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Compositional Variation and Nutritive Value of Processed Liquid Milk in the Republic of Sudan and Kingdom of Saudi Arabia . A comparative Study

اختلاف التكوين والقيمة الغذائية للحليب السائل المصنع في جمهورية السودان والمملكة العربية السعودية . دراسة مقارنة

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Introduction

Milk is known as white yellowish solution secreted by mammary glands .(in human and animal (Ishraga 2005

The word bovine in Arabic language means milk (Labon),which is used .(in many Arabian Countries, i.e Egypt, East countries ,(Algabani,1975

Milk is also defined as the normal secretion of the mammary gland of mammals (Clarence et. al .1982) and (Abdelwahab and Mahmoud ,1984). It is also defined essentially as an emulsion of fat in a watery solution of sugar and minerals salts (true solution) and with protein in a colloidal .(suspension (Clarence et. al .1982

The term milk is referred to the liquid excreted by the mammary glands of both human and mammals, which is serving the newborn as food. .((Spreer and Mixa 1995

Cow's milk is defined as the lacteal secretion practically free from colostrums , obtained by the complete milking of one or more healthy cow , which contains not less than 8.25% of milk solid non fat and not . (less than 3.25% of milk fat .(Lee 1983

From the legal point of view ,milk is defined as the normal ,clear and fresh secretion obtained by complete milking of the udder of healthy cow or animal during the period following at least 72 hours after calving or .[until milk is colostrums free [Abdelwahab and Mahmoud 1984

Milk is also defined as a solution secreted by mammary glands ,which consist of fat emulsion in a watery solution of lactose, some minerals, vitamins, enzymes and also contains organic acids , salts and antibodies .(especially in colostrums (Gubartella1988

Milk is secreted by udder gland of mammals to feed their infants .It consists of emulsion of fat in a watery solution, lactose and some minerals, vitamins and enzymes. Also it contains organic acids , and their . salts, and antibodies in colostrums

The quantity constituents of milk changes according to kind of animals , age, time of milking , kind of food and health state[Abdullah2002]. The function of the mammary gland is primarily to supply milk for the off spring in mammalians . This function has been greatly extended in animals that supply milk for human consumption (Elsayed 2001) . Milk is secreted by the mammary gland of the female of human , cows , . (goats , sheep , camel ect , (Nutrition 2004

All mammalians produce milk with different constituents to meet infant needs,(Uoguelph 2007) . .

Today many cattle is used to produce milk in most countries of the world , i.e. Friesian, and cow is mainly used in Asia and Africa . . ((Abdelkarim 1986

Milk consists of blood components which some stay in the blood and enforce to filter directly to milk and the other components synthesis .inside udder cell

Enzymes play an important role in the synthesis of this components . Milk is known to be as fat emulsion in a watery solution and of protein .[with other colloidal suspension,[Zalzala 2000

Most milk composition is formed inside milk gland ,which change to the milk components by formation ,initiation and filtrations for sugar, protein .(,vitamin and minerals (Darwish 1990

Animal's milk is highly nutritious and can play an important role in the human diet especially infants and children . There is no adequate substitute for milk ,and no food has a wider acceptability or offers a .[greater variety of use like milk,[Salih2001

For centuries, milk has been recognized an indispensable food for .mankind

It's value in the human diet was known for hundreds of years . Being highly nutritious, it has always been an important part in the diet of .(infants and children ,(Abdullah 1995

According to Ibrahim (1989) milk is a mixture of three main constituent , water, fat and solid non fat and it is not a commodity with a uniform composition, but is more widely influenced by environmental and genetic . factors than any other biological fluid

Milk is composed of blood components from which some stay as it is the blood and the other are synthesis ,(Darwish,1990). .

Abdelaziz (1988) gave that milk is a natural composition of natural gland secretion of animal female of mammary , without any additives . Milk is the only food that provides a well balanced array of essential nutrients including proteins ,fats , carbohydrates ,vitamins and minerals in the form which is palatable , digestible and sanitary . Milk thus deserves recognition as whale meal and (perfect food) .Man consumes various types of milk such as cows , goats , mares and reinders . (Kordylas 1991). Milk has long been identified as nature most nearly complete food . It is elevated perishable than an unwatched bodily belongings and subject to widely varying natural and acquired relish , different and transportation and handling costs make up main item in its division the solid content as refereed by the depth of the cream line was a major factor in building sales appeal . Homogenized milk was first sold in 1927 in Ottawa , . (Ontario , Canada , (Porter et.al.1965

Milk is the nearest approach we possess to a complete food , since it contains all the material essential for the growth and maintenance of life in a form readily assimilable by the body, the energy giving nutrients (protein ,fat and carbohydrate) all the known essential vitamins , calcium, phosphate and other minerals salts ,(Series of League Nation 1937). Milk is the liquid food secreted by mammary gland for the nourishment of the newly born ,containing water ,fat ,protein ,lactose and minerals (ash). An average gross composition of cows milk would be as follows water 87.30% , fat 3.6% , lactose 4.9%, protein 3.5%, and ash .((minerals)0.7% (Walt and Merrill 1963

Verma and Sommer (1957) indicated that the salts of milk are considered to be the chloride, phosphate and citrates of potassium ,sodium ,calcium and magnesium , and the average values for milk salt constituents content on whole milk (mg /100ml) are: calcium 123mg /100ml, magnesium 12mg /100ml, phosphorus 95mg /100ml ,sodium 58mg/100ml , potassium 141mg /100ml,chlorine119mg /100ml , sulfur 30 mg/100ml . and citric acid 160mg/100ml

Milk contains large quantities of calcium and phosphorus which are included in both bones and teeth formation, building, density and strength until 35 years of age. Also it contains proteins with high nutrients, which are referred to the eight essential amino acids , that the body is not able to synthesize and contains fat , that provides human bodies with energy and heat, which comes from fat constituents (essential fatty acids oleic , linoleic , Arashidonic) , (Dairy PAAF 2004). .

Milk contains lactose sugar , which is not found in other foods , but only in milk and milk products .The lactose sugar provides human body with energy and heat and contributes to the sweet taste of the milk. According to Abdelkarim (1986) milk contains most essential vitamins , that human body needs , which are fatty soluble vitamins (A,D,E,K).Also it contains some minerals (Ca,P,Na,K,Zn ect.).,which participate in the . formation of blood, hormone and antibodies

The human needs four cups of milk daily ,which two of them in a .(solution form and others in a sort of milk product (Abdullah 2002

The ability of milk digestion is high in comparison to other food which moderately reaches to 90%. Researches show that children fed on milk have better growth rate than .those not getting enough milk

Cow milk can substitute mother's milk , especially when there is a .(problem in feeding naturally by mother milk , (Roleofl milk 1998

Although the Knowledge of milk composition , is important in dairy processing and pricing , milk plays an important role as a complete diet , which provides human body with all nutrients needed . Infants completely depend on it for many months .Adults intake of milk during different life stage provides bodies with most nutrient needs in a . (balance phase (Blog 2005

Recently milk industry is distributed in many countries of the world , but it varies in systems : some use primitive ways , other use a modern way. The starting of milk industry depends on three reasons , which are : appropriate market for milk and milk product , ability for best preparation and training staff for collection , distribution and marketing , and all these reasons , recently found in the modern countries , are essential for milk . (production ,(Abdelkarim 1986

Research Objectives

To study the chemical composition of processed liquid milk by using .1 . different heat treatment methods in Sudan and Saudi Arabia

. To study the nutritive value of the two produced milk.2

To compare the components and nutritive value of the milk produced in .3 . the two countries with each other

Available are different types of liquid milk ,e.g. pasteurized or sterile, which are distributed in the markets of Sudan and Saudi Arabia for .consumption

The mentioned types of milk are processed by different factories and dairy plants. Thus, it does worth to study, if the chemical composition of this products meet the international standard value of the quality control. Another problem to be put in consideration is that, if there is a significant variation in composition between the products produced in the two .countries

It is assumed that, variation in components and of commercial milk .produce in Sudan and Saudi Arabia might exist

This research will discuss the validity of this assumption

Following methods , will be carried out : References , journals, publications , internet , laboratory tests and statistical analysis . Since integration is found between different curricula , so all historical , . descriptive and comparative curricula are used in this research

Milk components . 2

Mottram et.al.(1940) noticed that milk regarding its chemical composition , occupies an almost unique position among animal food ,for it contains itself representatives of all three nutritive constituents proteins ,carbohydrates ,fat and other constituents like water ,enzymes and .vitamins

According to Osman (2007) the milk components can be divided into orginary components which include protein , fat , sugar , minerals , vitamins , enzymes and water and in non –originary components such as . chemicals , bacteria and others

.Milk Water 1 .2

Abdelaziz (1988) stated that water is a medium which makes the component in a form of colloids like protein or emulsion as in fat or dissolved as in minerals and lactose. The enzymes activities and milking . operation are done in a watery form

According to Ansci (2007) water is a medium in which the other milk constituents are either dissolved or suspended. Most of them are free and only a very small portion are in the bound form , being firmly bound with milk proteins and phospholipids, whereby cow milk contains . approximately about 87 % water

Abudawd et.al.(2003) indicated that milk is a fat emulsion in a watery solution of lactose and minerals, and it contains protein in a colloidal suspension form. Water represents about85.9%in cow milk and 83.5% in buffalo milk .Most of milk water are found in a free form (96%) and the others few are bound with milk protein, phospholipids or at the surface of .fat globules

Water is an important medium for dissolving milk components ,which are needed for the biological reactions and plays an important role in .fermentation and industries

According to Eltakriti and Alkhal(1986) water forms about 87 % of the cow milk , fat is found in an emulsion state in water and a most protein , calcium ,phosphorus are found in a colloidal or suspension form in .water

Lactose , most minerals , vitamin (B,C) and little of the proteins are found in a free form and little are bound with casein , albumin , lacto globulin and phospholipids . .

Spreer and Mixa(1995) explained that water is the major component of milk, it is used principally as a solvent for the ingredients in the dairy products ,i.e. butter , cheese , milk powder .Also it is found in the form of chemically bound water , i.e as hydrated water in protein ,bound in lactose crystals or as freely available moisture in products . Abdullah(2002) recorded that milk contains about 79-89% water according to animal type and effect of another factors , i.e. the kind of food given to animal .

Water keeps the milk and their nutrient composition in a liquid form . According to Alshabibi et.al.(1984) milk contains a high percentage of water(87%) , and is a medium for distribution of all milk components ,i.e. the total soluble materials in a true solution or suspension form and very little bound with lactose , minerals and proteins .

Abdeltwab(1977) gave that water represents the most part of milk compounds . It's average in milk is 82 -88% with an average of 87 % of milk components.

Zalzala (2000) stated that water plays an important role in various chemical reactions and fermentation in milk and milk products , and added that the percentage of water in cow's milk and human milk is about 87–87.5% in the same condensed quality for each. .

Alsafar et.al.(1982) reported that water represent about 87% of the total milk constituents .

Water is a main component of milk . It gives milk it's natural characteristics , maintains the balance between components and solubility ,a medium for many microorganisms activities and it play a co- factor in a chemical and biological reaction .

Larson and Smith (1974) pointed out that water content of milk is estimated as a loss of weight during drying under the condition which limited the analysis of organic compounds .

Mottram et .al. (1940) mentioned that the water forms by far the largest proportion of the milk 87-88% , but in cow milk it holds the other ingredients in suspension or solution .

Alnimer (2007) indicated that water is a solution in all milk components , it constitutes about 85-90% of the mammalian milk and some milk components are soluble in water . i.e. vitamins , enzymes and lactose. And he added that water is found in milk in two forms , free water represent about 96% of the total milk water and bound water reaches about 4% of the total milk water and it combined with proteins , phospholipids and fat globules .

Larson and Smith (1974) noticed that in most milk yet analyzed ,water is quantitively the most prominent compound , although some arctic and aquatic species produce milk containing more fat than water . In addition physiologically the secretion of milk puts a drain on the water economy of the lactating female and necessities increased consumption of water.

Milk Fat 2.2

According to Abdullah (2002) milk fat consists of triglycerides and other material ,i.e. phospholipids ,soluble vitamins , sterol-cholesterol ; the milk of buffalo contains 7% and of a Friesian cow 3.5%fat and the fat is found in milk in a form of small or big particles according to the kind of animal .

Abudawd and Mtwali (1993) added that milk fat is an important milk component ,which provides desirable taste of importance in milk fat industry. .

Darwish (1990) stated that milk fat is composed of triglycerides containing saturated fatty acids of 4 - 20 carbon and some of unsaturated fatty acids e.g oleic acid and some small unsaturated fatty acids e.g linoleic and linolenic acid . The amount of milk fatty acids vary with variation of animal species and nutrition.

Campbell and Marshall (1975) explained that lipids are insoluble in water phase in exception of traces of water soluble fatty acids . They are found in a globular form (emulsion) and their primary component is the triglyceride fraction .

Smit(2005) indicated that the lipid fraction of milk mainly composed of triglycerides(98%) ,phospholipids (1%) and small amount of diglycerides ,monoglycerides , cholesterol , cholestery esters and traces of fat soluble vitamins and other lipids .

The lipids found in globules with a diameter 0.1-20 um , and surrounded by the milk fat globule membrane .

The concentrations of lipids varies with species , breed ,individual animal ,stage of lactation , mastitic infection ,plan of nutrition ,interval between milking and point during milking when the sample is taken . Welch et.al. (1997) stated that milk fat is a complex mixture of triglyceride with abroad melting range and when coupled with inherent biological variability in composition and function ,leads to discouraging variations in butter quality and limit utilization of milk fat. According to Harper and Hall (1981) milk fat reaches approximately (98%) of the total of the milk lipid system and is comprised of triglycerides which are composed of one molecule of glycerol and three molecules of fatty acids , and they added that it is a complex mixture composed of 60-128 or more fatty acids and the most probable number of triglycerides types in bovine milk fat do not exceed 124,800 because of non-random synthesis .

The triglycerides can be divided into three major classes: short-chain(26-46 units) , medium chain(34-54 units)and long chain(46-60 units) and the extend of milk fat is about 3.5-5.9 with an .(average 3.71,Harper and Hall 1981 (

Lee (1983) explained that milk fat is composed mainly of triglyceride , about 95-96 % of fatty acids and most of them are present in rather . small amount and a few are in significant quantities

Donald et.al.(1982) noticed that fat is an important milk component , . which gives the milk product the desirable taste

.It has a high nutritional value and it is important in fatty milk industry

According to Uoguelph (2007) the fat content of milk is of economic importance because milk is sold on the basis of fat .The main milk lipids are triglycerides which are comprised of a glycerol back bone binding up to three different fatty acids .Other classes of lipids include phospholipids (0.8%) which are mainly associated with the fat globule membrane and cholesterol(0.3%) which mostly located in the fat globule core . Generally milk fat represent about 2.4-5.5% with an average 3.9% . Alshababi et.al.(1984) showed that fat is a most milk component , it represent about 3.5 or 3.7% of its total components , and is comprised of triglycerides which make about 98 – 99% of milk fat and the other milk fat are phospholipids , sterols , carotene , fat soluble vitamin and some free fatty acids which represent about (1 – 2%) of milk fat . Abdullah (2002) indicated that milk fat consist of natural fat triglycerides and other substance like phospholipids , soluble vitamins , sterols and . cholesterol

The milk fat is variable, i . e . Friesian milk contain 3.5% fat , Buffalo . milk contain 7% fat

The milk fat constitutes of small or big particles according to the animal . species , which help their collection in cream separation

Abudawd and Mtwali (1993) reported that milk fat composed of a triglyceride , which represents about 98% of its component and the other 2% include many material like mono , tetra glyceride , cholesterol ,fatty . acids and phospho- lipids

The glyceride chemically consists of a molecule of dialcohol combined with three fatty acids . The milk fat specified by the rind of a fatty acids .which glycerides content

Fox and McSweeney (1998) mentioned that triglycerides represent 97-98% of the total lipids in the milk of most species, and added that the . diglycerides probably represent incompletely synthesized lipids in most cases ,although the value of the fat probably also includes partially hydrolysed triglcerides as indicated by the high concentration of .free fatty acids

Fox (1983) stated that triacylglycerols are the major lipids class , accounting for 97-98 % of the milk total lipids and the triacylglycerols are almost invariably accompanied by small amounts of di and mono – .acylglycerols ,free cholesterol and cholesterol esters

According to Abdullah (2002) milk fat is found in an emulsion form and contains phospholipids, carotene and glyceride with a high melting point is composed of triglyceride (97 – 98%) and phospholipids found in a very small amount (0.2 – 1.0%) but is regard as an important component of fat. Spreer and Mixa (1995) stated that milk fat varies from 3.2 to 6.0% according to breed, feeding maintenance , health and specific .characteristic of the milk animals

Fat is found in a form of sphere or droplets with diameter of 2 to 5 um , consisting of a fat core enclosed by a membrane and at temperature >40̊C it is liquid and at < 40C° it contains both liquid and solid parts, (Spreer .(and Mixa , 1995

Fox and McSweeney (1998) explained that bovine milk contains 3.5%fat ; their level varies widely depending on several factors which are breed , animal individuality ,stage of lactation , season , nutrition status ,type of feed , health , animal age , interval between milking and the point . during milking when sample is taken

Alsafar <u>et .al</u>. (1982) stated that milk contains special kind of fat , differed according to animal kind and some external factors and milk fat found . mainly in a globular state , free fat and phospholipids

Albkiri <u>et.al .</u> (1994) mentioned that the milk fat percentage in each human and cow milk has the same quantities which are 3.5 %. Singh (1979) indicated that studying milk composition of Hariana cows in India , it was found that the fat content was the highest in curing months , November and December (4.6%) while lowest in Spetember and . (October(4.2%

In addition O'mahony and Peters (1987) stated that milk fat is . commercially the most significant solid compound of milk

Algondi (1979) reported that milk fat is easily digestable in emulsion form and it increases in homogenized milk , and it is characterized by having a high content of short chain fatty acids .Abdeltwab (1977) added that fats play an important role in their effect on milk taste and milk products properties and the average fat content of cow's milk is 4% . According to Mottram <u>et.al.</u> (1940) the fat of milk stands intermediate in the amount between protein and sugar , ranging between 3.5 to 4 % of the total weight.

According to Malkiya (2007) that milk fatty acids originate either from microbial activity in the rumen , and transported to the secretary cells via the blood and lymph , or form synthesis the secretary cells.

The fatty acids found in milk have long chains e.g. myristic11% , palmitic 26% , stearic 10% ,Oleic 20% and short chain , butyric and caproic , caprylic and capric 11% .

Abdeltwab (1977) explained that there are about 60 fatty acids in milk , and described it as comparing of fatty acids with double carbon atom ,which start from 4 to 18 carbon atoms with straight chain , and it contain two type of acids , first saturated fatty acids , are specified by a liquid form ,easily dissolved and exposed to oxidation from the saturated fatty acids ,like Decenoic , Dodecenoic ,Tetradecenoic , Linoleic ,linoleneic ,Stearic ,Oleic and palmitic . .

Campbell and Marshall (1975) stated that milk fat is characterized by a high content (7%) of short- chain volatile fatty acids ,mainly butyric and caproic ,which are easily digested by man and other mammals and one pint of whole milk contains about 7.2 g of unsaturated fatty acids and about 10.5 g of saturated fatty acids .

Alnimer (2007) noticed that milk fat is a natural emulsion , easily digestable and has a high melting point , containing about 10% from a fatty acid with a short chain and 20% from a fatty acid with long-chain and 4% of the total fatty acid from the essential fatty acid linoleic and linoleneic .

Spreer and Mixa (1995) indicated that more than 400 fatty acids have been found in milk fat ,of which only ten (10) determine the physical characteristic ; among them are the short- chain fatty acids ,C4 , C6 ,C8 ,C10 and C12 and long chain fatty acids C14 , C16 ,C18 and C18:1 where by the long- chain fatty acids exist in both saturated and unsaturated state. Fox and McSweeney(1998) mentioned that milk fat especially ruminant fats , contain a very wide range of fatty acids , and more than 400 distinct acid detected in bovine milk .

Abudawd et .al. (2003) gave that milk fatty acid can be divided into two kinds , saturated fatty acid with concentration of 60% and unsaturated fatty acids with about 40% and found in a soluble state . Sommer(1938) suggested that the essential fatty acids seem to be present in milk in adequate amounts . In average the milk fat represents from 30 to35% of the milk solids . Milk fat contains the essential fatty acids in adequate amounts .The milk fat contains fatty acids with two double bonds and it found in amounts ranging from 1.9 to 3.7 %.

It reported that milk fat contains about 0.19 to 0.52% linoleic and 0.11 to 0.15% linolenic acid .

Alnimer (2007) reported that the phospholipids act as emulsifying agents by building fat globules ,act as antioxidant in milk and their products and stabilize foam which are important in manufacturing of cream and ice products.

According to Jds.fass .org (2004) that in milk there are three types of phospholipids , lecithin , cephalin and sphingomylin . Lecithin which forms an important constituent of the fat globule membrane , contributes to the richness of flavour of milk . It is higher sensitive to oxidative change , giving rise to oxidized metallic flavours . Phospholipids are excellent emulsifying agents .

Harper and Hall(1981) stated that the phospholipids are similar to fat and gave two major phospholipids in milk (lecithin ,cephalin) which have a phosphorus and nitrogen group replacing one fatty acid .

The phospholipids are the primary precursor of a major portion of the triglyceride of milk fat .

Although they represent low concentration ,but they are highly significant in the milk system , because they are active emulsifying agents , and are rich in unsaturated fatty acids and easily oxidized to give rise to the oxidized flavour of milk finally because they impart a richness flavour of fluid milk products .

Abudawd et.al. (2003) gave that phospholipids are fat compounds containing phosphorus and they have ability to absorb large quantities of water and stop milk particle to gather in a company.

Most phospholipids consist of glycerine ,fatty acids and phosphoric acid associated with zotic base .

Eltakriti and Alkhal (1986) stated that phospholipin the membrane globules and they are formed from diglycerides ,phosphoric acid and nitrogenic base.

During milk separation about 70% of phospholipids go with cream and when manufacturing cream to butter half of them go with sour milk ; phospholipids are important as apart of fat globule membrane which stops the accumulation of fat globules .

Sommer (1938) reported that the milk phospholipids consist of lecithin cephalin,cephalin and sphingomyelin- like phospholipids are intimately involved in the elaboration of milk fat in the secretary process. The amount of phospholipids are apparently located exclusively at the fat serum interface .

He added that , the phospholipids of skim milk contents are 13.91%and 18.46% expressed as percent of the fat and the phospholipids content of the milk of 4breeds as percent of the fat – as follow : Holstein 0.77%,Ayrshire 0.71%, Gurnesey 0.67% and Jersey 0.67%. Larson and Smith (1974) indicated that the protective membrane of the fat globules consists primarily of phospholipids of the milk, it is the remaining present in a complex with protein dispersed in the skim milk. A complete extraction of all milk lipids is difficult, since the lipids bound . to protein have not carried with extract

Fox and McSweeney (1998) explained that most of the cholesterol is in the free form , with less than 10% as cholesteryl ester and several other sterols, including steroid hormones occur at trace levels .

Cholesterol is the principal sterol in milk (>95% of total sterols), the level (-0.3%ww) of total lipids , according to above mentioned authors .

Spreer and Mixa (1995) showed that cholesterol milk has a salty taste , slightly gluer, yellow to brownish colour and is subject to flocculation during boiling ; the specific density is in the range 1.033- 1094g cm^3.

At the end of lactation period i.e. few weeks before the new calving, the . milk return to a cholesterol character

Alshabibi <u>et. al.</u> (1984) mentioned that cholesterol is an essential sterol in milk cholesterol it concentrates in nerves cells and it is source of bile acid ,hormones and vitamin D3 , where by concentration in milk fat is between 0.25-0.40% of the total fat , and is found in milk in a free form free cholesterd or in ester form (cholesteryl ester). .

Abdeltwab (1977) stated that the milk fats are distributed in the liquid media (skim milk) in a form of small cell with a diameter ranging from 0.1-20 micron an average 3 microns in the cow milk . Each particle keeps its shape inside a group and not combined with other particles ,due to the presence of surrounded layer of it , where on the surface layer vitamin A, carotene and some enzymes like phosphatase are attached .

Mottram <u>et.al.</u> (1940) explained that fat exists in the form of an emulsion of extraordinary perfection , and the average diameter of a globule of milk fat is about 2.3 to 4.0U , though there may be some with a diameter . greater than 12U

Walstra <u>et.al</u>. (1999) showed that most milk fats are in globule ,which are concentrated by means of gravity creaming , and thus the form of high .fat products depends on the crystallization of the fat

Abudawd <u>et. al.</u> (2003) reported that fat is found in a small globules distributed in milk in the form of an emulsion ; their sizes is various according to many factors like animal breeding ,fodder and milking ° .season , and their melting point is at a temperature between 33-36C

Fox (1983) noticed that the physical colloidal properties of milk fat globules depend on their size , surface layer (membrane) and presence and orientation of fat crystals and on external conditions. The melting of milk fat occurs over a range of 30 to 41C° (86-106 F°) ,it affected by previous treatment of fat , especially the rate of cooling and the physical of the fat in a short chain , in addition to milk lipids , which have a distinctive physical properties that affect the processing of dairy products (Fox .1983) .

According to Islamoline (2007) milk fat is found in a colloidal emulsion globules ,they are different in volume and percentage according to animal kind and species ; with a percentage between 3 – 5 % in cow and 6 – 9 % in buffalo .

Milk fat has a lower density compared with other milk components , so it flow at the surface of milk and cause cream .

Brunner (1965) stated that milk fat is dispersed in the form of droplets or globules protected by adsorbed layer or membrane and most of the fat is characterized by globules ranging from 1 to 10 UM in diameter . Welstra (1987) pointed that a very large number of the globules are less than 1U in diameter and that very few large globules are in characteristic of species , if the breed or strain within the species .

Sommer (1938) mentioned that the size of fat globules in milk is not uniform ,they range in size as 0.1 to 10 UM , and about 80 to 90% of the fat is in globules falling within the range of 2 to 6 UM. The number of fat globules in a cubic centimeter of milk varies with globules size and with the fat content .

Abudawd and Mtwali (1993) suggested that milk fat found in a form of small ball , distributed in milk and formulated an emulsion . These balls have a various volume and the particle surrounded by a layer , called fat particles layer .

2.3 Milk Carbohydrates

According to Sommer (1938) lactose is the only carbohydrate present in milk.

Mottram et.al. (1940) stated that the carbohydrate constituent of milk is milk sugar or lactose , which is present to the extent of from 4 to 5 % ,and differs very much from cane- sugar .

Milk would call upon the taste much more readily than it does . Another peculiarity of lactose is that it is hardly capable of being fermented by yeasts . On the other hand , it is readily converted into lactic acid by the

lactic acid bacteria , a process which occurs in the souring milk (Mottram
. (et .al.1940

Abdeltwab (1977) explained that lactose is found only in the mammary milk , it's percentage in cow about 4.7 % in average .
It analyses by microorganisms to lactic acid by lactic fermentation. .
The presence of lactic acid in milk which is accompanied with acid smell is produced from lactose fermentation ,i.e Butyric and proponic acid. So acidity increase until reaches 0.6 – 0.7 % and so milk curd occurred.
The disadvantages of lactic fermentation is the fasting milk deterioration when transported from farm to milk factory or to the consumer .
Fox and Mc Sweeney (1998) indicated that lactose is the principal carbohydrates in milks of mammals and it's concentration in milk varies
. widely between species

Lactose content of cow's milk varies due to some factor , i.e breed of cow ,individuality factors , udder infection and stage of lactation .
Lactose concentration decreases progressively and significantly during
. lactation

Any increase or decrease in lactose content is compensated for by an
. increase or decrease in the soluble salt constituents

Alnimer (2007) gave that milk lactose is hydrolysis in the digestive
. system to glucose and galactose

Lactose have a benefit fermentation in nutrition .It activated a useful bacteria (lactic acid bacteria) that help in the absorption and metabolism of calcium , and their fermentation is important in manufacturing of sour
. milk and lactic acid

Lactose play a role in the changes occur in colour and taste of milk products treated by a high heat like caramel and milliard reaction and regarded as an important product of whey which are used in
. pharmaceutical industries

Abdeltwab (1977) showed that lactose is used in medicine purposes in the preparation of antibiotic covered tablet medicine and in the
. preparation of artificial child milk

Abdelwahab and Mahmoud (1984) stated that lactose is a sugar found
. % only in milk in an of average 4.8

Lactic acid ,as the result of lactose fermentation ,has a good effect when taking antibiotics , because it activates desirable intestinal flora ,so some
. vitamins can be formed

Spreer and Mixa (1995) mentioned that lactose is a disaccharide, consisting of glucose and galactose , which is formed in small quantities by isomerization of lactose during heat treatment of milk.

Lactose has technological importance during all acidificatioses involving milk .

And also it can participate in reactions during technological process ,leading to the formation of lactose and in Millard reaction . It's concentration in cow is about 4.8 % and in buffalo is about 5.5 % (Spreer and Mixa 1995).

Alsafar et. al.(1982) gave that lactose is a disaccharide sugar, composed of glucose and galactose and its an essential sugar in milk . Lactose is elementary material for giving lactic acid which is essential in milk industry and taste and flavour of different milk products . Abudawd et.al. (2003) stated that lactose is an essential carbohydrate in milk , composed of glucose and galactose , less soluble in water , less sweetener than sucrose , fermented with bacteria to give lactic acid and during heating and when combined with amino acid produces cook taste and dark colour . Furthermore it is easily absorbed , helps in the absorption of some mineral through the small intestine , and of a concentration of about 4.91% in cow milk.

According to Alhigrawi (1987) lactose is less sweetener than sucrose with at about 5% and it's only found milk and formed in milking gland and hydrolysis by lactic acid to glucose and galactose . According to Eltakriti and Alkhal (1986) lactose is the only milk sugar ; it consist of glucose and galactose ,less sweetener than sucrose, and soluble in water and with a concentration of about 4.5- 5% of cow milk .During butter manufacturing it remains with whey and during milk separation most of it goes with skim milk.

Abdelatif (2005) noticed that lactose is the only milk sugar , characterized with ability of fermentation and it affects the stomach mucosal due to the less solubility.

Darwish (1990) indicated that lactose in native is only found in milk and it consists of the attachment of glucose and galactose .

According Islamoline(2007) the lactose percentage is different according to cow breed , the average is between 4 – 6 % of the total milk components and it is similar in constituent to the normal sugar , but is less soluble and sweetness and easily hydrolysis by bacteria to form lactic acid , which is coagulate milk at percentage 0.8 – 1.0 % .

Uoguelph (2007) gave that lactose is a disaccharide made up of glucose and galactose , and comprises 4.8 – 5.2 % of milk , 52 % of milk SNF (solid non fat) and 70% of whey solids . It is not as sweet as sucrose . When lactose is hydrolyzed by B-D-galactosidase (lactose) an enzyme that splits these monosaccharides , the result is increased sweetness , and depressed freezing point one of most important function is its utilization as a fermentation substrate .Lactic acid bacteria produce lactic acid from lactose ,which is the beginning of many fermented dairy products . Walstra et.al. (1999) stated that lactose is the major carbohydrate in milk ,it is a reducing sugar and a disaccharide composed of D-glucose . and D-galactose and has been found in most mammals

Campbell and Marshall (1975) showed that lactose is the carbohydrate of milk and is usually the most abundant of the three major solid components of milk , where as cow milk contains about 5.0 % lactose. Smit (2005) mentioned that lactose is a reducing disaccharide composed of glucose and galactose and has low sweetness (16 % a sweet as sucrose as 1% solution) and bovine milk contains 4.8 % lactose , which is .responsible for 50 % of the osmotic pressure of milk

Harper and Hall (1981) explained that lactose is a disaccharide composed of two simple sugars (glucose and galactose) and the carbohydrate lactose is the most abundant compound in milk and the only carbohydrate in it with a concentration in cow milk of about 4.4 – 5 % . % with an average 4.64

Lee (1983) noticed that lactose is a normal component of cow's milk ; it comprises about 4.4 – 5.2 % with an average 4.8 % of anhydrous lactose and amount of 50 – 52 % of the total solids of skimmed milk. Alshabibi et.al. (1984) recorded that lactose is a disaccharide composed of glucose and galactose and only found in milk representing a high solid . material in comparison to other materials in cow milk

According to Alicia Noelle Jones(2002) lactose crystallized from water , is formed hard gritty crystals and it is one- sixth as sweet as sucrose . .representing about 4.6 % of milk

Zalzala (2000) stated that the lactose of milk is analyzed to its components which are glucose and galactose and the last is included in some substances that surrounded muscle in the body, where by the percentage of lactose in cows milk is about 4 – 5 % and in mother milk is . % about 6.5 – 7

Zagzig (1999) gave that the milk lactose is essential milk compound , since it gives it the sweet taste and it represents about 5% of milk . .elements

O'Mahony and Peters (1987) explained that lactose is a disaccharide in milk , and usually predominant solid in milk although some high – yielding cows producing milk contain more fat than lactose , and he added that lactose is present as a solution and therefore it is more . difficult to recover it from milk as an isolated fraction .

Webb et.al.(1980) stated that lactose works as anti pellagrous ,because it helps in the production of niacin in the stomach and it provides half of the total solids in milk and contributes 30% of the food energy in whole .milk

According to Alshabibi et.al. (1984) milk contains lactose sugar which is analyses inside the intestinal tract to glucose and galactose and it ability to form a benefit fermentation in the nutrition and its content of galactose is important in the formation brain layer and nerve cell .Also it activates special kind of lactic acid and appreciate special kind of minerals to pass .(through the intestinal (ileum

According to some authors the percentage varies from one breed to another e.g Holstein 4.68 % , Brown Swiss 4.94 % , Ayrshire 4.60 % , Guernsey 4.71 % , Jersey 4.83 % and Thorthorn 4.89 % .

Paul and Southgate (1978) reported that milk lactose is different in concentration ; it lays between 4 – 6 % of the total milk element and found in component but with less solubility and sweetness and is easily analysis by lactic acid bacteria to lactic acid but when it's concentration reach of 0.8 – 1.2 L , milk coagulates and becomes less benefit . .

Altakrori and Almasri (1989) suggested that lactose is a carbohydrate of milk , and forms about 5 % of the total milk elements giving milk its sweetness.

Awida (2004) reported that lactose is known as milk sugar , it composed of glucose and galactose and represents about 5% of the total milk .weight

Milk Protein 2.4

O'sullivan (1973) stated that the protein in milk ranges between 3 and 3.5%.

Walstra et.al .(1999) gave that about 95 % of the nitrogen in milk in the .form of proteins , which are a complicated mixture

Fox and Mc Sweeney (1998) indicated that normal bovine milk contains about 3.5 % protein , and the concentration changes significantly during lactation , especially during the first few days post- patrium , the greatest .change occurs in the whey proteins fraction

Fox (1982) showed that normal bovine milk contains roughly 30-35 g protein/litre and about 88% of these proteins are present as large spherical complexes with inorganic species , particularly calcium . phosphate ,known as micelles

Campbell and Marshall (1975) gave that two main proteins in milk , casein and lactalbumin and traces of lacto globulin , and added that the protein in regard of milk is approximately equivalent to that in 5 ounce of meat or fish , 5 large egg , 4 ounces of American cheddar cheese and 16 slices of bread .

Smit (2005) mentioned that milk contains two types of proteins ,protein insoluble at PH 4.6 called casein and represents 78 % of the total nitrogen's in bovine milk and the soluble proteins called whey or serum protein , which consists of two types , globulins and albumins ,but now it is known that the two principal whey proteins are B- lactoglobulin and @-lactalbumin .

Abudawd and Mtwali (1993) reported that milk proteins consist of casein and whey proteins which are specified by easily digestability and absorption , and it contain much more amino acids , than any natural food .

According to Alicia Noelle Jones(2002) milk proteins are composed of a large number of amino acids ,some are essential and other are non essential and they represent about 3 – 4 % of the total milk components . It consist mainly of casein , B – lactoglobulin , @-lactoalbumin casein only in milk , it form more than eight percent of total milk protein and found in the form of calcium caseinate-phosphate complex. Donald et.al. (1982) noticed that the important protein component in milk is the casein , albumin and lactoglobulin and it is composed of non protein a zote material which found in blood i.e carotene , uric acid and febrrin.

Mottram et.al. (1940) stated that proteins are complex chemical structures that are build up out of amino acids which are sometimes popularly called" protein building blocks". There are a large number of amino acids which are known.

Abdullah (2002) showed that three kinds of proteins in milk , which are casein ,albumin , globulin and they are formed in blood amino acid ; cow's milk contains a lot of casein which help in milk curdling , while the albumin and globulin are known as whey proteins and they precipitate at temperature between 60 – 70C˚.

According to ALnimer (2007) milk is regarded as a high source of protein , it provides human being with the essential amino acid and it is rich in phosphors that helps in calcium absorption .

Eltakriti &Alkhal (1986) indicated that protein is a complex organic material ,consists of units called amino acids , some of it attached with fat which are called lipoprotein and when it is attached with carbohydrates are called glycoproteins i.e K-casein that contain phosphorus is called phosphoprotein ; milk protein is found in milk as a colloidal casein .micelle and soluble in whey protein

According to Abudawd &Mtwali (1993) milk contains two essential proteins with small amount of many other proteins and the main two kinds are casein ,which represent 80 % of the total milk proteins(20 g /kg milk) ,and the whey protein which represents 3.6 g/kg milk and contains many other kinds proteins like B-lactoglobulin , a-lactoalbumin , serum .albumin and immunoglobulin

Risha (1991) indicated that milk protein contains about 20 amino acids , which are largely different , and among them the essential amino acids which form 51.2 % of the total amino acids . He added that there are two other kinds of proteins which are albumin and globulin , they contains phosphorus ; the albumin contains a huge quantity of amino acids and the globulin has antibiotic properties as is important source of the antibodies in human body , but when boiling milk to 70 C^{o}, the albumin and globulin separated to a shape similar to cotton , and if the temperature increases more than 70 C^{o} ,the loss in albumin reaches 74 % and by sterilization .% the loss of albumin reaches 50

Lee (1983) showed that the milk proteins constitute about 3.5 % of total milk components , and are identified according to the classical nomenclature as casein 80 % and lactalbumin ,lacto globulin and serum proteins are comprising the other 20 % ,but milk contains also free amino . acids , peptides and other form of nitrogen

Mahna (2002) mentioned that the cow milk contains about 3.5 % . protein

Abdellatif (2005) explained that milk is important source of protein with a high nutrients which provide the human being with the essential amino . acid in a high concentration

According to Dubai Montada(2007) milk protein represents about 2.5 – 4.2 % , the important constituent is casein forming about 80% of the total protein and found in milk attached with calcium ,its not affect by heat but it affected by rennet acid , followed by albumin , which found in a soluble state in milk and coagulate by heat acid , or rennet . According to Uoguelph (.2007) the primary structure of proteins consists of a polypeptide chain of amino acids residues joined together by peptide linkage and the concentration of proteins in milk is about 3.25 % , described as follow , total protein 100 %(33 /L) , total casein 79.5 % (26 g/L) ,total whey proteins 19.3 % (6.3 g/L),alpha lactalbumin 3.7 % (1.2 g /L) , beta lacto globulin 9.8 %(3.2 g/L) and immunoglobulin 2.1 % . ((0.7g/L

Milk Casein 2.4.1

According to Abdullah (2002) casein is a protein which precipitate sour milk at pH 4.6 and is formed in the secretion cell in the udder gland of .cows

Mottram et.al.(1940) added that the principal protein is the substance called caseinogens ,which is not very soluble in pure water , but is kept in solution in milk by various inorganic salts . It is not clear , but opalescent .and least soluble at pH 4.6

O'sullivan (1973) mentioned that casein is found only in milk and not in other nutrients ,it constitutes about 80 % of the total milk proteins . Abdeltwab (1977) reported that casein is the major protein of milk representing about 80 % of it , found in all mammaries with different amounts and it's average in cow's milk is about 2.6 – 3 %. The casein contains all the essential amino acids needed for feeding .The number of amino acids is about 20 or more .It is specified by containing phosphorus of about 0.8 % ,beside carbon , oxygen ,hydrogen ,azotes and . sulphur

Fox and McSweeney (1998) explained that casein is phosphoprotein ,synthesized in the mammary gland , very stable to high temperature heterogeneous , low in sulphur and contains an average of about 0.85 . phosphorus

Mahna (2002) stated that casein is a phosphoric protein containing 0.85 % phosphorus ,little of sulphur attached with large quantity of calcium. Casein is a complex unhomogenized compound found in milk globules micelles . It contains about 35 – 45 % of unpolar amino acid (valine ,leucine ,isoleucine ,phenylalanine , tyrosine , proline) , which are activate reaction that are affect milk natural and technological properties . In addition milk casein , especially @S2 casein are rich in lysine which are giving milk the brown colour during heating in the presence of .reducing sugar ,as given by the same author

Alsafar et.al. (1982) gave that casein in milk represents about 3% , which forms about 80% of the total milk protein . In addition it is found in a small cell called micelles and in a colloidal form called caseinate .phosphates which are a complex compound

The casein micelles are equilibrium in the solution , due to their physical specification and their relation to temperature , acidity and reaction . between milk components

Lee (1983) noticed that casein is the largest group of protein in milk ; It contains in average 0.78 % sulfur , 0.09 % cystine and 0.69 % methionine , and he added that casein is not a single protein it consist of three main components ,which are @-casein ,B-casein and k-casein. The casein micelles is the protein in the dispersed phase in milk; it represent about 74 % of the total protein in the skim milk ,as given by same author .

Abudawd and Mtwali (1993) stated that casein is an essential milk protein , it gives milk the white colour ,which is found in small particles form called micelles ,that reflect light to give the white colour and it has nutritional and industrial form . Algondi (1978) gave that the casein is an important milk element , which represent 80% of milk proteins and added that casein is a completes protein containing all amino acids , which the body is not able to synthesize .

The casein particle and fat balls reflect the light rays that follow through milk to give dilution light .

According to Alshabibi et.al.(1984) milk casein is an essential protein in milk ,it represents about 80 % of the total protein and contains about 53.1% carbon , 6.95 % hydrogen ,15.65% nitrogen ,0.81% sulphur , 0.85 % phosphorus and the other percentage is the oxygen . Casein is found in a complex compounds inside cells called casein micelle . It consist of many protein units attached with calcium in the form of calcium casein in addition to calcium phosphate ,magnesium phosphate and citrate ions.

Eltakriti and Alkhal (1986) mentioned that casein is the only protein found in milk, represents about 80% of the total milk protein or about 2.6 – 3.4% of milk and found in milk as suspension colloidal form . They added also casein is found in a small micelle form with a diameter 10 – 300millimicron and combined with calcium and phosphorus as calcium caseinate phosphate .It's PH is about 4.6 – 4.7(isoelectritic point).

Spreer and Mixa (1995) explained that casein , which is 80 % of the milk proteins is arranged in milk as precisely formed micelle (Cluster of individual molecules which are kept together by lateral forces) , and a part from the casein , where by the micelles contain a fairly high percentage of colloidal calcium phosphate.

Abudawd et.al. (2003) showed that casein is an essential protein in milk ,it constitute about 80 % of the all milk protein and consist of may derivatives like @-Casein , B-casein and k-casein , which are attached with each other to form globules , that combined with colloidal calcium phosphates salt to form casein micelles .

Campbell & Marshall (1975) gave that casein is a major protein in milk synthesized in the secretary cells of the mammary gland and ranges in bovine milk from 0.03 to o.3 U in diameter (1um=10meters).

The two principal components of casein are @ and B-caseins , the k-casein is especially important because it stabilizes other caseins in the . presence of calcium

Alhigrawi (1987) stated that casein is an important milk protein , it forms about 3% of milk , found in milk as calcium salt distributed in a complex colloidal form with calcium phosphate and coagulates by acid , alcohol . and rennin

Alnimer (2007) pointed out that casein is formed in the secretion cell of udder gland , precipitate from souring of skim milk , represents about 2.5 % of milk and about 80 % of the total milk protein . It's pH is about 4.6 , and is found in a large colloidal molecules contains calcium , . magnesium , phosphates , citrate and casein protein

According to Uoguelph (2007) the casein content of milk represents about 80 % of milk proteins and the principal casein fractions are alpha (S^1) and alpha (S^2) ,B-casein and kappa casein and added that the distinguishing property of all caseins is their low solubility at pH 4.6 . The common compositional factor is that caseins are conjugated .proteins ,most with phosphate groups esterifies to serine residues .These phosphate groups are important to the structure micelle

Calcium binding by the individual casein is proportional to the phosphate . content

Fox (1982) indicated that it was suggested that the caseins which accounts 76 – 86 % of the total proteins , can be explained by four gene products ,Z^1-casein , Z^2 –caseins ,B-caseins ,k-caseins and the others are derived by post –translational processing such as phospharylation , .glycosylation or limited proteolysis

O'Mahony & Peters (1987) indicated that casein consist of fractions precipitated from raw skim milk by acidification to pH 4.6 at 20 C^o and the enzymatic precipitation of casein is used to coagulate milk for cheese making by using rennin ,a proteolytic enzyme extracted from the . abomasa of 10 to 30 day –old milk –fed calves

Smit (2005) noticed that casein is protein insoluble at pH 4.6 and it represent about 78 % of the total nitrogen in bovine milk and about 2.5 % of milk and the two principle caseins @- and B- caseins are devoid of cysteine or cystine residues ,the two minor caseins @2 and k-caseins contain two inter molecular disulphide's,B-LG contains two intermolecular disulphide's and one sulphydryl group , where by the Smit , the casein are often regarded as rather hydrophobic proteins ,but they are not particularly .So however , they do have a high surface .hydrophobicity owing to their open structure

According to Walstra et.al (1999) casein is defined as the protein precipitating from milk near pH 4.6 and is not a globular protein ; it associates extensively and present in milk in large aggregates , the casein micelles that also contain the colloidal calcium phosphate (CCP), and noticed that on acidification the (CCP) dissolves , casein is hardly heat sensitive .Only heating at temperature above about 120 C° causes the casein slowly to become insoluble and lowering the PH of milk .considerably diminishes heat stability

Recheigl (1983) stated that most of the casein produced for edible purposes is an acid precipitated casein ; the acids used can be sulfuric , or hydrochloric , or lactic acid produced by fermentation of lactose in the skim milk . The degree of purity desired is obtained by optimizing the level of acidity and the coagulating temperature , as well as the efficiency . of cleaning the coagulum with water

Furthermore , the sanitation conditions of the processing and storage are of great significance for the commercial value of edible caseins , where by the traditional edible casein , produced by acid precipitation, without .proper purification ,is easily manufactured

Hugh (1971) suggested that the casein is the major protein of milk , but is no area of milk protein research . As has clearly demonstrated the huge amount of data known about on the occurrence of the genetic variants of .@-B and k-caseins in the various breeds of cattle

There are marked differences in the micelles of mature milk from various species of cows , and it is necessary to determine whether this differences .reside in the k-caseins and or in the other caseins

Whey Proteins 2.4.2

Walstra et.al. (1999) stated that serum proteins are present in a dissolved form in the serum and are often called whey proteins , although they are not precisely identical to the protein of rennet .Whey which also contains the peptides split off from k-casein .The immunoglobulin in milk varies .widely in concentration and composition

All serum proteins except proteose –peptone are globular proteins .All their protein remain in solution ,but they are heat- sensitive. Mottram et.al. (1940) mentioned that whey is the fluid which exclude from clotted milk and is best prepared by adding to30 ounce of milk heated to104 F° ,two tea spoon full of rennet ,and setting aside in a warm place till clotting has occurred . The clot must then be broken up very thoroughly by stirring and the whole strained through muslin .Furthrmore

22 ounces of whey should be obtained with (approximately) the following composition in percentage water 93.64 ,protein0.82 ,fat 0.24 ,sugar 4.65 and mineral matter 0.65.

Algondi (1978) gave that whey proteins are the part of milk after manufacturing cheese ,the water separated from cheese contains soluble proteins , lactose and minerals and the whey constituents are soluble in the albumin and globulin water. The whey proteins contain some vitamin ,like vitamin B ,the riboflavin which gives milk a colour nearly to greenish .

Large quantities of whey proteins produced by cheese factories in the world , especially the producer countries are used in feeding animals . But now most whey proteins dried in a powder form and used in many food industries.

Campbell and Marshall (1975) mentioned that whey , as its composition indicates ,is a fluid of a small nutritive value ,it hardly ever enters into an ordinary diet ,but is often an aid in the feeding infants and added that whey proteins are proteins remaining in whey after removal of casein and constitute about 0.6 % of milk .

According toAbudawd et.al. (2003) whey proteins formed from casein precipitate ,they contain many proteins like B-lacto- globulin ,@ -lacto albumin and immunoglobulin .

Whey proteins are characterized with high solubility in water ,precipitate by both heat and acidity ,help in emulsion pitting and during heating give (-SH) which provide a cook taste .

According to Uoguelph (2007) the proteins appearing in the supernatant of milk after precipitation at PH 4.6 are collectively called whey proteins. These globular proteins are more water soluble than caseins and are subject to heat denaturation .

Native whey protein have good getting and whipping properties. Denaturation increases their water holding capacity.The principle fraction are B-lacto globulin , alpha –lacto albumin , bovine serum albumin (BSA) and immunoglobulin (Ig).

Fox (1982) reported that the major protein constituents of whey are B-lactoglobulin , Z-lactalbumin , bovine serum albumin ,immuno globulin and protease peptones ,in addition there are several minor whey proteins including lactoferrin ,lactollin ,glycoprotein and blood transferrin . Also he found that sterilization changes whey protein either become denatured or interact with components of casein micelles (k-casein) and become sedimentable with casein or co-precipitable at the isoelectric point of casein .

Smit (2005) showed that early during 1885 whey or serum proteins are of two types , globulins and albumins which are transferred directly from the blood ,(the proteins of blood and whey have generally similar physico- chemical properties and are classified as albumins or globulins). Alsafar et.al. (1982) pointed that during separation of fat and casein from full milk , it remains yellow nearly to a greenish liquid called whey and contains some other proteins in addition to lactose and minerals and estimated to be about 0.5 – 0.7 % of total milk protein .

Mahna (2002) gave that whey proteins represent about 20% of the total milk protein ,they regarded as a ball compact ,difference in milk components and properties .

Alnimer (2007) indicated that whey protein constitute about 0.6 % of the total milk protein and does not precipitate at PH 4.6 like casein ,but it precipitate by heat.

He added that protein formed essentially from lactoalbumin ,lactoglobulin and protease- peptone ,with concentration in milk12 ,32 ,and 0.8 g /kg respectively .

Eltakriti & Alkhal (1986) reported that whey proteins are a yellow greenish colour liquid remained from the removal of fat from milk casein ,and normally produced during cheese processing ., they formed about 0.5 – 0.7 % of skim milk and they contain lactalbumin and immunoglobulin and do not precipitate by rennet or dilute acid but by heat . Recheigl (1983) stated that traditionally produced lactalbumin is water insoluble ,but is of high nutritional value .

According to Abdeltwab (1977) whey proteins are rich in sulphur and amino acids ,i.e cystine and methionine and they contain soluble proteins of milk like albumin ,globulin and brotuzbutone with percentage of 0.5 – 0.7 %(1/6-1/7of the total milk protein) in cow milk and they increases in two cases , in colostrums milk and during udder inflammation . Zalzala (2000) noticed that albumin represents bigger part of the whey proteins , lacto albumin as a source of growth considered and it is found in colostrums with 3.5 % in cow milk while the normal mother milk contain 0.3% lacto albumin .

Abdeltwab (1977) showed that sometimes it is called lacto albumin and present in cow milk in average of 0.3 – 0.4 % and specified by sulphur content . Furthermore the presence of sulphydryl groups in protein molecule specify the albumin leads to it's analysis by heat forming cooking taste during milk boiling The albumin is benefit in cheese industry ,i.e. receta cheese .

And he added that ,their percentage in a natural cow milk is about 0.1 – 0.2 % and its composition is nearest to casein and it curdles by heat.

It is important in colostrums of the first hour ,because it carries the antibodies from mother to infant .
Globulin contains the agglutinin ,a substance which helps in collection of fat balls during cream spreated .

2.4.3 Lactoalbumin

Fox (1982) stated that the product precipitated from whey by heat denaturation is known traditionally as lacto -albumin , where by the production are independent of lactose manufacture.
Alsafar et.al (1982) reported that lactoalbumin has ability to precipitate and curd during exposing to heat and observed that some of it precipitate during pasteurization at temperature 70 C° or more .
Alnimer (2007) gave that lacto albumin is prepared from whey after casein separation , it represent about 70 % of the whey proteins and is regarded as unhomogenised protein , it consist of B-lacto globulin which is an important protein of whey and formed about 55.5 % of the total whey protein .It contains sulphur groups (-SH) which it gives the cock taste in heated milk , and it's not soluble at PH 5.2 in the absence of salts.
And he added that x- Lactalbumin is represent about 15 – 20% of Lactoalbumin . It's a most whey protein struggle heat and is the second protein from concentration in the whey . it is less soluble than B-Lactoglobulin in dilute solution salts .
Lee(1983) mentioned that the other important protein in whey proteins is@– lactalbumin , second in concentration to B-lactoglobulin , it contain no sulfhydryl groups , but has a high content of cystine .
@-lactalbumin is the best characterized protein of milk , it comprises up to 25% of the whey proteins and 4% of the total milk protein as given by the above mentioned author.
Mahna (2002) pointed out that @- lactalbumin is the smallest whey protein its molecular weight is about 14.2kg / Dalton , form lactose and high heat resistant .
It also contains cysteine (2) which is attached with calcium and it is responsible for contrast change in constituent .
Harper and Hall (1981) indicated that @- lactalbumin constitutes about 22 % of the total whey protein , biological active as the soluble fraction of enzymes lactose synthetase and it is rich in sulfur and it contains about 2.5 times sulfur casein .
According to Uoguelph (2007) @ -lactalbumin is a protein containing eight cysteine groups and has a highly ordered secondary structure and a

compact spherical tertiary structure ,where thermal denaturation and PH< 0.4 result in the release of bound calcium. .
Hugh (1971) stated that at present it is generally believed that the "A protein" of the lactose synthesize system is a galactosyl transferase and that @- lactalbumin (the B-protein) modifies its enzymic function to .enhance markedly its lactose synthesize activity

Fitzgerald et.al. (1970) indicated that their group has developed improved . assays for lactose synthesize system

Their work resulted in the following : the specific activity of @-lactalbumin increases as the "A protein" become more purified ,under certain conditions ; there is a nonlinear response of enzymes activity to .protein concentration

In assay for the "A protein" high levels of @-lactalbumin are inhibiting in a linear manner ,an optimum level of lactalbumin being required for maximum activity of a limiting amount of "Aprotein" ,also ,there is an inverse relationship between concentration of glucose and @-lactalbumin .required for optimum activity

As given by Recheigl (1983) lactoalbumin phosphates are precipitated from whey under acid condition in the presence of certain condensed phosphates . Although there is some evidence that this precipitation involves chemical reactions , it is presently through one of the cation and . anion interaction

The lactalbumin phosphates contain both the lactalbumin and beta lactoglobulin of milk in indentured ,no hydrating whey protein. They added furthermore that the colloidal effectiveness of lactalbumin is greatly enhanced in lactalbumin phosphate products ,that have developed mainly in the U.S between 1966 and 1971 and recommended that a broad usage of those products in cake mixes ,meats self raising flour bread and .pizza as a replacement of non fat milk solid

B-Lacto- globulin 4 .4 .2

Welch et.al. (1997) stated that B-lacto-globulin is the most abundant protein found in the whey and it may be involved in the transport of . retinol and fatty acids

According to Campbell and Marshall (1975) B-lactoglobulin contains only amino acids and free sulfhydryl (-SH) groups in the form of cysteine residues , which have been implicated in the development of cooked . . flavour during milk heating

Harper and Hall (1981) stated that B-lactoglobulin is a major protein of whey (about 66 %) ,soluble in dilute salt solutions ,and precipitate by magnesium sulfate or half –saturated ammonium sulfate .They further added that it is present in milk in colloidal form , denatured by heat and plays a significant role in the physical properties of fluid dairy food . subjected to high temperature processing

Mahna (2002) mentioned that B-lacto globulin is an essential whey protein , it represents about 50 % (3.3g/L) and about 12 % of milk . At room temperature on pH 5-7 it is found in a dimmer molecule and it is separated to elementary units at temperature 40C and is rich in sulphur . amino acid

According to Uoguelph (2007) B-lacto-globulins , include eight genetic variants ,comprises approximately half the total whey proteins and the isoelectric point (PH 3.5 to5.2) , the dimmers are further associated to octamers, but at pH below 3.4 ,they are dissociated to monomers . Hugh (1971) explained that for many years it was assumed that B-lactoglobulin was the predominant whey protein in all milk and he suggested that it was confined to ruminant milk . It has been found in cow , goat and sheep's milk .It does not seem to be present in kangaroo milk there is ,as yet ,no evidence of it in platypus and echidna milk . Alsafar et.al. (1982) noticed that lacto-globulin is a complex protein , representing about 0.05 % and it is usually found with lactoalbumin .It is found in many kinds, different in their amino acid(i.e B-lacto –globulin) which contain sulphydrol that have a relation with a cook flavour formed . .during heating milk at a high temperature

As given by Larson and Smith (1974) it is conceivable that the product produced in this study might be cytotoxic ,a potentiator of the reaction , or that some hidden sites on the B-lacto-globulin by a factor of 100 ,the level which elicited a positive response ,0.1 ug ,was not much different from that found to produce a number of positive skin testundenatured . B-lacto-globulin was used for skin scratch tests in other studies

And they added that Bleumink and Young (1968) studied proteins milk allergy and specifically B- lacto-globulin ,sensitivity ,which was not documented except for the indication that a positive skin test was .obtained with undenatured B- lacto-globulin

Immunoglobulin 2.4.5

Campbell and Marshall (1975) mentioned that Immunoglobulins are closely related in chemical composition and physical properties and . include the antibodies of milk

According to Harper and Hall (1981) they constitute about 10% of the total whey protein and originally they were classified as lacto-globulins and later as euglobulins and later as euglobulins and pseudo globulins , and they are designated as 1gm ,1gA ,1gG1 and 1gG2 . They added that the immune globulins are significant as components of the milk fat globule membrane and also contribute to the natural bacteria inhibitory properties of fresh milk . .

Mahna (2002) showed that immunoglobulin (1g) contains many milk globulins which are 1gA (immunoglobulin A) ,1gG (immunoglobulin G) and represents about 80 % of the total globulins and it composed of many peptide chains .The IgG (immunoglobulin) is able to change thermolabile and it has special technological properties .

The cow milk contains about 0.6 – 1g /litre (which about 3 % of the total nitrogen) immunoglobulin (1g) .

Alsafar et.al. (1982) stated that immunoglobulin is found in colostrums with high concentration about 50 – 70 % and it has a relation with the immunity formation and gives an infant the natural immunity .

Larson and Smith (1974) reported that the immunoglobulin are involved in precipitating homologous antigens of the 1gG (immunoglobulin G) classes , and such antibodies were demonstrated in the sera of almost all children fed on milk .

And they added that in general from the current data that the presence or absence of immunoglobulin of the 1gG (immunoglobulin G) class in the sera of children appears to have little bearing upon the manifestation of milk allergic symptoms .

For present , the measurements of serum antibodies by a variety of techniques have not been of much diagnostic value in detecting milk allergy .

2.4.6 Other Proteins

Eltakriti and Alkhal (1986) gave that among the other proteins found in milk , which are found in very smaller quantities , but essential point of view are lactinin , lactoferrin and urea .

Abudawd et.al .(2003) stated that milk contain other protein like proteose –peptone which is obtained from whey and protein isolation and also contains lactoferrin and transferrin which inhibit the bacterial growth by binding with iron .

Mahna (2002) indicated that most proteose peptone in whey is a part of amine in B-casein , it is formed by protein hydrolysis in the presence of plasmin enzyme to produce a heat stable phospholipids which are soluble . .at pH 4.6

According to Smit (2005) milk contains several proteins at low or trace levels ,many of them are biologically active and some regarded as highly . significant as neutraceutical

They are found mainly in the whey , but some are also located in the fat globules membrane. In addition milk contains several metal-binding proteins ,ferroxidase ,lactollin ,osteopontin and proteose peptone 3 . Fox and McSweeney (1998) reported that in addition to the casein and whey proteins, milk contains two other groups of proteins or protein –like material , i.e the proteose – peptone fraction and the non-protein nitrogen .fraction

Walstra et.al. (1999) showed that miscellaneous proteins are numerous , the membrane of the fat globule contains several ,including various glycoprotein and some have cysteine residue .Most of the many enzyme proteins present in milk are located in the fat globule membranes . All membrane proteins occur in the plasma , albeit in very small . concentration

Fox (1982) pointed out that numerous proteins some of which are enzymes , phospholipids , cerebrosides , gangliosides and sterols are . found in the membrane

Almost all of the investigation of this material has been done with bovine milk in which proteins of the fat globule membrane constitute about 1% of the total protein of the milk or about230mg / liter as given by same .author

As noticed by Abdeltwab (1977) it is found in milk a trace of other proteins like Flave – proteins , which are composed of riboflavin , protein phosphoric acid beside fat particles and their percentage in milk s . .about.0025%

Milk Vitamins 5. 2

Fox and Mc Sweeney (1998) stated that vitamins are organic chemicals required by the body in trace amounts but can not be synthesized by the body . The vitamins required for growth and maintenance of health differ between species , compounds regarded as vitamins for one species may . be synthesized at an adequate rate by other species

Fiesland Campina (2009)indicated that vitamins are chemical compounds that are indispensable for our body .They play a role in growth and repair . processes and are vital for maintaining

As given by Sommer (1938) formerly fat , carbohydrates , protein and minerals were regarded as the only essentials in nutrition , but since recognition of vitamin A in 1931 by the first food accessory , the list has steadily grown . All of these food accessories has one characteristic in common ; they are needed only in traces as compared with fats , carbohydrates and proteins . On this basis they are grouped under the class name , vitamins , even though they are quite variable in their chemical structure and function .

Campbell and Marshall (1975) reported that vitamins are substances found in low concentrations in animal tissues , including milk , which are necessary for the metabolic reactions of tissues , and quantities of vitamins in milk and milk products are determined by three assay methods ; biological (feeding trials with animals) , microbiological (growth studies with bacterial) and chemical or physiochemical . According to Abdullah (2002) milk contains most vitamins with different amounts ,which are divided into two kinds : 1.the fat soluble vitamins containing vitamin A,D,E,and K ,found mostly in milk fat ,cream ,butter and little in cheese and not found in skim milk ,that contain a lot of vitamin A ,carotene , vitamin D and little of vitamin E.

2.Water soluble vitamins containing B-complex ,niacin ,riboflavin and vitamin C. .

This group is affected by heat , whereby they lose 10 – 20 % of its nutritional value and the riboflavin is influenced by light in colostrums. Abudawd & Mtwali (1993) added that the cow milk contains all the known vitamins that needed by human for nutrition ,except vitamin k . Spreer and Mixa (1995) indicated that the vitamins content of raw milk is influenced mainly by the feeding and health of the animal and they can be reduced further by treatment .

As given by Zalzala (2000) the cow milk contains abundance of vitamin(A) and B-complex , little of vitamin (C) and (D) ,which are not enough for infant needs in the first month of life .

According to Abdelkarim (1986) the intake of one litre of milk daily provides children at age of 1 to 2 years up to age of 8 to 10 years and almost 40% and for adults 29 % with vitamins . The American studies referred to the daily consumption of a quart of milk furnishes the human body with all fat ,calcium , phosphors , riboflavin and half of protein and 1/3 of vitamin A ,1/4 of energy , ascorbic acid and thiamin , as given by the above mentioned author .

ALgondi (1978) showed that milk contains vitamin (A) and (B2) in a high quantity and other vitamins in low quantities .

Vitamin (D) is added to commercial milk and vitamin (A) disappeared . during removing fat from milk

Abdeltwab (1977) mentioned that generally milk is good source of vitamin (A) , riboflavin and some of vitamin (B) ,(C) ,(E)and vitamin .((D

Table (1)

: The amount of vitamins in milk are given in the following table

No	Kinds of vitamin	. The contents of vitamin in milk
1	(Vitamin (A	IU 20
2	Carotene	5ug /g of fat
3	(Vit .B1 (thiamin	ug / 100 ml 37
4	Riboflavin	ug / 100 ml 139
5	Panthothenic	ug / 100 ml 400
6	(Niacin (Nicotinic acid	ug / 100 ml 63
7	(Vit. B6 (pyridoxine	ug / 100 ml 37
8	Biotin	ug / 100 ml 1.6
9	(Vitamin (B12	ug / 100 ml 0.3
10	Folic acid	ug / 100 ml 0.3
11	(Vit. (C) (Scorbic acid	mg / 100 ml 2
12	(Vit . (E) (Tocopherol	ug / g fat 28

(Source : - Abdeltwab (1977

The Vitamin (A) content of milk 2.5.1

Alsafar et.al. (1982) stated that milk and their products are a rich in vitamin (A) which is usually found in abundance fat especially fat globules .The concentration of milk fat varies in cow breed and the quantities of vitamin increase by increasing fat content . Smit (2005) recorded that large seasonal variations , the breed of cow and fodder ,have a significant effect on fat milk i.e Jersey and Guernsey have a higher content of the vitamin than Friesian and Holstein . The yellow –orange colour of high fat dairy products depends on the concentrations of carotenoids and vitamin (A) , goats , sheep and buffalo do not transfer carotenoids to their milk and products produced there form are Winter than corresponding products from bovine milk . Gomestic (2009) whole milk is a good source of vitamin (A), but during the skimming process , most of the vitamin lost , so skim milk must be fortified with vitamin (A) before packaged .

Fox and Mc Sweeney (1998) pointed out that vitamin (A)activity is present in milk as retinol , retinyl esters and carotene and whole cow's milk contains an average of 52 ug retinol and 21 ug carotene per 100g . ALnimer (2007) gave that milk is an important source of vitamin (A) ,which is show about 0.04 mg /100 ml milk , in addition to carotene which changes to vitamin (A) in the body by oxidation .

Spreer and Mixa (1995) showed that vitamin (A) is available in cow's milk with concentration 0.02 – 0.2 mg /100 ml and is sensitive to UV rays and oxygen .It survives braising and deficiency causes skin and eye damage (Night blindness) . .

Eltakriti and Alkhal (1986) noticed that the buffalo milk is characterised with the white colour because it has ability to change carotene to a non colour vitamin where in Gurensey species the milk is more yellowish than other species , due to the content of carotene unchanged to vitamin (A) . Also colostrums contain high quantity of vitamin (A) which is reduced to the normal state after two or three days after delivery. vitamin is influenced with the heat treatment of pasteurization and sterilization , but long heating in the presence of air reduce its validity . Alshabibi et.al. (1984) stated that vitamin (A) is found in colostrums with percentage of 2 – 6 % and carotene represents about 11 – 50 % of the vitamin (A) activity in milk .

According to Uoguelph (2007) Vitamin (A) is derived from retinol and B-carotene , because milk is an important source of dietary vitamin (A) ,it gives about 400 g /litre .A fat reduced products which have lost vitamin ((A) with the fat are required to supplement the product with vitamin (A

The Vitamin (D) content of milk 2 . 5 . 2

Fox and Mc Sweeney (1998) mentioned that the major forms of vitamin (D) (calciferol) in cow's milk are vitamin D2 and D3 , whole cow's milk contains only about 0.03 mg vitamin (D) per 100g , will supply only 10 – 20% RDA (recommended daily allowance) , milk is relatively stable during storage , but it may be degraded by exposure to light and oxygen . Campbell and Marshall (1975) recorded that the concentration of this vitamin in milk is low , the am ounts present in milk are related to the fat content of milk , which mainly depends on diet and the exposure of cow .to sunlight

Spreer and Mixa (1995) reported that vitamin (D) is available in cow's . milk at level 0.0002 – 0.0004 mg

Smit (2005) stated that vitamin (D) binding protein has been detected in the milk of several species at the level of 2% in blood serum . The concentration of vitamin (D) binding protein is higher in bovine . colostrums and in early milk than in mature milk

Alnimer (2007) showed that milk is rich in vitamin . it represent about 0.06ug /100mg of milk , which is helps in precipitation calcium and magnesium in body (to promate bones growth and to avoid rickets) . Also milk contains cholesterol which is chage to vitamin (D) by exposing . to sunlight or ultra violet rays

Eltakriti and Alkhal (1986) explained that vitamin is a fat soluble vitamin and milk and butter are a rich source of it. He added its quantity in milk are appropriate with their content in fodder and the exposes of animal leather and udder to the direct sunlight , in addition to season variations , i .e the concentration of the vitamin the summer milk is higher than winter .milk

Books.Google (2009) stated that vitamin (D) is quite stable towards heat and oxidation under the prevailing conditions in milk ; is not destroyed by pasteurization , nor by the sterilizing process as applied to evaporated . milk ,which is about 240°F (115°C) for 15 to 18 minutes

According to Natural health (2008) found that the treatment of milk by ultra violet increases its strength 20times in addition to killing microbe . and sterilized milk. And it use in some American and Uropian

According to Fatair(2000) human milk contains about 0.5mg / vitamin (D) , full cream milk contains 4.4 calciferol / 100g and fortified milk contains 4.4calciferol /100g . Human adult gains most need of vitamin .(D) (90%) during exposing skin to sunlight

The Vitamin(E)Tocopherols content of 2 . 5 . 3 milk

Campbell and Marshall (1975) stated that milk contains relatively small amounts of vitamin (E) , almost solely in the alpha form , which mammals selectively absorb and deposit in their tissues .

Extensive losses in vitamin (E) result when milk fat becomes oxidized .with the development of metallic to fishy flavours

Fox and McSweeney (1998) indicated that the concentration of vitamin (E) in cow's milk is quite low , 0.09 mg /100 g and is higher in Summer than in Winter . And they added that vitamin (E) is relatively stable below 100 C^{o} ,but is destroyed at higher temperature and it may be lost through oxidation during processing and oxidative losses are increased by exposure to light , heat or an alkaline pH .

Eltakriti and Alkhal (1986) showed that vitamin (E) is a fat soluble vitamin ; milk is not a rich source of it and its content in milk increases by increasing the green fodder for cow . Furthermore vitamin (E) is important to stop the oxidation of milk fat and to resist the heat treatment .that occur during processing

Alshabibi et .al. (1984) noticed that @-tocopherol (vitamin E) is a main factor for milk oxidation and milk fat contains about 25 ug /g . Meruyn (1989) pointed out that vitamin (E) is one of the soluble vitamin , and it's concentration in milk is about 0.098 mg/100ml , deficiency cause sterility and play an important role in sexual maturation . Awida (2004) mentioned that human milk is rich in vitamin (E) and cow milk contain a low percentage of it .

According to Mohamed Salih (2004) milk is a rich source of vitamin (E) and it functions as antioxidant to fat , vitamin (A) and vitamin (C) and has a role in amino acid metabolism , treatment sterility ,important in heme synthesis ,co-enzymes and strength immunity in human .

Until now its deficiency is unobvious , except in the case of kwashiorkor and rapid apportion .

TheVitamin (K) (Phylloguinone)content of 2.5.4. milk

Fox and McSweeney (1998) gave that the whole milk contains about 0.4 .– 1.8 ug vitamin (k) per 100 g

Campbell and Marshall (1975) mentioned that milk contains a little of vitamin,(K) and the intestinal flora usually synthesized an adequate .amount for an animal

It's function is regulation and maintenance the normal concentration of prothrombin in the blood and it's deficiency is mostly occur in newborn . infants

Eltakriti and Alkhal (1986) stated that vitamin (K) is a fat soluble vitamin and acts as anti bleeding blood , and stops the development of . acid and oxidized taste in milk

They added that its main factor is to regulate and store the natural concentration of protein in the blood . It's concentration in milk is about 400 Iu /kg and it's melting point is 106 C°. .

Awida (2004) indicated that cow milk contains a high amount of vitamin . (k) than human milk and helps in blood clotting

He added that most vitamin is stored in liver ,by passing in chylomicrons through lymphatic system to the blood circulation and attached with .B-lipoprotein and passed to liver

Fatair (2000) showed that milk shows a little concentration of vitamin (k) ., which is about 0.001 mg phyloquiones (k) /100g

It's fatal role is helping liver to form the clotting factor and a cofactor for . oxidation of the phosphoric enzymes

According to Mohamed Salih(2004) milk is a poor source of vitamin (k), and the daily requirement is 70-140 mg for adult and +5 mg to pregnant .women

2.5.5 The Thiamine (Vitamin B_1) content of milk

According to Sommer (1938) in1934 , before the chemical structure of vitamin (B) was known , the international units was defined in terms of the vitamin as obtained from an extract of rice polishing and adsorbed on .Fuller's earth

Moreover the thiamine content of milk generally ranges from 27 to 56 micrograms per 100 cc .It seem to be quite representative of pooled supplies of fresh , raw milk ,and these values have been widely adopted . in tabulation of vitamin content in foods

It is known that thiamine is quite thermostable under acid conditions , but in case of milk it undergoes some destruction during pasteurization. Campbell and Marshall (1975) explained that vitamin (B_1) thiamine is essential for metabolism to all animals , their bodies store only the needs for a few weeks and it is abundant in milk , one quart of milk supplies about 30 to 40 % of the RDA (recommended daily allowance) for person . over 10 years of age

Thiamine is partially destroyed by heat ,although it losses at high temperature , short –time or ultra pasteurization and less than 5% for .sterilization in cans

Eltakriti and Alkhal (1986) mentioned that thiamine is a water soluble vitamin ,it is found in abundance in milk and milk products . Fox and Mc Sweeney (1998) stated that most of the thiamine in bovine milk is produced by microorganisms in the rumen , and therefore feed ,breed of cow or season have relatively little effect on its concentration in milk In addition thiamine is unstable ,especially during storage , but its more stable under slightly acid conditions and pasteurization. Fatair (2000) reported that milk and its products is an important source of thiamine , although milk contains little of it and this is related to the high consumption of milk and its products by human and the full cream milk contains about 0.07 mg /kg . It's big role is in the form of (thiamine .pp)thiamin perophosphate which is work as cofactor to . enzymes

Awida (2004) showed that milk is a fair source of vitamin (B) . One cup . (244 g) of full cream or skim milk gives about 0.08 mg thiamin

2.5.6 The Riboflavin (Vitamin B_2) content of milk

According to Sommer (1938) riboflavin is synthesized in the rumen of cows by bacterial action , and the content of the vitamin in milk is . therefore largely independent of the feed

It has been observed that cows receiving a diet , that is almost free from riboflavin produce milk with a practically normal content of this vitamin . Also it found that commercial summer milk was 20 % richer in riboflavin than winter milk , and Jersey milk has the highest ,Guernsey milk intermediate and Holstein milk is the lowest riboflavin content . The content was about 50 % higher in Jersey milk than in Holstein milk and the riboflavin content of colostrums is about two or three times as high as for normal milk , but by the fifth day after parturition it is only slightly . (above the normal(Sommer 1938

The riboflavin content of milk tends to be inversely related to milk yield , since the milk yield is influenced by the feeding level , and apparently to . milk yielding capacity between individual cows and breeds

Also riboflavin is sensitive to light and is converted to biologically . inactive compounds by light

Therefore it is advisable to protect the riboflavin of the milk by storing it in the darkness or by using protective containers to reduce the effect of . light

Campbell and Marshall (1975) stated that milk , skim milk and whey are . a rich source of riboflavin

Quantitative milk are usually highest in riboflavin in during spring and . summer

During milk fermentation some cultures use riboflavin , especially in .early incubation

Fox and McSweeney (1998) reported that milk is a good source of . riboflavin , whole milk contains about 0.17 mg /100g

Spreer and Mixa (1995) showed that vitamin (B_2) is available in cow milk at level 0.2 mg , it causes discoloration of whey (green –yellowish) , important for growth especially for lactobacilli and it's deficiency cause an intestinal illness , it is not sensitive to oxygen and heat and the daily requirement for human is 2 – 4 mg and 0.8 – 1.2 mg for infant . Riboflavin is stable in the presence of oxygen ,heat and acidity PH. The concentration of riboflavin in milk is unaffected with pasteurization .(and little loss are reported for UHT (ultra high temperature

The most important parameter affecting the stability of riboflavin in dairy products is exposure to light. .

ALnimer (2007) indicated that in milk vitamin (B_2) is about 0.175 mg / 100 ml , causes the greenish colour for the whey protein and it's . deficiency results in a disease

Eltakriti and Alkhal (1986) pointed out that vitamin (B_2) is a water soluble vitamin and is abundant in milk and their products . Vitamin (B_2) is a green yellowish dye gives whey special colour , moderately resist heat and acid and it is easily destroyed by exposing to light . It gains undesirable taste when exposed to sun light due to the sulphur formed from the analysis of the amino acid methionine . Alshair and Gatash (2000) suggested that milk is an important source of riboflavin and it's role is important in enzyme constituent which is help . oxidation inside cell

Awida (2004) expressed that milk functions is work as coenzyme ,dehydrogenase ,co- adehydrogenase and it include in the enzyme that change glycerol -3-phosphate to dihydroxy acetone .

Fatair (2000) mentioned that about 90 % of the free riboflavin (vitamin B_2) is found in milk , legumes and the eye cornea , but milk is a favorite .source of the vitamin and full cream milk gives about 0.44 mg /k

.(As given by Aromatherapy (2008) milk is a rich source of vitamin(B_2

The Niacin (Nicotinic acid) content of milk 2.5.7

Niacin is synthesized in the rumen of cows , and its content in milk is .apparently not influenced to any extent by the feed

As given by Sommer (1938) niacin content of milk ranged from 60 to 80 microgram per 100 ml .A content of 0.65 to 0. 70 mg /quart of milk is apparently quite representative of pooled milk supplies .Niacin is quite . thermostables ,and there is no loss by pasteurization

Fox and Mc Sweeney (1998) mentioned that milk contains about 0.1 mg niacin per 100 g , tryptophan contributes roughly 0.7 mg nicotinamide . per 100 g milk

In milk niacin exists primarily as nicotinamide and its concentration is . not affected largely with cow breed , feed , stage of lactation or seasons

Niacin is stable when exposed to air and resistant to autoclaving and also . stable to pasteurization and UHT treatments

Campbell and Marshall (1975) gave that the niacin is stable to heat and sun . Little variation occurs in the concentration of niacin in milk due to .the diet , breed or stage of lactation

According to Eltakriti and Alkhal (1986) niacin (nicotinic acid) is called a vitamin antipellagra , ir's apart of a coenzymes that are important in hydrolysis of lipids , fatty acids and also benefical in metabolism of carbohydrates , sterols and hormones . .

Fatair (2000) stated that milk is a poor source of niacin and the full milk . contains about 0.2 mg /k niacin

Other vitamins contents of (B) complex of 2.5.8 milk

The significance of other vitamins of the B-complex in human nutrition is unknown . Presumably they are required , but they appear to create no practical problem either because they are generally available in human .diet ,or because of synthesis in the body

Sommer (1938) pointed out that the presence of pantothenic acid , pyridoxine, biotin , inositol, choline and folic acid has been demonstrated in milk .Panthothenic acid ,pyridoxine and biotin are known to be .synthesized in the rumens of cows

2.5.8.1 Pyridoxine (Vitamin B_6) content of milk

Fox and McSweeney (1998) indicated that whole milk contains in average 0.06 mg B6 per 100g , mainly in the form of pyridoxal (80 %) and pyridoxamine (20 %), with trace amounts of pyridoxamine phosphate , concentrations in raw and pasteurized bovine milk are similar to those in cow's milk (0.08 and 0.06 mg per 100g , respectively) .The concentration of vitamin B6 varies during lactation ; colostrums contains lower levels than mature milk . Seasonal variation in the concentration of vitamin B6 has been reported in Finnish milk ,levels were higher (14 %) when cattle were fed outdoors than when they fed indoors . All forms of vitamin B_6 are sensitive to UV light and may be decomposed by heat .

Losses during pasteurization and UHT treatments are relatively small , although losses of up to 50 % can occur in UHT milk during its shelf –life . .

Vitamin (B_6) is not sensitive to heat or acid but it's sensitive to light and the daily recommended amount for human is 2 – 4 mg.

Campbell and Marshall (1975) recorded that vitamin (B_6) is important in metabolism of essential fatty acids and amino acids . Pasteurization causes no significant decreases in vitamin (B_6) activity , but about 50% of vitamin (B_6) may be destroyed . . During sterilization ,It is mildly susceptible to light inactivation .

According to Eltakriti and Alkhal (1986) vitamin (B_6) is a water soluble vitamin , found in abundance in milk , removes the carboxyl group and hydrogen sulphur and passes the amine group . Pasteurization and homogenization have no effect on its validity.

Awida (2004) showed that milk is a fair source of vitamin (B_6) and (8) ounce of full milk contains about 0.10 mg of vitamin (B_6). It's functions are coenzyme to many enzymatic system , help in change tryptophan to niacin ,help in production antibodies , work as coenzymes , forming the precursors porphyrine which include in the formation of the haemoglobin molecules and important in the metabolism of the polyunsaturated fatty acid .

2.5.8.2. Cobalamine (Vitamin B_{12}) content of milk

Campbell and Marshall (1975) stated that vitamin (B_{12}) possesses the most complex structure of any vitamin , where milk contains about 4 ug per quart , or about 65 – 80 % of RDA for adult and is highly stable to pasteurization or sterilization , since deaeration stabilizes the vitamin to heat. .

Fox and Mc Sweeney (1998) mentioned that bovine milk contains an average 0.4 ug vitamin (B_{12}) per 100 g , in a predominant form of hydroxycobalamin and more than 95 % of this nutrient is protein bound. Higher concentrations are found in colostrums than in mature milk .

Meruyn (1989) indicated that cobalamine (vitamin B_{12})is stable to pasteurization and storage of pasteurized milk , but ultra high heat treatment (UHT), and in particular storage of UHT milk , causes greater losses and storage temperature has a major influence on the stability of B_{12} in UHT milk.. Losses during storage at 7C^{O} are minimal group to 6 months but at room temperature losses can be significant after only a few weeks .oxygen levels in UHT milk do not appear to influence the stability .of vitamin B_{12}

Eltakriti and Alkhal (1986) explained that vitamin B_{12} is an antianemia vitamin , resistant to temperature and acidity and destroyed by the direct sunlight . It contain cobalt and is important in the metabolism of carbohydrates ,fat ,protein and nucleic acid .Milk and their products are a rich source of it. .

According to Mohamed Salih (2004) milk is an important source of vitamin B_{12} (cobalamin), it has a role in formation red blood cell and . nucleic acid 1,2 DNA-RNA

As given by Awida (2004) milk contains vitamin B_{12} and (8) ounces of it .gives about 86 mg of the vitamin

As showed by Fatair (2000) cobalamine (vitamin B_{12}) has a low concentration in milk , abouts 0.03ug/100g in cow milk and about .0.01-0.1 ug /100g in human milk

Panthothenic acid content of milk 2.5.8.3

Eltakriti and Alkhal (1986) stated that panthothenic acid is one of the (B) vitamins group , abundant in the whey and skim milk , and does not . resist acid or base but it resist light and the oxidation reduction factor

Fox and Mc Sweeney (1998)mentioned that milk contains, an average of 0.35mg panthothenate per 100g Panthothenic exists partly free and partly bound in milk and its concentration is influenced by breed ,feed and season , but it is stable at neutral pH , easily hydrolyzed by acid and alkali .at high temperature and stable to pasteurization

Campbell and Marshall(1975) showed that panthothenic acid forms a part of coenzyme(A) which plays a vital role in the metabolism of carbohydrates, fatty acids and nitrogenous compounds, where human requirement is estimated as 10milligram per day and milk supplies about .3 mg per quart

There is a little destruction of the vitamin by pasteurization . ,sterilization ,drying or prolonged exposure to sunlight

Awida (2004) stated that milk is a fair source of pantothenic acid .It functions as coenzyme(A),transmits acyl group in fat oxidation , includes in prophyrin forming which is essential in the heme forming ,transmits the acetyl group that requires to synthesis acetylcholine and absorbed in a .small intestine and adrenal necrosis

Biotin content of millk 2.5.8.4

Fox and Mc Sweeney(1998) stated that milk contains about 1.9 ug biotin per 100 g , apparently in the free form and pasteurized caprine , raw bovine and human milk contains about 3.0 ,2.5 and 0.7 ug per 100 g respectively. Biotin is stable during processing and storage and Campbell and Marshall (1975) mentioned that milk is a dependable source of biotin , with a concentration in milk of about 29 mg per quart ,about 20 % of the daily human requirement. .

Eltakriti and Alkhal (1986) reported that biotin is a water soluble vitamin found in milk and its products , main function is metabolism of fatty acids and amino acids ,and helps in synthesis of the amino acids about 10 – 15 % of biotin is destroyed by pasteurization and sterilization of milk .

Awida (2004) showed that milk is a fair source of biotin ;it functions as coenzyme for many enzymes , maintenance the health of skin , and synthesis the insulin hormone ,nicotinic acid, pancreatic amylase and . anibodies

Choline content of Milk 2.5.8.5

According to Alnimer (2007) choline is a part of lechinine which is found in milk fat and it plays an important factor in fat metabolism and usage in .body

Campbell and Marshall (1975) pointed out that about half of the choline in milk is a water soluble vitamin ,the remainder is bound mainly in the phospholipids , one quart of milk supplies slightly more than 100 mg of . choline

Eltakriti and Alkhal (1986) showed that half of choline is found in milk in a free form and the other is bound with phospholipids and is viscous uncoloured liquid ,not resisting the alkaline base but it resists the acidity .circular

Passmore and Eastwood (1986) reported that choline is abundant in milk and its antifactor for accumulation fat around liver and milk is contains . about 2.1 mg /100 ml choline

As given by Aromatherpay (2008) choline is available in milk and . antifactor for gathering fat around liver

As indicated by Natural health (2008) that the increase of choline in human body is unfavorite , but cell layers need it for safety and facilitate . fat movement inside and outside muscle

Folate content of milk 8.6. 2.5

Fox and Mc Sweeney (1998) indicated that milk contains about 6 ug folate per 100 g and is mainly bound to folate – binding proteins and about 40 % occurs as conjugated poly – glutamate forms . The folate binding proteins of milk of various species have been characterized . Winter milk is reported to contain higher concentration of folate than . (Summer milk (7 and 4ug per 100 g ,respectively

In addition an antioxidants , particularly ascorbic acid in the milk ,can .protect folate against destruction

Campbell and Marshall (1975) stated that folic acid(pteroylglutamic acid) in man is necessary in the development of a normal blood cells ,but milk .is a relatively poor source of folic acid

According to Eltakriti and Alkhal (1986) folic acid is a vitamin resists up to PH 4 – 12 ,but it is destroyed in curricula of high acidity. Colostrum is a rich source of it and it is biological function is synthesis the nucleic acid. .

Heat treatment influences folate levels in milk ; pasteurization and the storage of the pasteurized milk have relatively little effect on the stability of folate , but UHT treatments can cause substantial losses . The concentration of oxygen in UHT milk (form the head space above the milk or by diffusion through the packaging material) has an important influence on the stability of folate during the storage of UHT milk . As given by Awida (2004) milk and its products contain a small amount . of folacin ; eight ounces of full milk contain about 12mg folacin

The Ascorbic acid content of milk .2.5.9

The ascorbic acid content of milk is not directly dependent upon the .cows ration ,and is fairly uniform throughout the year

The cow is able to synthesize ascorbic acid ,the synthesis of ascorbic acid . is in the body tissues of the cow itself .

Sommer (1938) recorded that the ascorbic acid content of milk from individual cows generally falls within the range of 1.5 to 2.5 mg per 100ml, and in pooled milk supplies it is quite uniformly 2.0 to 2.2 mg / . 100ml

Meruyn (1989) reported that (ascorbic acid) vitamin © is apart of the water soluble vitamins ; it helps in the metabolism of the amino acid , injury curd ,absorption iron to build haemoglobin , protect vitamins (A,E,B) from oxidation and destruction ,important in the formation adrenal gland and protect from cancer ,its concentration in milk is about . 2.11mg /100ml

According to Uoguelph (2007) vitamin© (ascorbic acid) is a water soluble vitamin , but it is very heat liable and is easily destroyed by pasteurization , its concentration in raw milk is about 30mg/ litre. Awida (2004) gave that milk and its products is a poor source of vitamin ©.,about 2mg /100 g milk , because pasteurization and sterilization . process destroy this vitamins

One cup (244g) of treated milk give 2mg ascorbic acid . It functions are protection from scurvey , synthesis of collagen , absorption iron , metabolism of amino acid , cold tolerance , antioxidant , utilization of folic acid , synthesis of mucopoly –saccharides and anti-inflammatory . steroids

Milk Minerals Content 2.6

Mottram et.al.(1940) stated that inorganic substances are fairly abundant . % in milk , forming about 0.7

Seeing that milk is the sole food of young animals , one is not surprised to learn that its different mineral ingredients are present in the same proportion as in the body of the particular animal , which the milk is . designed to feed

Darwish (1990) mentioned that all minerals elements found in milk are present in the blood , except some found in milk combined with organic compound. .

Campbell and Marshall (1975) explained that the minerals of milk beside their nutritional importance , also strongly affect the physical state and stability of milk proteins , flavour and sometimes catalyze chemical reactions in milk and they are present in the milk form . The major minerals in milk are potassium 0.14 , calcium 0.12 , chlorine 0.10 ,phosphorus 0.9 , sodium 0.05 . sulfur 0.02 and magnesium 0.01 .Besides minor amounts of zinc , iron ,copper , iodine ,bromine ,fluorine ,boron ,nickel , manganese , molybdenum and cobalt , plus at least (13) .microelement

Fox and McSweeney (1998) pointed out that the milk salts are mainly phosphates , citrates ,chloride , sulphates , carbonates ,bicarbonates of sodium , potassium , calcium , magnesium in addition to more than 20 elements found in trace amount including copper , iron ,silicon ,zinc . ,iodine and others

Zalzala (2000) mentioned that the mineral content of cow milk is about 0.7 to 0.75 % , which is more than mother (human) milk which to be . % about 0.15 – 0.25

The cow milk has a high percentage in all minerals elements , except iron . and copper

So, infants have a shortage in iron in the first month of the age . As stated by Abuzaid (1999) milk contains minerals such as Zn, Mg ,Fe , Cu ,Mn which are activator and important in enzymes work , while Mo .and Co are essential part of vitamin (B_{12}) and Fe for blood haemoglobin

Fox and Mc Sweeney (1998) noticed that ash does not accurately represent the salt of milk and the principle inorganic and organic ions in milk can be determined directly by potentiometric , spectrophotometric or other method . They also noticed that milk contains 20 – 25 elements at very low or trace levels and these micro-elements are very important from a nutritional view point and some i.e Fe and Cu are very important lipid . prooxidants

According to Alnimer (2007) milk salts are one of the milk components found in the ions form or a compound with ions insipide of hydrogen and . carboxyl ions

Harper and Hall (`1981) indicated that milk contains seven minerals as major components and many more in trace amounts. The major . components may vary widely

The primary salts of milk are considered to be the chlorides, phosphates and citrates of calcium , magnesium ,sodium and potassium , which . influence heat stability of milk proteins

Phosphorus and citric acid generally have stabilizing effect , the balance between them is referred to the salt balance which are important in milk .processing to avoid heat precipitation of the casein

From a functional and a nutritional view point calcium and phosphorus . are the most important minerals of milk

Abdeltwab (1977) suggested that the evaporation of milk sample treated at 550C̊ , a lot of mineral salts with grey colour called ash remained ; its percentage in cow milk ranges between 0.70 and 0.75 %. The milks salt are found in a soluble or sticky form . The heat sterilization affects the distribution of calcium , magnesium ,phosphate , citrate .percentage and causes crude in milk

Abudawd and Mtwali (1993) explained that calcium and phosphorus found in milk with high percentages covers the most human needs i.e. one litre covers 75 % of a daily need . The cow milk is specified by having % a high percentage of calcium and phosphorus which may reach 1.3 .% and in human 2.2

According to Smit (2005) changes in salts equilibrium have major effects on the stability of milk proteins ,and to a lesser extent of milk lipids and . consequently on the process ability of milk

As reported by Spreer and Mixa (1995) the milk salt content depends upon factors such as stock , stage of lactation ,health and the mineral . supply by the feed

ALnimer (2007) stated milk is a rich source of calcium 120 mg /100 g and phosphors 100mg /100 g, which are important and essential for . human body

Calcium content of milk 2.6.1

As stated by Campbell and Marshall (1975) milk and milk products supply about 75 % of the dietary calcium in the united states , and is an essential nutrient with multiple function , where by adult human body contains 1.0 to1.5 kg of calcium. (about 99% is in the skeleton). And they added that calcium concentrations of milk remain stable despite changes in the calcium content of feed . This is due to the fact that cow can draw on skeletal reserves in times of dietary deficiency or can excrete calcium in times of dietary surplus.The calcium concentration can be affected sufficiently by feeding to influence the stability of milk products. The increased of calcium ingestion caused significant reduction in serum . cholesterol

Spreer and Mixa (1995) gave that in milk about 33% of calcium is bound .to casein

According to Google.com (2007) milk is a main and large source of calcium and one cup of milk provides half of the daily recommended of calcium. .

As given by Annaharoline (2003) calcium is an important element for children and adults and the calcium absorption is positively affected by the milk lactose. .

Devendra and Burns (1970) showed that the average value of calcium in milk of French Alphine goat is 138 mg /1 , in Anglo Nubian goat 1393 mg /1 and 1493 mg/ l in cross breed saanen goats.

As indicated by Sommer (1938) milk is the most important source of calcium in the diet and average calcium content of cow's milk is about 0.17 % calcium oxide . Also a quart of milk (946.4cc) weight about 975 g and contains about 1.66 g calcium oxide or 1.185 g of calcium . According to Hardwick et.al. (1991) milk contains about 125 mg/100 of calcium and is one of the elements found in the solid part of bones and passes to and from bones through cells called osteoplast.

Fatair (2000) noticed that milk and it's products are a rich source of calcium , providing about 60 % of calcium food.

About 50 % of human milk calcium and 25% of cow milk calcium citrate at PH 6.8, and the reminder of the milk calcium are in the form calcium phosphate emulsion and casein its fatal role is participate in many activities. i.e bones calcification ,activate many clotting factor , enzymes, regulate muscle contraction , reduction, transmission nerve impulse and regulate cell layer and blood vessels permeability.

It's deficiency cause disturbance in cell nerve impulse transmission ,digestive system and kidney .also it occurs during intake aluminumderivative as antiacidic and the severe cases human suffer form osteomalcia.

Alshair and Gatash (2000) pointed out that calcium in human body represents about 1.5 – 2 % of the body weight , which about 99% of it is in skeletal (bones and teeth) and the others in tissues and extracellular liquid. .

Shills and young (1988) reported that the daily requirement of calcium varies according to age sex pregnancy, lactating. So three serving per day which is equal about 250ml of milk are recommended .For example the daily for children at the age between 1 – 8 years is 500 – 800mg , children at the age 9 – 18 years about 1300mg ,adult at the age 19 – 50years about 1000 mg and adult at the age of 50 and over about 1200 mg . As given by Mohamed Salih (2004) The daily requirements of calcium are about 0.4 – 0.5g/ day for children at age between 1 – 9 years , about 0.6 – 0.7g /day for adolescence at the age of

13 – 15years , about 0.4 to 0.5 / day for adult ,about 1 – 1.2 g /day for pregnant about 1 – 1.2 g/ day (5 – 6 cup of milk or products) for . lactating women respectively

phosphorus content of milk 2.6.2

Sommer (1938) stated that a quart of milk with an average phosphorus peroxide content of 0.195 % will furnish 1.90 g of $P_2 O_5$ or 0.83 g of . phosphorus

Campbell and Marshall (1975) explained that about 85 % of the phosphorus in the human body is combined with calcium in bones and teeth , and the highly favorable ratio of calcium and phosphorus in milk .1.2 :1

Spreer and Mixa (1995) mentioned that the analogous distribution of phosphorus is at the level of 33,38 and 20 % with 1 % bound to lipids (in the fat globule membrane) . The colloidal solution of the compound is based on the fact that due to their charges are surrounded with a hydrogen . sphere and are kept in solution

Harper and Hall (1981) gave that the distribution of phosphorus in milk is 18 % as organic phosphorus esterifies to the various caseins , 7 % as organic esters such as sugar phosphates , 1.5 in phospholipids , 38.5 % as colloidal calcium phosphate , and 35 % in the form of soluble phosphate salts

Awida (2004) showed that phosphorus is regard as a second element after calcium from quantity and about 80 % of the total phosphorus of the body are in bones and teeth and it found in a large amount in milk and its products . .

Fatair (2000) reported that , milk is regard as a rich source of food phosphorus ,its concentration is about 150 – 175 mg/L and in cow milk is . about 1000 mg /L

Mohamed Salih (2004) noticed that phosphorus is found in a large amount in milk . It estimated to be about one (1%) of the body weight (600 – 900 g) and about 80 – 85 % of this quantity is found in bones and teeth combined with calcium and formed calcium phosphate and the other .percentage 15 – 20 % is distributed in body cells and tissues

The daily requirement is 100 g for infant at 1 – 6 month , for children at age 1 – 8 year about 460 – 500 mg , adolescence between 12 – 18 year 1.250 g , adult over 19 years 700 mg and pregnant and lactating women is . 1.250 g

Magnesium , Sodium , Potassium , 2.6.3 ZINC ,Chlorine and Manganese in milk

As stated by Devendra and Burns (1970) milk magnesium concentration is lower at the beginning and the end of lactation. .
Church and Pond (1988) gave that sodium and potassium are considered together because they are all electrolytes that play a vital role in maintaining osmotic pressure in the extra and intra cellular fluids , and maintaining acid – base balance .

As indicated by Awida (2004) sodium is found naturally in milk . It's functions are regulating acid base balance ,osmotic pressure , cell membrane permeability , dietary sources of sodium and transmission of the nerve impulses . The daily requirement according to National Research Council of America (1989) the lower requirement per day for infants is about 120 – 200 mg , children and adolescence 225 – 400 mg and adult and elderly is about 500 g for each .

Fatair (2000) recorded that the normal food provides about 2.3 – 2.9 g /day sodium , which is equal about 8 – 12 g sodium chloride . Milk is a best natural source of sodium.

The previous author added that the normal food provides about 2000 to 6000 mg / day potassium .

Milk is a good source of potassium , full milk contains about one milliter per/ounce .

It's fatal roles are regulates water between body tissue , acid base balance and muscle contraction also it activate many enzymes , where as it's deficiency occurs when the rate of secretion increases in kidney and digestive system and the daily requirement of potassium for adult is about 2500 mg /kg ,infant is about 90 mg /kg and the amount of about 800 mg potassium / day is enough to protect human body from the deficiency .
Mohamed Salih (2004) noticed that milk contains much potassium . It's function in body is associated with sodium in many activities , i.e regulate the osmotic pressure , acid – base , muscle contraction , nerve sensitivity and activator to many biological operation .The daily requirement for adult is about 2.5 g /day .

Zinc is essential nutrient for normal growth and development in farm animal . .

Awida (2004) stated that whole milk, contains about 4 mg potassium per litre milk and the mother milk during the first six month after delivery contain about 16 mg per litre and reduced after that to reach 0.65 mg per litre .

The daily recommended allowance according to National Research Council of America (1989) is about 15 mg / day for , adult and elderly male and pregnant women , about 12 mg /day for adolescent , adult and elderly female , about 5 mg /day for infants and is about 10 mg / day for children. According to Awida (2004) chlorine is the most anions present in the body fluids . Milk is a rich source of chlorine . It's functions include the hydrochloric acid component , activate salivary amylase , regulate the acid balance , regulate the osmotic pressure and water balance and increase the ability of the red blood cell to liable a large amount of carbon dioxide from body tissues and cells to lungs . Devendra and Burns (1970) reported that manganese was recognized .essential for animal and reproduction in 1931

Iron in milk 2.6.4

According to Ferguson (2007) iron is essential in the body tissues and . the hemoglobin of the red blood corpuscles

Milk is deficient in iron ,the iron content of cow's milk ranges from 0.021 to 0.091mg /100cc of milk , and the average falls within the range of . 0.021 to 0.049

Mottram et.al.(1940) indicated that iron is an essential element in the body and especially in the blood , but iron is very scontily represented in milk . Five pints of milk would be required to supply the amount of iron necessary for man every day. .

Alkhatib (1985) stated that although iron found in low amount in milk , . but plays an important role in the hemoglobin formation

Awida (2004) noticed that milk contains a trace amount of iron ,a cup of milk (244 g) contains about 0.2 mg iron and its functions include the constituent of haemoglobin which is regarded as the essential component of the red blood cell , for the muscle haemoglobin and works as oxygen reservoir , for oxidative enzymes in muscle ,storing in ferritin and hemosiderin to be used in haemoglobulin synthesis and synthesis material works as neurotransmitter from cell nerve to another and . synthesis collagen

As given by Fatair (2000) iron forms about 0.25 – 0.85 % of the normal food iron ; its concentration in human milk is about 0.3 % mg /L , in cow milk about 0.5 mg /L and about 50 % of natural milk iron is absorbed in . body compared with to about 10 % absorbed from manufactured milk

Copper in milk 5. 6. 2

Devendra and Burns (1970) stated that copper was first shown to be .dietary essential in 1928

Colostrums is significantly richer in copper than mature milk and in most .cases there is progressive fall throughout the lactation period

As given by Mohamed Salih (2004) milk is a poor source of copper and human adult body contains about 0.00010% of weight copper which is .equal 100-150mg distributed in all body tissues

It is important in forming some enzymes ,haemoglobins, release of iron from liver, in synthesis of phospholipids , factor for growth ,reproduction and bone formation ,also is important in forming elastin (protein) for . aorta and the daily requirement for adult is about 0.09mg /kg weight

Iodine in milk 2.6.6

Iodine is indispensable in nutrition ,and it is needed in the production of .thyroxin ,the hormone of the thyroid gland

Sommer (1938) showed that values have been reported ranging from the merest traces to0.276 part of iodine per million parts of milk .Aquart of milk with the higher iodine content would contain nearly 0.276 mg of iodine,which is about the daily requirement .However, most milk is deficient in Iodine. By increasing the Iodine content of the cows ration the iodine content of milk can be made adequate, but the commercial practicability of such as procedure is questionable in view of the ease with which iodine can be supplied in the diet ,e:g through the use of . iodized salt

Iodine is normally secreted in milk and its source is the concentrated fodder which animal feeds on it . it is also transmitted as pollutant from .antiseptic compounds

Zalzala (2000) stated that the concentration of iodine in cow milk is 5 – 700 micro gram per litre and 1 – 4910 micro gram per litre in milk .

The production of milk and its products in the total iodine of the food is 20 – 31% in Western countries. Most iodine found in the cow milk ranges between 80 and 90% and is in inorganic form (mostly iodide) in the water medium of milk ,and from 0 – 13%of iodine is attached weakly or strengthly with protein and less than 0.1% of it is combined with fat and . easily absorbed

As given by Fatair (2000) iodine concentration in milk depends on its availability in animals and fodders , where milk and its products contain .about 3 – 4ug /ounce

Mohamed Salih (2004) pointed out that milk is a poor source of iodine ,which is important for the thyroid gland , maturation cell , water balance . and activating muscle ,endocrine cell and reproductive system

Milk Enzymes 2.7

Campbell and Marshall (1975) stated that ,enzymes are primarily composed of proteins and are organic catalytic agents that participate in chemical reactions without being used up themselves ; they are needed in lower requirements for energy reaction and they are vital in all biological . .reactions

The milk enzymes have protein nature and they are related to sticky compound . Some are originally found in milk as a result of filtration of blood , these are nine enzymes , and the other are secreted on it by . microorganisms

The enzymes functions as assistance factor to fasten the chemical reaction . operation in the human body

Walstra et.al.(1999) showed that milk contains scores of enzymes , the .native enzymes and enzymes of microbial origin

The native enzymes can be present at different location in milk of them . associated with the fat globule membrane

Most milk enzymes have no biological function in milk although present . in high concentration

Spreer and Mixa (1995) mentioned that milk enzymes originate partially in the blood and are transferred via the milk formation cells in form of natural enzymes and partially as metabolic products of microorganisms which have found their way into the milk in form of bacterial enzymes . And they added that the reaction of enzymes are dependent on the temperature and pH , whereby at low temperature their reaction are . delayed and their optimum at temperature 30 – 40 C̊

Abudawd et.al. (2003) explained that milk contains many enzymes which help in the biological reaction , specialized with their optimum temperature and acidity , effect on the products and they are also used to investigate the kind of the heat treatment used and their effectiveness.

The action of enzymes is very specific . Milk contains both indigenous .and exogenous enzymes

Exogenous enzymes mainly consist of heat stable enzymes produced by psychrotrophic bacteria : lipases and proteinases .There are many indigenous enzymes that have been isolated from milk . The most significant group are the hydrolases : lipoprotein lipase , plasmin and . alkaline phosphatase

Fox (1982) noticed that approximately (50) enzymes have been detected in bovine milk , from them the lactoperoxidase is quantitatively the most prominent enzyme in bovine skim milk , its concentration is 30 mg / litre . or more

Fox and Mc Sweeney (1998) suggested that milk contains about 60 indigenous enzymes derived from the secretors cells or from blood and both indigenous and bacterial enzymes can have undesirable effects in milk and dairy products . Some of the indigenous enzymes in milk are inactivated by the commercially used heat processes , although many are . relatively heat stable

Walstra et .al. (1999) gave that most of the milk enzymes seem to have no biological function in milk , even if they are present in high concentration e,g ribonuclease , and often , they do not significantly alter the milk . Some enzymes have an antimicrobial function or play other beneficial roles .A few of the enzymes may facilitate resumptions of milk constituents into the blood if and when milking is stopped . It presumably concern plasmin and lipoprotein lipase , which are not very active in fresh milk , though they are present in high concentration . These as well as some other enzymes , can cause spoilage of milk during storage and some enzymes are used for analytical purpose . Abudawd and Mtwali (1993) stated that the milk enzymes are divided : into two groups , which are

a)As indicators of the kind of heat treatment which are done for milk and . their quality. i.e phosphatase and peroxidase enzymes

And they added that , there are two kinds of milk phosphatase , one is acidic and active at PH 4.2 and the other is alkaline at PH 7.6 – 7.8 and it is characterized by a high sensitivity to inhibit heat activity and used to know the range and quality of pasteurization operation .The required heat for milk pasteurization agrees with the temperature needed for stopping . the enzyme activity

b) As indicators to know the degree of milk cleanness , quality and safety udder from disease i.e oxidase and reductase enzymes, amylase and . catalase enzymes

As expressed by Abdeltwab (1977) there is also a group of this enzymes affecting milk properties and its products ; this includes lipase ,lactase , . protease and galactase enzymes

The lipase enzyme affect the fat and analyze it watery to glycerin and . fatty acids

The lactase enzyme analyze lactose to glucose and galactose and prepares them for lactic fermentation .It is secreted by various kinds of bacteria that grow in milk and a few amounts is found naturally in milk . It's not destroyed by pasteurization , but it's activity stops at 80C̊ for 2.5 seconds and at 75 C̊ for 2.5 minutes and completely destroyed by boiling. So it is used for investigation heated milk to a degree more than

pasteurization as an indicator. It is also used for previously boiled milk
. and this is called starch test
Fox (1982) mentioned that milk contains some enzymes in a small amounts and are influenced by heat and the lipase , lactase , catalase , phosphotase ,reductase and peroxydase enzymes are absent in sweetened
. and pasteurized milk

Lipase in milk 2.7.1

Campbell and Marshall (1975) stated that milk contains an unknown number of esterases . Freshly drawn milk contains two lipases , cow milk in late lactation and on dry feed often contains high concentration of membrane lipase , the lipolytic activity of lipase is nil after
. pasteurization and can reactivated by storage for 48 hours
Abudawd et.al. (2003) added that lipases are many enzymes in milk , affects the milk fat and hydrolysis it to fatty acid and glycerin and it's activity produces some fatty acids than giving milk rancid taste . Smit (2005) showed that in milk the enzyme are not normally active and its association with casein affords some protection . It's almost completely inactivated by high temperature short – time pasteurization . As indicated by Spreer and Mixa (1995) lipase is an esterase which hydrolyzes the ester bounds to fat . It found in low level in milk as a natural enzyme . Bacterial lipases indicates a strong contamination or recontamination with microorganisms in pH 8.5 – 9.1 and at a temperature of 38 – 40C̊. and in activated during high temperature treatment at 285C̊ Significance , it splits milk from defective fat globule membranes , develops noticeable taste and flavour modifications in milk
. (and dairy products (rancidity
Walstra et.al. (1999) pointed out that lipase liberates fatty acids from tri and diglycerides , it is bound largely to casein micelles and in milk ,
. lipolysis causes a soapy – rancid off – flavour
Harper and Hall (1981) mentioned that about 90 % of lipase is found in the casein micelle .It's substrates milk fat and triglycerides and is responsible for rancid flavour in dairy food. It survives partially minimal pasteurization , can react in sterilized products and it's optimum PH is
. about 8.6
Fox (1982) gave that lipoprotein in bovine milk is about 2 mg / litre , and largely bound to casein micelles ; it does not attack the glycerides of the fat a globule unless the membrane of the latter are damaged .

The latter effect may arise from leakage of blood into milk if the tight junctions between secretory cells are impaired .

Eltakriti and Alkhal (1986) gave that lipase is found naturally in raw milk in two form , lipase (A) and lipase(B) . Lipases have ability to analysis fat and release amino acid with a short chain which it gives milk rancid taste.

<u>Lactase in milk 2.7.2</u>

Spreer and Mixa (1995) stated that bacterial carbohydrate formation from the metabolism of lactobacillus and yeast , splits lactose into glucose and galactose .

According to Abudawd <u>et.al.</u>(2003) lactase analysis lactose to glucose and galactose , found in milk in minimum amounts and it is secreted by many microorganisms growing in milk .

Eltakriti and Alkhal (1986) added that lactose in milk analyses lactose to gluose and galactose which are important in milk fermentation . This agrees with Alshabibi <u>et.al.</u> (1984) gave that lactase (Beta–Galactosidase) analyse the milk lactose to glucose and galactose .

<u>Catalase in milk 2.7.3</u>

Harper and Hall (1981) stated that catalase is found in lipoprotein particles of the fat globule in whey fraction , also it can associate with casein . It is decreased by acids and increased by leucocytes which is used as screening test for mastitis with optimum pH of 7.0 and inactivated by substrate at temperature above 50 $^{\circ}F$.

As showed by Campbell and Marshall (1975) catalase presence in milk is primarily associated with leukocytes that are elaborated in mastitis milk Catalse in milk is destroyed by pasteurization . However its concentration is higher in colostrums and cream than in skim milk .

According to Alshabibi <u>et.al.</u>(1984) the catalase enzyme is active at pH 6.5 – 7.5 and the best temperature for estimation the enzyme is about 20 -25C$^{\circ}$.

The milk enzyme content is variable due to race , milking intervals and the presence of bacteria .

The heat treatment for milk to temperature about 60 -75C$^{\circ}$ for half an hour destroy completely the enzyme .

Spreer and Mixa (1995) indicated that the function of catalase enzyme is splitting of oxygen in molecular form from hydrogen peroxide . The level is high in colostrums milk from old cows or cows with mastitis and is inactivated during pasteurization . The natural level of catalase in milk can be absent or low ; they indicate the status of the abnormality of milk. As given by Eltakriti and Alkhal (1986) catalase enzyme helps in hydrolysis of the hydrogen peroxide to oxygen and water and their maximum validity is at pH 7 and temperature 0 – 10C° , where as heating to temperature more than 45C° decrease their validity until despaired at .temperature 65C̊ .

Phosphatase in milk 2.7.4

According to Abudawd et.al. (2003) phosphatases are a company of enzymes that analysis monomer salt to phosphoric acid , and it is found in two kinds of active alkaline medium called alkaline phosphatase which is most important and is loses its effectiveness by heating milk to pasteurization temperature 62 C̊ for half an hour or 71C̊ for 15 second .and used to investigate the effectiveness of pasteurization

Alshabibi et.al. (1984) stated that phoaphatase enzymes help in analysis . the different esters bonds to phosphoric acid

Alhigrawi (1987) expressed that phosphatases are often found in milk and their concentration nearly constant in milk mixture and their absence in . milk indicates a complete milk pasteurization

Spreer and Mixa (1995) pointed out that phosphatase enzyme is important enzyme group of hydrolases catalyzing hydrolysis from phosphoric acid esters and they added that alkaline phosphatase optimum reaction is found at 70 – 75 C̊ , which is proof of sufficient heat treatment of milk in . short time heat treatment processes

Eltakriti and Alkhal (1986) mentioned that the organic phosphate is naturally found in raw milk and its pH is 9.65 and is found on the . surface of fat globules

Campbell and Marshall (1975) gave that alkaline phosphatase always is present in raw milk , though its concentration is variable and most of it associated with microsomal particulates which are absorbed to fat globules .

As noticed by Walstra et. al. (1999) several phosphatases occur in milk and the best known in milk is alkaline phosphatase ,which catalyzes the . hydrolysis of phosphoric monoesters

According to Uoguelph (2007) alkaline phosphatase enzymes are able to split specific phosphoric acid esters into phosphoric acid and the related . alcohols

Harper and Hall (1981) indicated that alkaline phosphatase about 80% of it is associated with fat globule membrane. Its relatively heat sensitive ,used as index of proper pasteurization, can be reactivated in UHT heat treated products ,exists as an isozyme system ,probably with genetic .variants

As show by Fox (1982) alkaline phosphatase is located in the fat globule membrane and it has been highly purified from bovine milk and found to be a dimer of two identical or very similar subunits each of about 85000 . Daltons

<u>Amylase in milk 2.7.5</u>

Spreer and Mixa (1995) stated that amylase splits the glycoside is bond in carbohydrates at pH 7.4 and temperature of 44C and is inactivated during . pasteurization

According to Alshabibi <u>et. al.</u> (1984) amylases has ability to destroy the bond between glucose molecules and two kinds of it are found in milk .amylase and B- amylase - @

The @amylase activity varies from cow to another where by the concentration increases in cow infected with udder mastitis and has an , optimum PH of 7.4 and a temperature of 44c, while B- amylase is found in milk in few amount and its validity is constant to temperature 65C for .30 minutes

Alhigrawi (1987) gave that amylase analysis starch and the less enzyme exposed to changes in quantities in milk , which is increases in infected animal milk, so it is used as an indicator for production of milk for . healthy cow

<u>Proteases Proteinase (Proteinases) in milk 2.7.6</u>

As given by Hanna and Mohamed (1986) protease is the most important enzymes in milk and it is assumed to help in reconstitution of the protein . components

Abudawd <u>et. al.</u> (2003) stated that proteases are many enzymes that analyse the complex protein to a simple one and play an important role in . cheese making

Eltakriti & Alkhal (1986) suggested that protein is hydrolysed watery by the galactase enzyme (protease) to peptone and amino acid , which help in making some cheeses and loses validity at temperature 74 – 80C̊ with . an optimum activity at pH 8.5

ALhigrawi (1987) added that proteases cause coagulation of casein and they are formed when temperature is reduced to 165 – 175F° . Alshabibi et.al.(1984) expressed that proteases are enzymes analyses protein by breaking the peptide linkages to produce peptones , proteoses ,peptides , amino acids and ammonia and most of them are concentrated in the precipitated casein. The ideal pH for the enzymes . activity is 8.5 and a temperature of 75 – 80 C̊ destroys the enzyme

Walstra et. al (1999) reported that in milk at least two trypsin – like . endopeptidase occur

Most of the alkaline proteinase in milk is present as the inactive plasminogen . The enzyme is largely associated with the casein micelles . It's activity in milk varies widely , partly because of a variable ratio of plasmin to plasminogen . Usually , the activity increases with time as well .as by heating , i.e pasteurization

Milk contains one more promoters that catalyze the hydrolysis of plaminogen yield plasmin and at least one substance that inhibits the . promoters

Milk of a high somatic cell count generally shows enhanced plasmin .activity

Campbell & Marshall (1975) noticed that bacteria produce proteases in milk , proteolysis has been demonstrate in milk incubated at 37 C̊. The active fraction is precipitated with casein when milk is acidified. Pseudomonas bacteria sometimes produce proteases that are not . inactivated by pasteurization

Smit (2005) explained that the major proteinase in milk is a serine . proteinase with trypsin- like activity called plasmin

Plasmin causes proteolysis in milk and some dairy products , it may be . responsible for age gelation in UHT milk

At acid and neutral PH , the enzyme is stable to pasteurization , but at alkaline PH it is rapidly inactivated . Some plasmin activity resists UHT .(processing (heat treatment at 140C̊ /3c

Nevertheless , the occurrence of plasmin is associated with physiological conditions . i.e very early lactation , very late lactation and udder disease .which causes abnormally high concentration of plasmin in milk

Spreer and Mixa (1995) indicated that proteinases denatures proteins and their subgroups while splitting the peptide bonds . Milk contains low levels of natural protease , bound to casein . Proteinase survive the pasteurization and bacterial proteases are formed in large quantities from .desirable and non desirable microorganisms

Peroxidase (Lactoperoxidase) in milk 2.7.7

Campbell and Marshall (1975) stated that milk contains relatively high concentrations of peroxidase , about one percent of the total serum protein content , (about 0.07 %) and does not inactivated at minimal . temperature

Fox (1982) gave that lactoperoxidase is quantitatively the most prominent enzyme in bovine skim milk ,with a concentration of 30 mg /litre or . more

Abudawd et.al. (2003) pointed out that peroxidase is an oxidised enzyme and can be used to investigate the effectiveness of milk boiling or heating at a temperature 80C̊ for 30 minutes or 70C̊ for one hour. Harper and Hall (1981) mentioned that lactoperoxidase is found in the whey fraction of milk and substrates peroxides , alcohols and amino acids , highly resistance to heat and used as to test for detecting high temperature treatment , with an optimum is optimum pH of 6.8 . Eltakriti and Alkhal (1986) indicated that peroxidase enzyme loses its validity when exposed to heat treatment at temperature of 75C° for 5 minutes and a .temperature of 70C̊ for two hours are required to stop its validity .

According to Alshabibi et.al.(1984) lactoperoxidase is used to investigate milk that exposed to temperature of flash pasteurization and the content of this enzyme in milk is about 15.56 % nitrogen , 0.06 % iron and it's pH .6.8 at 23.2C̊

Alhigrawi (1987) gave that peroxidase are is an oxidized enzyme used to release the active oxygen from the upper hydrogen peroxide ; the released . oxidised the gyuoiconic acid and produce blue material

Abudawd et.al. (2003) expressed that peroxidase is an oxidized enzyme , its presence in milk indicates the proper pasteurization by heating to 80C̊ for 30 minutes or 70C̊ for hour and this enzyme loses its activity at .temperature higher than pasteurization

Smit (2005) gave that lactoperoxidase is a very effective bacteriocidal . agent in the presence of a low level of H_2O_2 and SCN

Xanthine's Oxidase in milk 8 .7 . 2

Campbell & Marshall (1975) mentioned that xanthine oxidase is a part of the lipoprotein complex of milk which are composed of phospholipids , nucleic acid and enzymes and is adsorbed in the surface of fat globules in fresh milk .

It is found in bovine milk in high concentration and catalyzes oxidation – reduction reactions .

Riboflavin is a component of xanthine oxidase .Pasteurization does not destroy it , but it is less stable to heat than peroxidase . Milk contains about 120 mg of xanthine oxidase per litre .

Walstra et.al. (1999) gave that xanthine oxidase can catalyze oxidation of various substances and can reduce nitrate , which occurs only in milk in trace amount to nitrite.

Smit (2005) stated that xanthine oxidase is a very potent prooxidant , which may cause oxidative rancidity in milk and reduces nitrate to nitrite that prevents the growth of clostridia in cheese .

Spreer and Mixa (1995) showed that xanthine oxidase (acidic phosohatase) has an optimum pH 4.0 – 4.5 , inactivated at 100C̊ , adsorbed into the fat globule membranes , and also called schardinger enzyme .

Fox (1982) pointed out that xanthine oxidase enzyme is largely associated with the fat globule membrane , amount is about 120 mg /litre in bovine milk , and consists of a protein of 270 000 daltons .

Hanna and Mohamed(1986) gave that xanthine oxidase enzyme is associated with the fat globules and is resistant to high temperatures . According to Alshabibi et.al (1984) xanthine oxidase enzymes make a spontaneous oxidation to milk fat and the concentration is not constant in milk , especially during milking intervals , breed , seasons and fodder , which is about 160 mg /L and it is active at pH 6 – 9.

2.2 The Nutritive Value of Milk

Animal milk was first used as human food at the beginning of animal domestication and cow's milk was first used as human food in the Middle East (Wikipedia 2006).

Because of its composition milk has a very good nutritive value .

It meets the nutritional needs of the body for better than other simple foods .

The term "milk is the nearly most perfect foods ", finds it's expression due to the energy content of milk and the proportion and quantity of the different food elements found in it (Osman ,2006).

The components that give the milk its nutritive value are grouped in fats , . proteins , carbohydrates (lactose) , minerals and vitamins

The main sources of energy supplied to the human body are related to the . fat , lactose and protein compounds

To determine accurately the nutritive value of milk , the components . responsible for that will be studied separately

The nutritive value of milk proteins 1. 2 .2

O'sullivan (1973) stated that milk supplies the human diet with a high quality protein compared with other supplement proteins from other . nutrient sources

The biological value of milk protein according to Risha (1991) is about . 75 % compared with proteins in eggs of hens

The high nutritive value of milk protein is related to the amount of the . amino acids it contains especially the essential amino acids

Abdellatif (2005) explained that milk is an important source of protein with high nutrients , which provide the human being with the essential . amino acids in a high concentration

These essential amino acids , which the human body can not synthesise are eight in number and include : Lysin , Alanin , Valin , Lusin , Isolusin , Thrionins , Histidin , Treptophan ,Methionine and Venylalanin. According to Algondi (1984) milk proteins has a high quality value and the milk amino acids statisfy the cell needs and provide the human body . with lysine and treptophan

The milk proteins provide infants with the essential amino acids .(important for growth , activity and immunity.(Mahna ,2002

The cow full milk as noticed by Alshabibi et .al .(1984) is regarded as a rich sourse of amino acids especially lysine (3.99%), methionine (0.58 %) . (% , therionine (1.23%) and treptophan (0.35

In general the nutritive value of milk proteins can be given as follow :

. -Essential for growth and reproduction

Essential for formation of blood , enzymes , hormones and antibodies .-

-Provides the body with the basic needs for building the human body .cells

. Provide the body with energy and heat -

Sommer (1938) noticed that milk proteins are known to be very efficient and complex , and the assimilation of ingested milk protein ranges between 97 - 98 % compared with an average of 92 %of proteins in general .

The nutritive value of milk fat 2. 2 .2

The fat fraction in the milk is important for the palatability of the milk and for its nutritive value .

Welch et .al. (1997) noticed that milk fat has been one of the premier edible fats in the world for centuries and it has very well established functions in various product forms and enjoyed in substantial market value .

The improvement of flavor dairy products in related to a greater extent to the fat. .

Alsafar et. al.(1982) pointed out that milk fat provides milk and its products with the desirable flavor and color .

From nutritional point of view milk fat has the following values: - It provides the body with heat and energy , since it has high energy content.

It serves as a carrier for the fat soluble vitamins , A ,D ,E and K.

It contains the essential unsaturated fatty acids , e,g oleic, linoleic and a rachidonic , which their absence in human diet affects the kidneys and the skin .

Eltakriti and Alkhal (1986) gave that milk fat is the most easily digestable and the human body benefits of about 97 % of milk fat and also plays an important role in milk processing .

Albikri et .al. (1994) explained , there is a different in the quality of human and cow's milk , but infants are able to digest cow's milk fat . The cholesterol – content of milk fat is not harmful compared with other animal fats , since the human body itself produces three times as much cholesterol as what normally consumed per day considering that other often used foods may contain more cholesterol than that in milk fat (Osman , 2006) .

Alnimer (2007) reported that the phospholipids similar to milk fat , play an important role in nutrition , especially in formation of bones and brain cells .

The nutritive value of milk sugar 3. 2 . 2

The sugar of milk , known as lactose is found only in the milk and no other foods .

According to Sommer (1938) lactose together with the fat and milk proteins , provides the fuel and energy values of milk and thus it has some points of superiority over other carbohydrates in nutrition , since it is helpful in establishing a mildly acid reaction in the intestine and in increasing calcium assimilation .

Zagzig (1999) noticed that lactose is a carbohydrates analyzed by human body to give heat ; it is easily digested by children than adults and problems of lactose digestibility occur in children and youth , who only have shortage in lactose enzyme (lactose intolerance) .

Algondi (1984) pointed out that lactose has special specification in nutrition due to the reduction in the sweetness, less dissolved Increases stability compared with other sugars and helps in the absorption of calcium and phosphorus .

Awida (2004) reported , the sweetness of galactose of the lactose is six times compared with sucrose sweetness .

Lactose contains galactose , which is essential for brain layer and nerve cells (Abdellatif 2005) .

Campbell and Marshall (1975) stated that lactose has many favorable features ,since it stimulates growth of microorganisms and is considered as brain food and enhances the absorption of calcium , phosphorus , magnesium and barium have intestine.

Alnimer (2007) noticed that lactose is beneficial , since it represents a source of carbohydrates for infants .

The lactose is slowly digested and absorbed by the intestines , because it is less soluble. Therefore it is less irritating to stomach and intestinal mucosa and be considered as a valuable diet during treatment to the digestive system .

The nutritive value of milk vitamins 4. 2 . 2

The vitamins are organic compounds that serve as accessory food factors and responsible for proper nutrition , normal growth, health and reproduction .

Milk is rich vitamins . The nutritive value of these vitamins might be given as follows :

Vitamin (A)

Alsafar et. al. (1982) , Alnimer (2007) and Natural health (2008) gave that vitamin (A) has a maximum health protection ; it protects human from deterioration , important for growth , vision , immunity , bone formation . and fertility

(Vitamin (D

The daily requirement for human of this vitamin is 0.01 mg (Spreer and Mixa 1995) .
According to Campbell and Marshall (1975) , Eltakriti and Alkhal(1986), , Meryun (1989) , Spreer and Mixa (1995) and Natural health (2008) , the main function of vitamin D in the promotion of the absorption and transportation of calcium and phosphorus through intestinal wall ; it promotes tooth growth and bones reconstitution , where by the deficiency in the vitamin causes rickets by children and .osteomalacia among adults , elderly , pregnant and lactating women
Awida (2004) noticed that milk especially for infant and children is .fortified with vitamin D to provide their daily requirement

(Vitamin (E

Meruyn (1989) , Fatair (2000) and Awida (2004) noticed that vitamin E main functions are working as antioxidant , controlling the respiratory chain , synthesing the vital body compounds , mainting of enzymatic system and regulating growth and antisterility. Furthermore it is distributed in different tissues to resist waxes oxidation and to stop the deterioration of the cell layer and hydrolysis of unconscious muscle . Deficiency in this vitamin causes sterility, deterioration of the gland capsule and muscle spam's . The daily recommended requirement is 10 .(mg for men and 8 mg for women (Meruyn 1989

(Vitamin (K

Passmore and Eastwood (1986) , Fatir (2000) and Awida (2004), stated that the daily recommended amount for consumption of this vitamin is about 8 ug for men and 6 ug for women , where by a shortage in this vitamin causes continuous bleeding in case of injury , decreases the clotting time in addition to several diseases e.g. neonatal hemorrhage , hypoprotherombirienia , colitis and cystic tibrosis , if it is absent in the . diet

(Vitamin (B_1

The daily requirement for vitamin B_1(Thiamin) ranges according to Fatair (2000) between 0.2 – 0.3 mg it increases by ageing due to reduction in the .ability of benefiting from this vitamin

Deficiency in thiamin causes , beri – beri , accumulation of pyruvic and ketoglutanic disorder , gastrointestinal disorder, neurologic disorders and . Wernicke – Korskaff (mental disorder) among alcohol addicters

(Vitamin (B_2

Vitamin B_2 or Riboflavin is considered according to Eltakriti and Alkhal (1986) as a part of co- enzymes which are important in the oxidation of . glucose fatty and amino acids

The daily requirement is 0.8 – 1.2 , 0.4 -1.6 , 0.3 and 0.5 mg for infants ,children , adult males , adult females , female pregnant and lactating . (women respectively (Mohamed Salih 2004

Eltakriti and Alkhal (1986) , Alshair and Gatash (2000) ,Fatair (2000) and Mohamed Salih (2004) gave that deficiency of the vitamin causes skin .determisis , stomatitis and unliability to light rays

(Niacin (Nicotinic acid

A daily requirement of nicotinic acid as given by Campbell and Marshall . (1975) ranges between 13 to 20 mg

This vitamin can precipitate building a co –factor for many oxidized enzymes , so the increase in niacin causes reduction in the concentration of cholesterol and increase the expansion of the surface of blood vessels . Deficiency causes pellagra (Eltakriti and Alkhal , 1986 ; Campbell and . (Marshall , 1975

(Vitamin (B_6

According to Awida (2004) vitamin B_6 or pyridoxine is essential for blood vessels , muscles , skin , normal growth of children , maintenance of the synthesis of brain enzymes . Deficiency causes convulsion , cheilosis , seborrhea , glosstitis , anemia , nerves disorder , confussion and . depression

(Vitamin (B_{12}

According to Mohamed Salih(2004) vitamin B_{12} or co- protector for human body from anemia , co- enzymes to many enzymes associated with food metabolism and formation of red blood cells . The daily requirement is about 3 ug / 100g and 4 ug /100g for adults , . (children and pregnant women (Fatair 2000

Adeficiency in this vitamin causes anemia (pernicious anemia) , weakness , diarrhea , loss of hair and paraesthesia (Alshair and Gatash . ((2000) ; Fatair (2000

(Vitamin (C

The daily requirement of vitamin C(ascorbic acid) is about 40 – 70 , 35 , 10 – 20 and 20 – 25 mg for adults , infants , pregnant and lactating . (women respectively (Fatair 2000
. (The ascorbic acid is present in milk in small amounts (Uoguelph 2007
Deficiency in ascorbic acid causes scurvey , common cold and infant . megaloblastic anemia

The nutritive value of milk minerals 5. 2. 2

Milk contain all essential and secondary elements needed by human and is important for human nutrition , such as calcium , phosphorus , potassium , but has poor content of chlor and sodium (Abudawd and .(Mtwali 1993

According to Campbell and Marshall (1975) milk is an abundant supply of minerals and it is the best nutritional source of calcium , but deficient . in iron

Alnimer (2007) noticed that milk minerals are important for their highly nutritive value and play an important role in fixing colloidal suspension of milk proteins , affect milk curd during cheese making and in the buffer system of milk and also some minerals like iron and copper help by .oxidation of milk fat

Also is an important source of minerals for young animals , elderly and sick people and young children (Abuzaid . 1999). The nutritive value of : some milk minerals is given as follows

Annaharoline (2003) stated that calcium plays a vital role in the building and formation of teeth and bones and also important for blood .clotting enzymes

Calcium deficiency causes improper growth , dental caries , rickets , osteomalacia and muscle pain and contraction by adults (Shills and Young 1988 ; Alshair and Gatash 2000 ; Annaharoline ; 2003 and .(Mohamed Salih 2004

As indicated by Awida (2004) a cup of full cream milk or skim milk provides the human adults body with about 20mg calcium per day and the daily recommended intake are two cups of milk per day for adult and 3 . cups for children , elderly people and pregnant women

Phosphorus and calcium are two important elements in bone and teeth building and according to Ferguson (2007) phosphorus is needed for a number of organic combination in the body and inorganic phosphorus are needed in various body fluids and serves an important function in regulating the reaction of blood , whereby the requirements for phosphorus are actually slightly higher than that of calcium . According to Sommer (1938) the ration of calcium to phosphorus Ca : P in milk is satisfactory and that favorable for growth and teeth formation ranges between 1: 1 & 2 : 1with an average of 1.43 : 1 . Deficiency of phosphorus causes hypophosphalemia in blood , kidney disorders , muscle tetany , muscle weakness and growth retardation especially among children .(Fatair 2000 ; Awida 2004 ; Mohamed Salih (2004 .

<u>: Magnesium , Sodium , Pottasium , Zinc & Chlorine</u>

These elements are indispensible in nutrition , but they present no special problems in the diet . In general food contains them in adequate amounts and milk contains in such amounts that a milk diet provides them in adequate quantities .

According to Awida (2004) , Mohamed Salih (2004) , Fatair (2000) and Ferguson (2007) deficiencies in sodium , potassium ,chlorine , iron ,copper and iodine are as follows :

<u>: Sodium</u>

Fever pain , liver failure , muscle convulsion , abdominal cramps , nausea , anorexia , disorder in the acid – base balance and mental confusion .

<u>: Potassium</u>

Dwarfism ,severe anemia , cellular immunity , skin infection , night blindness , slow growth , weak muscle and destruction of the nervous system .

<u>: Chlorine</u>

Deficiency is rare , but certain factors cause reduction in the role of chlorine in the body fluid e.g vomiting ,diarrhea and excess sweating .

<u>:Iron</u>

Anemia , reduction in red blood cells , fatigue , headaches , physiological disturbances and in the color index of red blood cells .

<u>: Copper</u>

Reduction in the age of red blood cells and formation of haemoglobin and absorption of iron and release of stored iron from the liver , that results in anemia .

<u>Iodine</u>

Goitre and meyxedema cretinism .