

Study on Manufacturing and Nutritional Contents of Milk and Milk Products at Dugdh Utpadak Sahkari Sangh Ltd, Varanasi

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Abstract—Milk is a valuable nutritious food that has a short shelf-life and requires careful handling. This is the basis of all dairy products by constituting water: 87.3%, fat:3.9% , proteins: 3.25%, Casein: 2.6% , carbohydrates (Lactose): 4.6%, minerals: 0.65% , Cationic: K, Ca, Mg, K, etc., organic acids: 0.18%, Enzymes: peroxidase, catalase, phosphatase, lipase, vitamins - A, C, D, thiamine, riboflavin and gases – CO₂, N₂, O₂. In recent years, there has been wide spread and increasing interest throughout the world in creating newer channels of utilisation for milk products and by-products of the dairy industry such as: cream, butter, cheese, chhana, paneer, ghee etc. A dairy by-product may be defined as a product of commercial value produced during the manufacture of a main product. A production plant for the processing of milk and milk products are known as dairy or dairy factories. Product line of a dairy consists of main products and by-products. This study is a part of internship programme which was done at PARAG dairy (Dugdh Utpadak Sahkari Sangh Ltd), Industrial Area, Ramnagar, Varanasi. The topic of the short training was “Processing and Manufacturing of Milk and Milk Products” which was scheduled from 5th March-31st March, 2011. This training helped in understanding nutritional aspects of milk and milk products, their processing methods, chemical analysis involved in testing of milk and detection of adulterants. Therefore, a small part of this internship programme has been taken under the aforementioned topic.

Keywords: Milk, Milk products, Milk by-products, Dairy, Manufacturing, Nutrients.

Introduction

Milk an emulsion or colloid of butterfat globules within a water-based fluid. The precise components of raw milk vary by species and by a number other factors, but it contains significant amounts of saturated fat, protein and calcium well as Vitamin C. Cow's milk has a pH ranging from 6.4 to 6.8, making it slightly acidic.

Butterfat

Each fat globule is surrounded by a membrane consisting of phospholipids and proteins; these emulsifiers keep the individual globules from joining together into noticeable grains of butter fat and also protect the globules from the fat-

digesting activity enzymes found in the fluid portion of the milk. In unhomogenized cow's milk, the fat globules average about four micrometers across. The fat-soluble vitamins A, D, E. and K are found within the milk fat portion of the milk.

Other proteins

The largest structures in the fluid portion of the milk are casein protein micelles: aggregates of several thousand protein molecules, bonded with the help of nanometer scale particles of calcium phosphate. There are four different types of casein proteins, and collectively they make up around 80% of the protein in milk, by weight. Most of the casein proteins are bound into the micelles. There are several competing theories regarding the precise structure of the micelles, but they share one important feature: the outermost layer consists of strands of one type of protein, k-casein, reaching out from the body of the micelle into the surrounding fluid. The Kappa-casein molecules all have a negative electrical charge and therefore repel each other, keeping the micelles separated under normal conditions and in a stable colloidal suspension in the water based surrounding fluid.

Milk contains dozens of other types of proteins beside the caseins. They are water-soluble than the caseins and do not form larger structures. Because these proteins remain suspended in the whey left behind when the caseins coagulate into curds, they are collectively known as whey proteins. Whey proteins make up approximately 20% of the protein in milk, by weight. Lactoglobulin is the most common whey protein by a large margin.

Carbohydrates

The carbohydrate lactose gives milk its sweet taste and contributes approximate 40% of whole cow's milk calories. Lactose is a disaccharide composite of two simple sugars, glucose and galactose. In nature, lactose is found only in milk and a small number of plants. Other components found in raw cow's milk are living white blood cells, mammary gland cells, various bacteria, and a large number of active enzymes.

Appearance

Both the fat globules and the smaller casein micelles, which are just large enough to deflect light, contribute to the opaque white color of milk. The fat globules contain some yellow-orange carotene, enough in some breeds (such as Guernsey and Jersey cattle) to impart a golden or "creamy" hue to glass of milk. The riboflavin in the whey portion of milk has a greenish color, which sometimes can be discerned in skimmed milk or whey products. Fat-free skimmed milk has only the casein micelles to scatter light, and they tend to scatter shorter-wavelength blue light more than they do red, giving skimmed milk a bluish tint.

2. Background of PARAG Dairy, Varanasi

PARAG Dairy Varanasi is actually named as Dugdh Utpadak Sakhari Sangh Ltd. Varanasi, registered as a cooperative Society under UP Cooperative Societies Act 5. This was established in 1947 as a Banaras Cooperative Milk Union registered under the UP Cooperative Societies Act 1912.

Product Line

A production plant for processing of milk is called a dairy or a dairy factory. Indian customers' choices are: Gold milk, Toned milk, Janta milk, Butter, Ghee, Paneer Curd, Lassi, Mattha, Peda, Chhena kheer, Skimmed milk powder etc. Indian dairy industry produces two types of products: main products and by-products. A dairy by-product may be defined as a product of commercial value, produced during the manufacture of a main product. Because of their unique and important nutrients available, they have to be utilized in a proper manner considering the welfare of general masses. Some of the examples of main products are; milk, paneer, ghee, butter, cheese etc. and by-products are skimmed milk, butter milk, lassi, ghee residue, whey etc.

2.1. Butter

Butter is the smooth, fatty substance obtained from churning cream with fat content of at least 35 per cent. Simple agitation of this cream in machines known as churning; rupture the membranes of fat globules and these globules then group into granules of butter. Because only the milk fat is used, ten litres of whole milk are required to produce 500 g of butter. Butter is salted after churning, using sodium chloride during the creaming process. The salt performs two main functions: enhances the taste and prolongs the preservation of the product by inhibiting the growth of microorganisms.

Composition

Prepared in accordance with strict manufacturing practices, butter is produced from milk or milk products, and contains no less than 80% milk fat. Commercial butter contains 80 to 82% fat, which is of animal origin, 14 to 16% moisture and 0 to 4% salt. The butterfat is composed of 62% saturated fatty acids and contains lecithin (0.25%) and cholesterol (2.2 mg/g of butter).

Variety	Moisture	Protein	Fat	Carbs	Ash
Salted Butter	16	1	81	0	2
Unsalted Butter	18	1	81	0	0

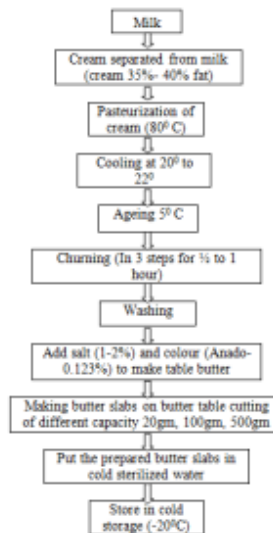


Figure1: Butter

2.2. Dahi:

Dahi is a dairy product produced by bacterial fermentation of milk. Fermentation of lactose by these bacteria produces lactic acid, which acts on milk protein to give yoghurt its texture and its characteristic tang.

Nutrients in Dahi:

Dahi is a fermented milk product made by adding a harmless bacteria culture to milk. As with all dairy products it naturally contains many nutrients essential to growth, development and maintenance of the human body. Dahi is nutritionally rich in protein, calcium, riboflavin, vitamin B₆ and vitamin B₁₂. People who are moderately lactose-intolerant can consume yoghurt without ill effects, because much of the lactose in the milk precursor is converted to lactic acid by the bacterial culture. Dahi containing live cultures is sometimes used in an attempt to prevent antibiotic associated diarrhea.

Characteristics	Yogurt
Calories	61
Carbohydrates	4.7 gms
Protein	3.5 gms
Fat	3.3 gms
Sugar	4.7 gms
Water	88%

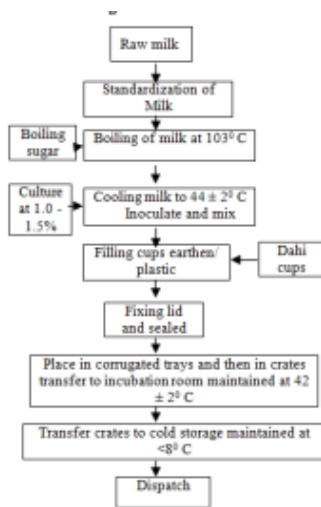


Figure2. DAHI

2.3.Paneer

Chhana, also called paneer in certain parts of the country, constitutes one of the two chief bases (the other being khoa) for the preparation of indigenous sweetners. Chhana refers to the milk-solids obtained by the acid coagulation of boiled hot whole milk and subsequent drainage of whey. The acids commonly used are lactic or citric, in both natural and chemical forms. It should not contain more than 70% moisture, and the milk fat content should not be less than 50.0 per cent of the dry matter.

Characteristics	Cow (%)	Buffalo (%)
Moisture	53.4	51.6
Fat	24.8	29.6
Protein	17.4	14.4
Lactose	2.1	2.3
Ash	2.1	2.0

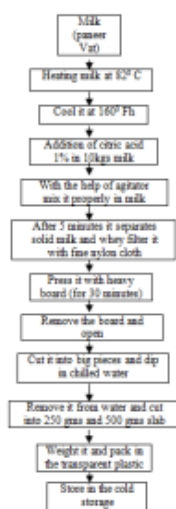


Figure3. PANEER

2.4. Ghee

Ghee is a clarified butter fat prepared from cow or buffalo milk. The production of ghee is higher in winter and lower in summer.

Nutrition

Like any clarified butter, ghee is composed almost entirely of fat. Ghee is very high in Vitamin A and Vitamin D content. It can be supportive for eye and bone health. Ghee helps the absorption of not only vitamins and minerals but also phytonutrients.

Characteristics	Cow	Buffalo
Milk Fat	99 to 99.5%	
Moisture	Not more than 0.5%	
Carotene (mg/g.)	3.2 – 7.4	-
Vit. A (I.U./g.)	19 - 34	17 – 38
Charred casein, salts of copper and iron etc.	Max. 2.8	

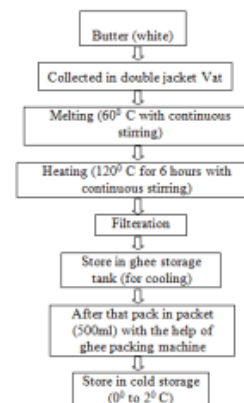


Figure 4 GHEE

2.5. Peda

The word peda is also generically used to mean a sphere of any doughy substance, such as flour or khoa. Break freshly made khoa (mawa) into bits. Mix (preferably ground) sugar into it. Put into a karahi and cook over a very slow non-smoky fire, stirring all the while with a khunti. Add crushed cardamom if desired. When mixture is ready (mixture forms balls when tested), pour into a tray and leave to cool and set. Decorate with sliced pista and cut into required size and shape to serve.

Characteristics	Peda
Calories	155
Carbohydrate	18 gm
Protein	5.5 gm
Fat	7 gm

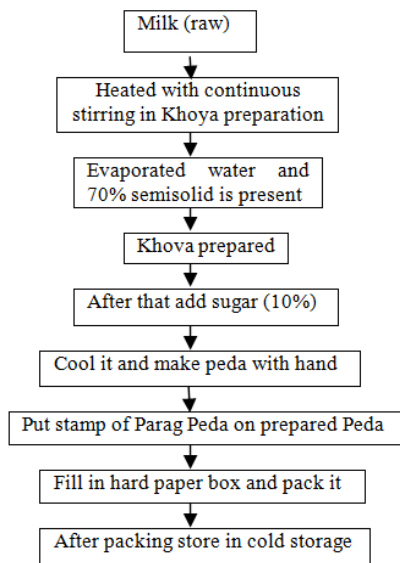


Figure. 5 PEDA

2.6. Lassi:

Lassi is made by blending yogurt with water or milk and Indian spices. Traditional lassi is blended with sugar or fruits. Lassi contains appreciable amounts of milk proteins and phospholipids.

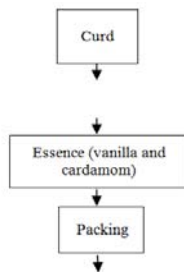


Figure.6. LASSI

Characteristics	Milk
Water	96.2
Total solids	3.8
Fat	0.8
Solids-not-fat	3.0
Protein	1.3
Lactose	1.2
Ash	0.4
Lactic acid	0.44

2.7. Skimmed Milk Powder:

Skimmed milk powder has a fat content of between 0-0.5% and an average fat content of 0.1%. Skimmed milk therefore has nearly all the fat removed. It contains slightly more calcium than whole milk and lower levels of fat soluble

vitamins, particularly vitamin A, as this is lost when the fat is removed. The lower level of fat in skimmed milk reduces its calorie (energy) content. For this reason it is not recommended for children under the age of 5 years as they need the extra energy for growth.

However, it is ideal for adults who wish to limit their fat or calorie intake. Skimmed milk has a slightly more watery appearance than other types of milk and has a less creamy taste due to the removal of fat. This powder is obtained in the process of two-step dehydration of liquid milk. The first step is condensing the material and then drying in spray drying tower. It consists of mechanical spraying of condensed milk in a special tower where in contact with hot air dehydration of falling drops of milk takes place.

Nutrients	Calories	Lactose	Protein	Fat	Water
Skimmed Milk	35	49.5-52%	34-37 gms	0.60 - 1.25	3-4 %

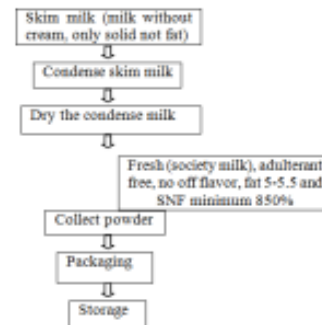


Figure 7: SKIMMED MILK POWDER

2.8. Buttermilk/Mattha:

Originally, buttermilk was the liquid left behind after churning butter out of cultured cream. This type of buttermilk is now specifically referred to as traditional buttermilk. Most modern buttermilk is a fermented dairy product known as cultured buttermilk

Characteristics	Buttermilk
Calories	41
Carbohydrate	4.79 gm
Protein	3.31 gm
Fat	0.88 gm
Water	90%
Sodium	105 mg
Potassium	151 mg
Magnesium	11 mg

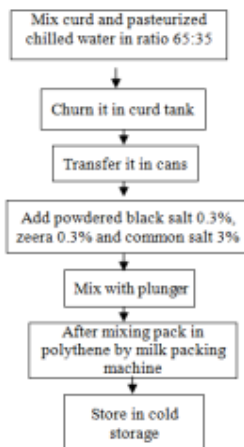


Figure 8. MATTHA

2.9. Chhena kheer

Characteristics	Chhena kheer
Total energy	263
Fat	15 gm
Protein	10.5 gm
Carbohydrate	21.5 gm
Sugar	8 gm
Calcium	260 mg

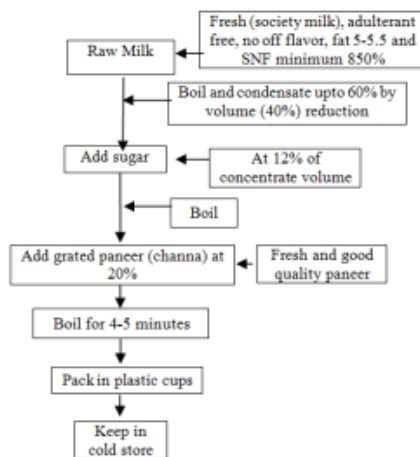


Figure.9. CHHENA KHEER

Conclusion:

Codex Alimentarius defines a milk product as a “product obtained by any processing of milk, which may contain food additives, and other ingredients functionally necessary for the processing”. The range of milk products varies significantly from region to region and among countries in the same region, depending on dietary habits, the milk processing technologies available, market demand, and social and cultural

circumstances. Milk testing and quality control should be carried out at all stages of the dairy chain. Good-quality raw milk has to be free of debris and sediment; free of off-flavours and abnormal colour and odour; low in bacterial count; free of chemicals (e.g., antibiotics, detergents); and of normal composition and acidity. The quality of raw milk is the primary factor determining the quality of milk products. Good-quality milk products can be produced only from good-quality raw milk. To achieve this quality, good hygiene practices should be applied throughout the dairy chain. Milk is a valuable nutritious food that has a short shelf-life and requires careful handling. Milk is highly perishable because it is an excellent medium for the growth of micro-organisms particularly bacterial pathogens: that can cause spoilage and diseases in consumers. Milk processing allows the preservation of milk for days, weeks or months and helps to reduce food-borne illness. Pasteurization is a best heat treatment process that extends the usable life of milk and reduces the numbers of possible pathogenic microorganisms to levels at which they do not represent a significant health hazard. Milk can be processed further to convert it into high-value, concentrated and easily transportable dairy products with long shelf-lives, such as butter, cheese and ghee. [FAO] So, under this training, aforementioned products were available at Parag dairy at that time period. The products were taken with proper care, handling and various lab tastings under ISO standards.

References:

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