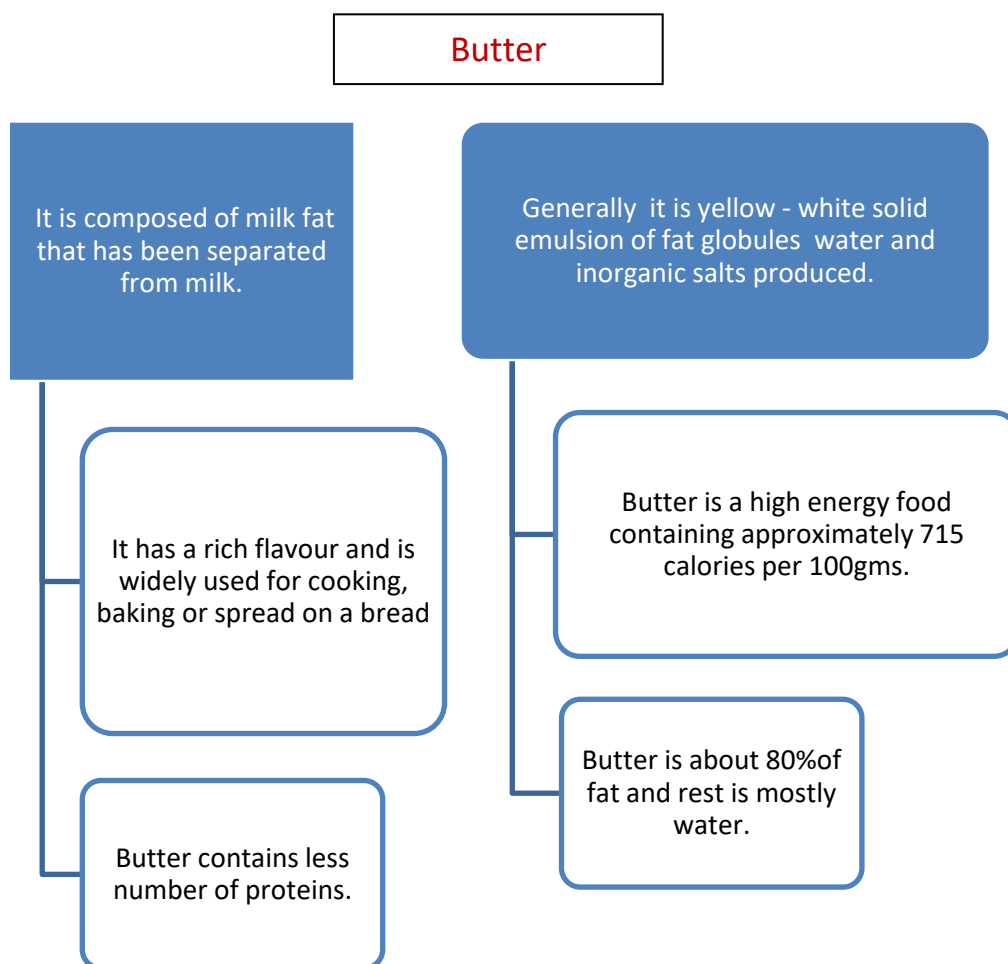


Flow chart :2 Classification of various milk products:

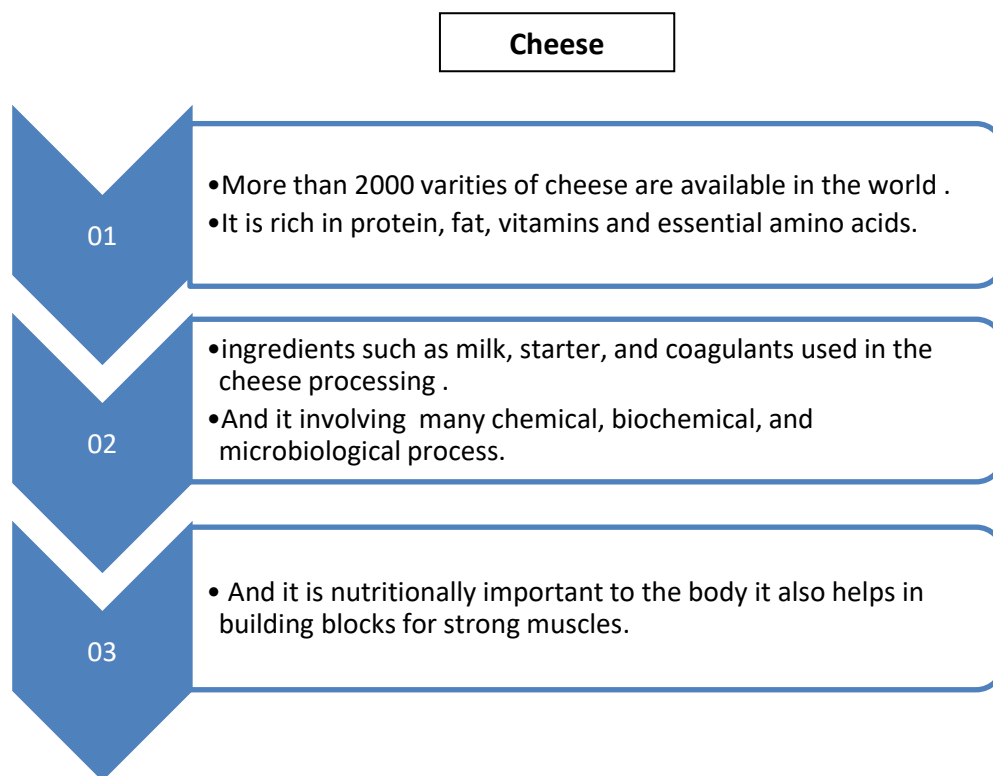
Various milk products available in market



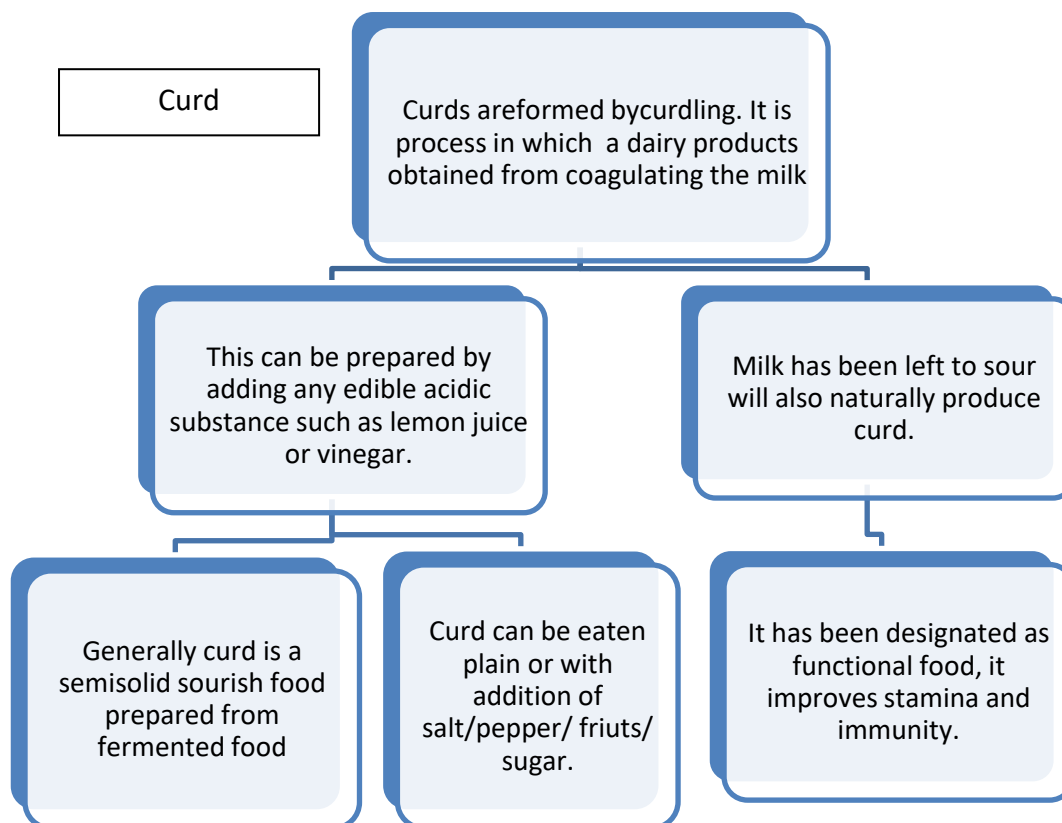
Flow chart:3 depicting composition and uses of butter



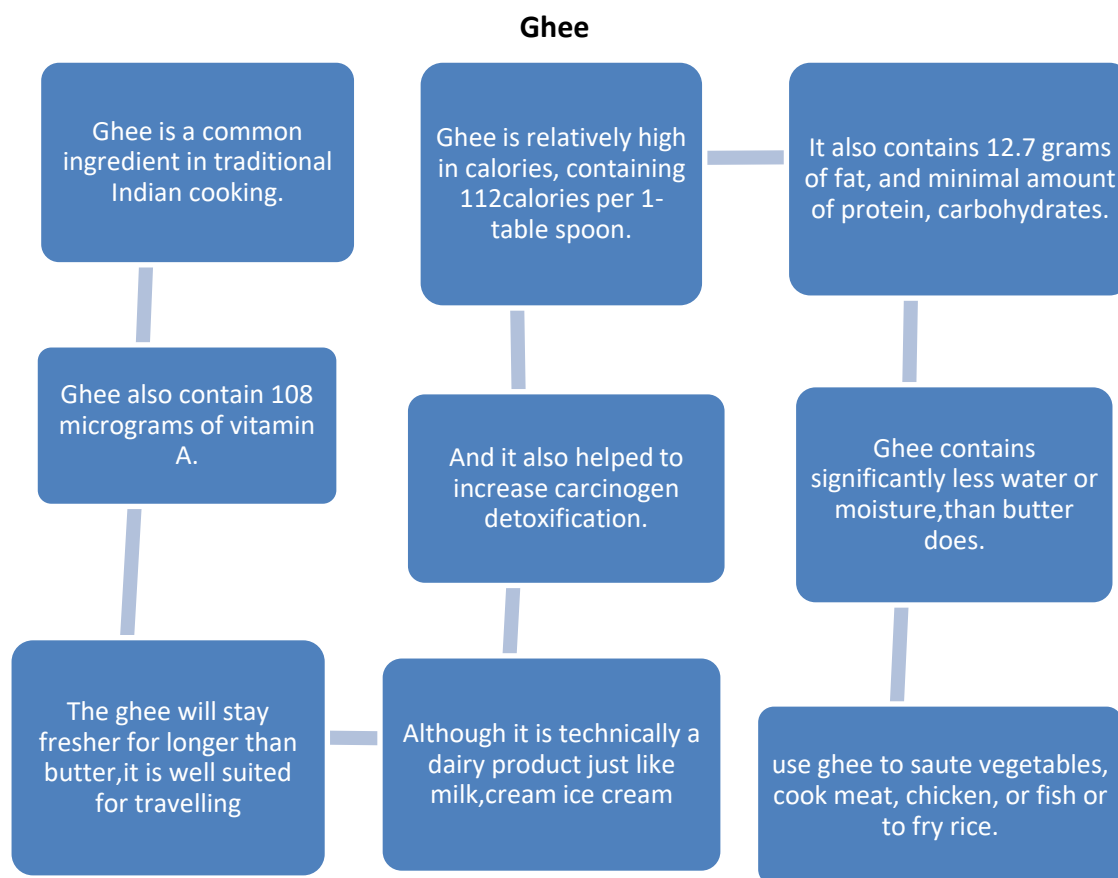
Flowchart:4 depicting usage of cheese



Flow chart-5 depicting formation and uses of curd



Flow chart-6 Depicting formation and uses of ghee



4. CONTENTS AND CONTAMINANTS POSSIBLE IN MILK:

Table no: 1 Shows the contents and contaminants of milk

S.NO	contents	Contaminants
	Constituents	Percentage
1.	<u>Proteins</u>	3.2
	Casein	82%
	Whey proteins	18%
2.	<u>Carbohydrates</u>	4.9%
	Lactose	
3.	Water	87%
4.	Vitamins and minerals	6%

- Cane sugar
- Starch
- Cellulose
- Urea
- Ammonium compound
- Sulphate
- Glucose
- Sodium chloride
- Nitrates

5.. ANALYSIS OF CONTENT MILK:

Table No: 2 Shows the analysis of content of milk

I. Qualitative analysis A. carbohydrate • Molisch test • Fehling's test • Barfoed's test • Iodine test • Benedict's test • Hydrolysis test for milk B. Protein • Biuret test	II. Quantitative analysis • Estimation of Casein by coagulation method • Total carbohydrate content (lactose)
---	---

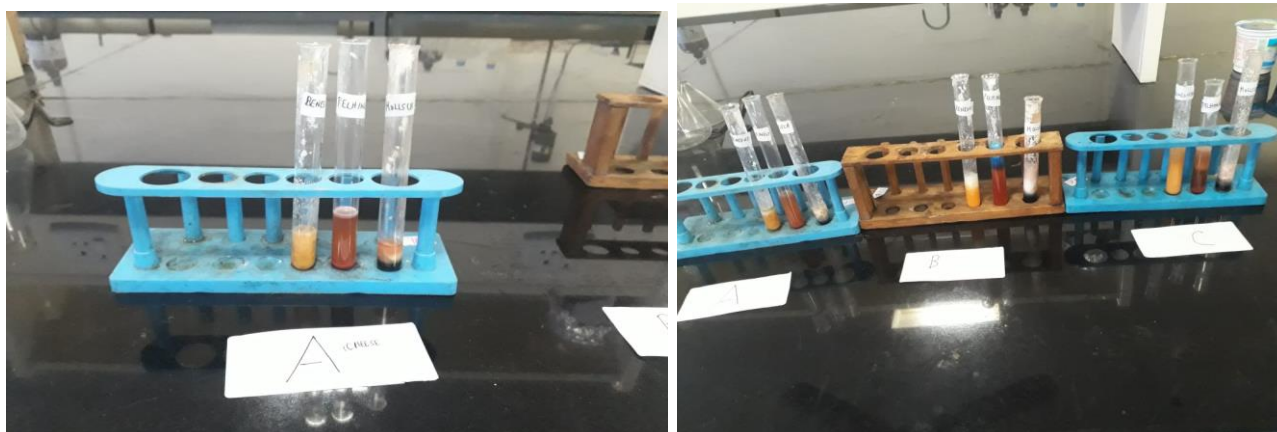
I. Qualitative tests for Carbohydrates:

A. Table no :3 Shows Qualitative tests for Carbohydrates:

S.No	Test	Procedure	Observation	Product used	Inference
1.	Molisch	1ml sample + Alpha naphthol + Conc. sulphuric acid along the sides of the test tube.	Violet ring is obtained at the junction of the two layers	Milk Butter Cheese Ghee Curd	+ve +ve +ve -ve +ve
2.	Fehlings test	1ml sample+3mlFehlings A solution+2ml Fehling's B solution and heat for 2-3 min.	Reddish brown precipitate is observed	Milk Butter Cheese Ghee Curd	+ve +ve +ve -ve +ve
3.	Barfoed's test	2ml sample +Barfoed's reagent + heat for 2-3 mins	No characteristic change observed	Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve
4.	Iodine test (Detecting the presence of starch)	1ml of sample+ Iodine+ potassium iodide	Absence of blue colour.	Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve
5.	Benedict's test:	1ml sample+ Benedict's reagent+ heat for 2-3 min	Appearance of brick red colour	Milk Butter Cheese Ghee Curd	+ve +ve +ve -ve +ve
6.	Hydrolysis test for milk	2-3ml of sample + subject to acid hydrolysis. Perform barfoed's test	Reddish brown precipitate is obtained.	Milk Butter Cheese Ghee Curd	+ve +ve +ve -ve +ve

[+] indicates presence of carbohydrates, [-] indicates absence of carbohydrates

Figure:1 Result showing test for carbohydrates

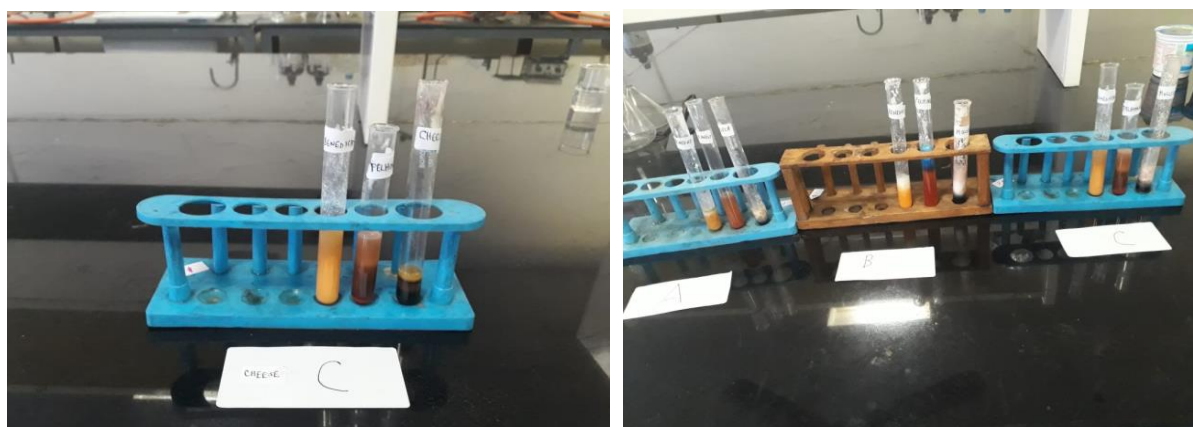


B. Test for Proteins:

Table no - 4 Shows test for protein

S.No	Test	Procedure	Observation	Product used	Inference
1.	Biuret test	1ml of sample+ potassium sodium tartarate treated with copper sulphate and sodium hydroxide.	Purple pink complex is observed.	Milk Butter Cheese Ghee Curd	+ve +ve +ve -ve -ve

Figure:2 Result showing TEST for Protein



A, B, C indicates-milk

Table no - 5 Shows content of protein in different branded milk

Brand	Amount/100m	%
A	2.62	26.2
B	2.42	24.2
C	2.56	25.6
D	-	-
E	2.67	26.7

Flowchart :7 shows content of protein in various branded milk in percentage



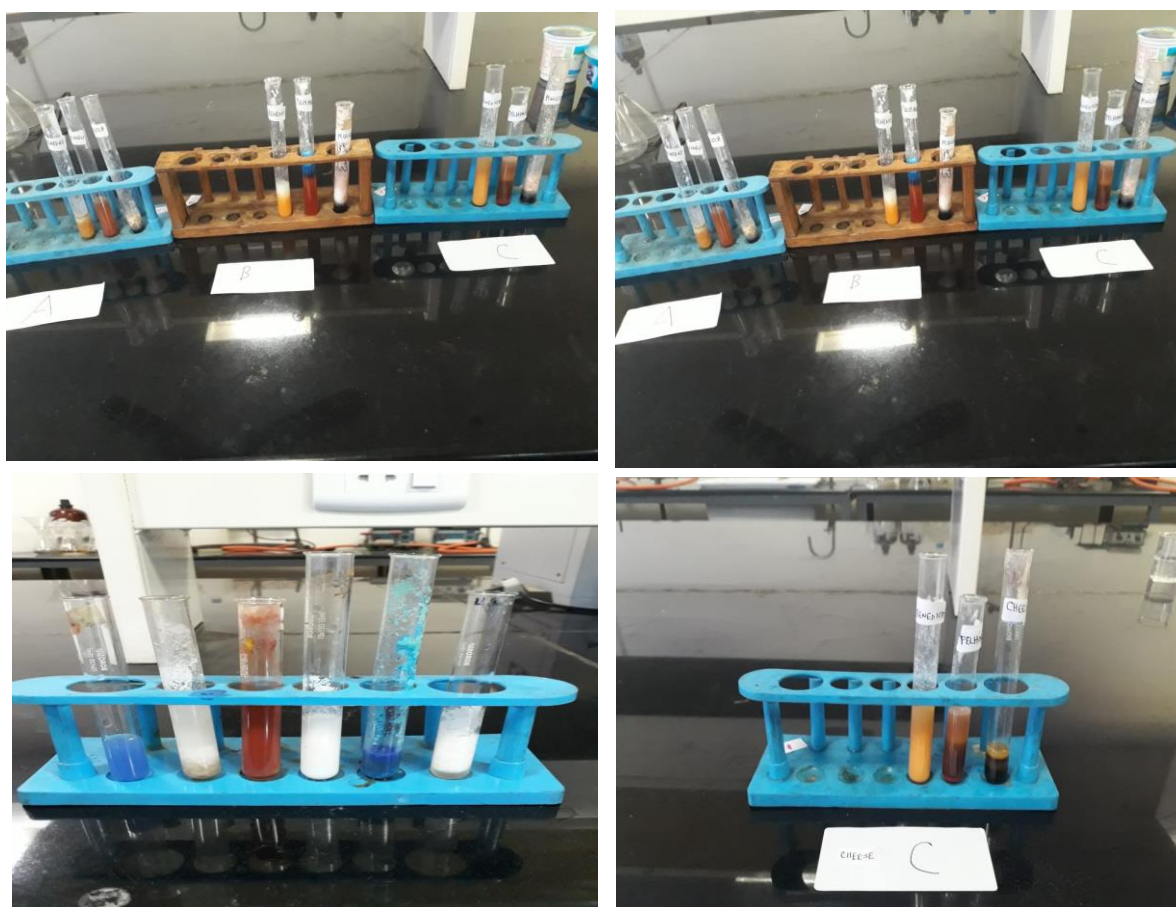
6. Analysis of contaminants in milk and milk products

Table no - 6 shows possible contaminants in milk and milk products

S.No	Test	Procedure	Observation	Product used	Inference
1.	Test for Cane sugar	1ml of sample + 1ml of resorcinol solution and heat it for 5 mins.	Absence of red colour	Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve
2.	Test for starch	5ml of sample in a test tube and it was heated for 5mins. Then add 1-2 drops of Iodine solution	Absence of blue colour	Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve
3.	Test for starch	1ml of sample + 1ml Para- Dimethyl Amino Benzaldehyde (DMAB)	Absence of blue colour	Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve
4.	Test for Urea.	1ml of sample + 2% sodium hydroxide + 2% sodium hypochlorite + 5% phenol solution	Violet colour was not obtained	Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve
5.	Test for Ammonium	1ml of sample + 2% sodium hydroxide + 2% sodium hypochlorite + 5% phenol solution. And heat it for 10mins in boiling water bath.	Absence of blue colouration	Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve
6.	Test for Sulphates.	10ml of sample in a 50ml stoppered test tube. Add 10ml of Trichloro acetic acid and filter through what man filter paper. Take 5ml of clear filtrate add few drops of barium chloride solution	White precipitate is observed.	Milk Butter Cheese Ghee Curd	+ve -ve -ve -ve -ve
7.	Test for Glucose.	1ml of sample in a test tube + 1ml of Barford's reagent. and heat it for 3mins in a boiling water bath. And cool under tap water + add 1ml of Phospho molybdic acid reagent.	No reddish-brown precipitate is obtained.	Milk Butter Cheese Ghee	-ve -ve -ve -ve

8.	Test for Sodium Chloride.	1ml of the sample + 0.1N Silver Nitrate solution. mix the contents and add 0.5ml of 10% potassium chromate solution.	Presence of chocolate brown colour	Curd Milk Butter Cheese Ghee	-ve -ve -ve -ve -ve
9.	Test for Nitrates.	2ml of the sample + Add 2-3 drops Di-phenyl Amine along the sides of the test tubes	Absence of Nitrates.	Curd Milk Butter Cheese Ghee Curd	-ve -ve -ve -ve -ve -ve

Figure:3 Result showing test for contaminants in milk and milk products:



CONCLUSION

In the present study the major contents of milk of protein and carbohydrate has been analysed by qualitative and quantitative method. Also, Various possible contaminants in milk and its products are Cane sugar, Starch, Cellulose, Urea, Ammonium compound, Sulphate, Glucose, Sodium chloride, Nitrates. This study proves that only milk contains traces of sulphate which was proved by qualitative analysis. This paper give knowledge to analyse milk and milk products by various test in laboratory level.

ACKNOWLEDGEMENT:

The authors thank Principal, Head of department of Pharmaceutical Chemistry, Management of Sri Ramachandra Institute of Higher Education and Research, Chennai to provide opportunity to carry out and complete this project successfully.

REFERENCE:

1. Food Chemistry; Milk and Dairy Product: 505-550
2. Vandana Awasthi, Sanjivan Bahman, Lalit K.Thakur, Santosh Kumar Singh , Ajit Dua, Sanjeev Ganguly, Contaminants In Milk And Impact Of Heating:An

- Assessment Study Indian Journal of Public Health, 2012; 56(1), 95-99.
3. Fransisco vosioli, A narrative review of recent Evidence, Advances in nutrition An International Journal, 2014 ;2: 131-143.
 4. Vesna Gantner, Pero Mijic, Mirjana Baban, Zoran skrtic, Alka Turalija, Mljekarstvo, The overall and fat composition of milk of various species, 2015;65 (4): 223-231.
 5. Albert C. Hale, Analysis Of Milk And Milk Products, *J. Am. Chem. Soc.*, 1893, 15 (10): 596–598
 6. E. Waller, Experiments On Milk Analysis, *J. Am. Chem. Soc.*, 1891, 13 (1): 52–61
 7. Bader A. Alfarraj, Herve K. Sanghapi, Chet R. Bhatt, Qualitative Analysis of Dairy and Powder Milk Using Laser-Induced Breakdown Spectroscopy (LIBS), Manual of Methods of Analysis of Foods, 2012.
 8. Rashida Kanwal, Toqeer Ahmed and Bushra Mirza, Comparative Analysis of Quality of Milk Collected from Buffalo, Cow, Goat and Sheep of Rawalpindi/Islamabad Region in Pakistan, *Asian Journal of Plant Sciences*, 2004; 3 (3): 300-305.
 9. Astha Parajuli, Prasiddhi Rimal, Rujisha Maharjan, Richa Chaudhary, Shashi Bhushan, Chaturwedi, Quality Analysis of Milk in Kathmandu Valley, 2018; Tribhuvan University Journal of Microbiology. 5, 1:7-10.
 10. Muhammad Naseer Abbas, Baharullah Khattak¹, Abdul Sajid, Taiseer U Islam Qaiser Jamal, Shahzad Munir, Biochemical and Bacteriological Analysis of Cows' Milk Samples Collected from District Peshawar, *Int. J. Pharm. Sci. Rev. Res.*, 2013;21(2), 221-226.
 11. Jette Jakobsen, Erling Saxholt, Vitamin D metabolites in bovine milk and butter *Journal of Food Composition and Analysis* 2009;22, 472–478