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Factors affecting quality of white cheese manufacturing From goats milk

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Dedication

I express my gratitude to Dr.Ibrahim Afaneh, for his valuable guidance throughout this study. His guidance and understanding provided me courage and strength.

I am very grateful to my husband Nadi for his help which making me feel better during difficulties faced in this study and for his understanding and support without which this thesis would not be completed.

I also thank my children's Majed, Islam and Sadeel for their kindness and their hopes to finish this thesis.

I am also deeply grateful to my parents especial my mother Rasmiya for their appreciable help, encouragement and kindness.

Declaration

I Certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of that) has not been submitted for a higher degree to any other university or institution.

Signed:

Hadeel Sady Ahmad Al karjeh

Date: 28 /2 / 2010

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I express my gratitude to Dr.Ibrahim Afaneh for his guidance and understanding provided me Courage and strength.

I am also deeply grateful to my parents especially my mother Rasmya for their encouragement and kindness.

I am very grateful to my children's Majed, Islam and Sadeel for their hopes to finish this thesis.

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Abstract

Cheese is produced by conversion of milk from a fluid to a gel (coagulation). Gel formation is a consequence of protein destabilization and may be brought about either by acid such as chymosin, the active component of rennet, quiescent acidification to a PH value close to the isoelectric point of the proteins, or by a combination of acidification and heating.
There are problems in the cheese which are produced from goat's milk first in their stability where there are loss in weight (total solid) during storage period also in their short shelf-life and undesirable aroma and flavour of final cheese which is related to the types of fatty acids that are present in goat's milk.

In Palestine there is a large number of goat's herd where there are trouble for manufacturing of white cheese from their milk and this is related to small yield of cheese also small amount of total solid compared to that produced by using cow's milk; also cheese from goat's milk have shelf life shorter than cheese of cow's milk, for these reasons we found that it is nessecary to solve the problems of goat's cheese by addition of different materials also using different percentage of mixed cow's to goat's milk.

In this study, the physico-chemical changes occurring in white cheese produced from goat's milk, as a result of possible effects of some addition in combining with the ripening period during the life of the experiments were examined.

120 cheese samples were produced in two parts, each part included 60 samples. All cheese samples, in both groups, were made basically by adding rennet enzymes. However, the investigated materials (starter culture, $CaCl_2$, carob latex, and fig latex) were added in certain arrangement to assure that each experiment has one variable. Different mix rations between goat's and cow's milk were used to have a comprehensive element of study.

The cheese were ripened in 15 % brine solution at 4°C for 30 days. Samples were taken from each treatment and analyzed on 2nd, 15th, and 30th day of storage. Sensory evaluation, microbiological analysis (mould, yeast, and coliform) and chemical properties (pH, acidity, salt, fat, moisture and protein content and total solid) of the prepared cheese were determined.

Important results found in this study were that mixing goat milk with cow milk decreases the goat flavour its present in cheese product, it increase the protein and total solid contents of the cheese.

Cheese made from raw milk mature faster and have higher flavor intensity than cheese made from pasteurized milk. The use of commercial starter cultures in makeing cheese from pasteurized milk results in uniform characteristics of the same cheese made from raw milk.

Fig latex addition affected the chemical properties of the cheese where it increaseof the total protein percentage in the final product. Also it affected negativily the sensory properties of the cheese resulting in strong odor, bitterness , less cohesion and gummier texture for cheese.

Carob latex addition affected the chemical properties of the cheese where its increase the total solid percentage in the final product. Also Carob latex affected the sensory properties of the cheese where its give.final cheese product with off-white color, however its give cheese with very hard texture.

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Definitions

Rennet: obtained from the fourth stomach of unweaned calves has been used in the production of cheese. Also papain from fruit of the papaw, usually microbial. Proteases may be used at various pH values, and they may be highly specific in their choice of cleavable peptide links or quite non-specific. Proteolysis generally increases the solubility of proteins at their isoelectric points

Dairy starter culture: are cultures of harmless, active bacteria, grown in milk or whey, which impart certain characteristics and qualities to various milk products. The culture may be one strain of a microorganism species, called a single-strength culture, or a number of strains and/or species called a multi-strain or mixed-strain culture.

Milk: may be defined as white fluid secreted by female mammals for the purpose of rearing their offspring.

List of Abbreviations

Abbreviation	**Full word**
S.C	Starter Culture
CaCl2	Calcuim chloride
W2	Weight
LBG	Locust Bean Gum (carob tree)
DVS	Direct Vat Set
LAB	lactic acid bacteria
Chap.	Chapter
Ed.	Edition
2nd. Ed	Second Edition
p. (pp.)	Page (pages)
Vol.	Volume
Vols.	Volumes
No.	Number
e. g.	For example
fig	Figure

Chapter *ONE*

Introduction

Chapter One Introduction

1.1 Introduction

In human nutrition milk and its products are very important. Milk may be defined as white fluid secreted by female mammals for the purpose of rearing their offspring. It is fresh, clean, lacteal secretion obtained by complete milking of one or more healthy animals, M.A.Mohamed A. Mehaia, (2002). Milk carries many nutrients that the infant needs for growth and development.

For children, adolescent, elderly people pregnant and nursing mothers, milk plays an important role in meeting the requirements of many essential nutrients, and hence milk is considered as a protective food. Milk helps to balance human diet by supplementing good quality protein, calcium and vitamins particularly, vitamin A, riboflavin, niacin and folic acid. In addition milk contains several bio-protective molecules that ensure health security to humans.

However, milk is also a suitable media for microorganisms and can spoil easily. Therefore, in order to increase its resistance and to obtain different dairy products, it is processed into different products.

Cheese is the most consumed milk product in the world. It is also as nutritious as milk considering proteins, vitamins and minerals. In addition, digestibility of proteins increases due to the proteolytic activity during cheese ripening. Cheese is also a suitable nutrient for patients who have diabetes or lactose mal absorption, because of the low lactose ratio it contains Massimo Todaro, (2005) and Fulya Kayagil, (2006).

Research carried out has revealed that goat milk has more beneficial properties to health than cow milk. Among these properties it helps to prevent iron deficiency and bone softening of the bones, Goat milk's tendency to be more easily digested than cow milk is due to its protein make-up. Goat milk has low levels of the protein alpha s1-casein, a protein that is involved in curd formation. Cow milk has higher quantities of alpha s1-casein than goat milk. In fact, some goats naturally produce very little alpha s1-casein. The higher proportion of small milk fat globules present in goat milk compared to cow milk may also contribute to goat milk's

tendency to be more easily digested. Goat's milk is a very good source of calcium. Abd El-Salam & Zerfiridis, (1993) ; El Soda, M. (1993); Forss, D. A. (1979); Harper, W.J. (1959); Le Jaouen,(1981).

In general milk contain from 85.5-87.3% water, 2.4-5.5% fat, (7.9-10.0)%Solids not fat, (3.25)% Protein were70% of its casein, (4.6)%Lactose, (0.65)% Minerals, (0,18) %Acids citrate, lactate, acetate, oxalate),Enzymes Gases and Vitamins A,C,D, others Mol, J. J., (1992).

1.2 Composition of goat milk:-

1.2.1 Proteins:

Protein which is divided into Albumin, α-Lacto albumin,β–Lacto globulin, Immunoglobulin and Casein (alphaS1 casein, alphaS2, casein,.β casein ,Kappa – casein). However, there is significant difference between cow and goat milk, with regard to the size of the casein micelle. The casein micelle in cow milk is small (60-80nm) when compared to goat milk casein micelle, which ranges between 100-200nm and also the essential amino acids presents in goat and cow milk are different . The soluble non-coagulable proteins and proteosespeptons occur in small amounts. The coagulable part (casein) of goat milk differs from that of the cows. This peculiarity is used to detect the presence of cow's milk in goat's milk/products as a way of quality control, Scotte,(1986).

1.2.2 Lactose:

Lactose is the major free carbohydrate that has been identified in the milk of the goat, though small amounts of inositol are also found (Table1.1). The lactose concentration is usually found to be lower than that found in cow's milk, but the magnitude of the difference is hard to quantify because of the variation in methods of analysis employed. A consensus has not been developed on whether to analyze for lactose in the non-hydrated form or the mono-hydrated

form, and this water of hydration is capable of introducing a five percent variation in the reported concentration of the same actual amount of lactose. Efforts are being taken to reduce this confusion (. Fox, P. F. 1989).

1.2.3 Ashes:

The total ash (calcium, phosphorous, etc.) content of goat's milk ranges from 0.78 mg to 0.83 mg per 100 g milk and is considered to be slightly higher than that associated with the cow (Table1.1). However, the relative percentages of the ash components appear to be comparable (Table1.1). As the nutritional value of milk is often evaluated in terms of the calcium and phosphorous that the milk makes available, it is important to note that the concentrations of these two minerals are similar in the cow and the goat. A significant variation between the milks of the two species should be noted in the chloride concentration, which appears to run higher in the goat.. Significant amounts of potassium, sodium and magnesium are also reported in caprine milk, their concentrations paralleling those found in bovine samples. While few assays have been completed on the citrate in goat's milk, indications are that the citrate level is little different than that found in cow's milk. (Citrate is an important precursor to flavor components in cultured dairy foods.)

Differences existing in the concentrations recorded for cobalt and molybdenum, differences associated with vitamin B, and xanthine oxidase levels respectively. The association of both cow's milk and goat's milk with infantile anemia appears to stem from low levels of iron and copper in these fluids, and the condition is easily reversed by the addition of those trace minerals to the diet.

1.2.4 Enzymes:

Enzymes of the milk of the goat are similar to those of the cow, although some specific differences have been described. Of primary interest, it has been shown that the level of alkaline phosphatase is slightly lower than that found in work with dairy cattle, but the enzyme demonstrates the same degree of heat susceptibility and therefore serves equally well as a pasteurization marker. Peroxidase activity in the milk of both species is the same in all

respects, while the xanthine oxidase level is lower in the milk of the goat. Higher levels of activity are observed for both ribonuclease and lysozyme.

1.2.5 Vitamins:

The vitamin content of goat's milk has been the subject of considerable study. Goat's milk differs from cow's milk in its much lower content of B12.The meaning of this difference is not entirely clear. Differences in B6 are uncertain when the recent USDA data are examined. Despite the fact that the concentrations of B6 and B12 are equal or exceed those concentrations found in human milk, anemia developed by infants and experimental animals is frequently attributed to deficiencies of these vitamins. However, the fact that the addition of copper and iron to the diet acts to eliminate the anemic condition removes much of the suspicion with which these levels are regarded. It has also been suggested that such an anemia could result from low levels of folic acid; however, the concentration of this vitamin does not differ significantly from that found in cow's milk.

It is remarkable that caprine milk derives its vitamin A potency entirely from the vitamin itself and entirely lacks the precursor carotenoid pigments characteristic of bovine milk, which also causes goat's milk and milkfat to be much whiter in color than the milk of the cow.

1.2.6 Lipid:

Lipids the character of the fat globules of goat milk is that they are smaller in size that of cow milk. The size of fat globules range from 1 to 10 micron in cow and goat milk. But the number of fat globules less than 5 micron is 62% in cow milk whereas it is approximately 83% in goat milk, which really matters; i.e. from nutritional point of view, the number of fat globules less than 5m is very important. But this creates a problem in butter making. Further, due to lack of agglutinins in goat milk, the fat globules do not clump together when it is chilled.

The fatty acid composition of goat milk reveals the presence of higher concentration of short and medium chain fatty acids which are thought to be responsible for the characteristic “goaty

odor" in goat milk. But, the silver lining is that they are amenable to heat treatment and hence pasteurization of milk removes the defect. McSweeney, and J. Wallace. (1993); Edmund; Denise Alvarez, (1994). The goat milk contains more small fat globules, i.e. globules of less than 1.5 mm in size. If these small globules are compared to that of the cow the percentage is 28 and 10 respectively. The higher amount of these small fat globules in the goat milk is responsible for the better digestibility of goat's milk.

Another group of scientists refute this claim and state that the presence of buck during milking is responsible for the absorption of the odor produced from the glands of buck. But however, this hypothesis is not yet proved Although cow's milk and goat's milk have similar overall fat contents, the higher proportion of medium-chain fatty acids such as caproic, caprylic and capric acid in goat's milk contributes to the characteristic tart flavor of goat's milk cheese. (These fatty acids take their name from the Latin for goat, 'capra'.), (L. Psoni, et al,(2003); Fox, P. F(1998).

There are different factors effect in composition of goats milk as inherited variation, nutrition of the goats, seasonal variation, temperature, age of goats, stage of lactation, Goats disease, milking procedure (Charles O'Connor., 1993; Skjevdal T., 1979; Antunac N., et al. 2001).

Also, the composition of goat's milk compares very well with that of the cow Table (1.1). All fresh normal milks are an emulsion of fat in a watery solution.

However,goat milk does not contain carotene like that of cows milk and the absence of carotene in goats milk is the reason why it does not have a yellow colour both as milk and milk products. Le Jaouen, (1981).

Table (1.1). Comparison of Goat Milk and Cow Milk

Milk	Goat	Cow
Yield (liters)	500-1000	3500-5000
Dry matter (g)	115-130	115-130
Lactose %	40-50	45-50
Nitrogen %	28-35	30-35
fat%	30-38	35-40
Mineral %	7-9	7-9

1.3 Physico-chemical properties of Goat Milk

The results indicate that sensory properties and lipid composition of ricotta cheese varies according to breed of goat. The higher level of mono-unsaturated and poly-unsaturated fatty acids, found in cheese. Nutritionally interesting and beneficial components were found to be at significantly superior levels in cheese made from milk under grazing management compared to an indoor feeding system regardless of animal species .The acidity of that of goat milk is slightly lower than that of the cow, i.e. pH 6.4 as compared to pH 6.7 The National Dairy Council(2004); Omo Ohiokpehai ,(2003).

Goat milk is used principally for cheese production. While goat cheeses are consumed as traditional products in Mediterranean countries, the demand for them is on the increase in northern Europe. This new interest could be partially explained by the unique sensorial properties of goat milk products, which are characterized by a specific and typical (‘goat’) flavour. This specific flavour may be undesirable in milk for direct consumption but for cheese production its presence can be much sought-after. The goat flavour originates from the lipid fraction, and several aroma compounds (free fatty acids) have been identified. Among them, 4- methyloctanoic acid (4-met-C8) and 4-ethyloctanoic acid (4-met-C8) have been

found to be principally responsible for the goat flavour, since they are perceived even at very low concentrations and are present at levels higher than their perception threshold.
The level of these compounds increases during cheese ripening, leading to a flavour improvement. These fatty acids, as well as others, are produced by lipolysis,which can be considered at three distinct levels: (i)initial milk lipolysis (spontaneous lipolysis); (ii) lipolysis induced by milking practices, storage and technological operations; and (iii) microbial lipolysis, generated notably by ripening strains.

The spontaneous lipolysis is influenced by several genetic and environmental factors, which induce important variations of the typical flavour of goat milk at the herd level. At the dairy plant level, the typical flavour of goat milk products should be controlled. The industrial processes applied to goat milk can affect its sensorial properties, and this could have some significant consequences for the manufacture of fresh cheeses. For ripened cheeses, the surface flora has a dominating Francois Morgan and Patrice Gaborit (2001); Skjevdal T (1979); Harold Eddleman, (1999).

1.4 Cheese Production

History of cheese making has remained the same for hundreds and even thousands of years. The use of milk from a goat, sheep, or cow and an enzyme resulted in whey. The nomads of the Middle East were the first skilful cheese makers and cheese even played a part in Greek mythology. Cheese was a staple part of every Romans diet but the production of cheese started to flourish when the French monasteries were created Fox P F (1993).

According to the National Dairy Council, "All cheese is made from milk, but different manufacturing and aging processes are used to produce the array of cheese available today. Cheese is made by coagulating or curdling milk, stirring and heating the curd, draining off the whey collecting and pressing the curd, and in some cases ripening.

Cow's milk is rich in a wide range of chemical compounds that can be processed into various dairy products such as cheese, butter, and yogurt. Specifically the milk component involved in cheese production is a soluble protein called casein. The enzyme rennet can be used to

catalyze the conversion of casein in milk to para-casein by removing a glycopeptide from the soluble casein. Para-casein further clots,i.e.coagulates, in the presence of calcium ions to form white, creamy lumps called the curd returned to equation(1.1) leaving behind the supernatant called the whey. The National Dairy Council (2004).

Equation (1.1)

$$\text{casein} \xrightarrow{\text{rennet}} \text{para-casein (aq.)} \xrightarrow{Ca^{++}} \text{para-casein (ppt)}$$

Obvious characteristics such as milk composition and curd manipulation are easier target culprits in the origins of cheese defects. However, more recent research has focused on physicochemical attributes of cheese that allows for a new level of understanding cheese.

To a great extent, the changes in behaviour or chemical changes that casein molecules (and aggregates of casein) undergo as a result of manufacturing and aging protocol become the defining factor in finished cheese performance characteristics. Specifically, the plethora of chemical, enzymatic and physical reactions that take place during cheese making and aging is manifested in the cheeses in an array of physical attributes such as color, flavor, sliceability, meltability and stretchability. (Harold Eddleman, (1999); Dybing,et al. (1988).

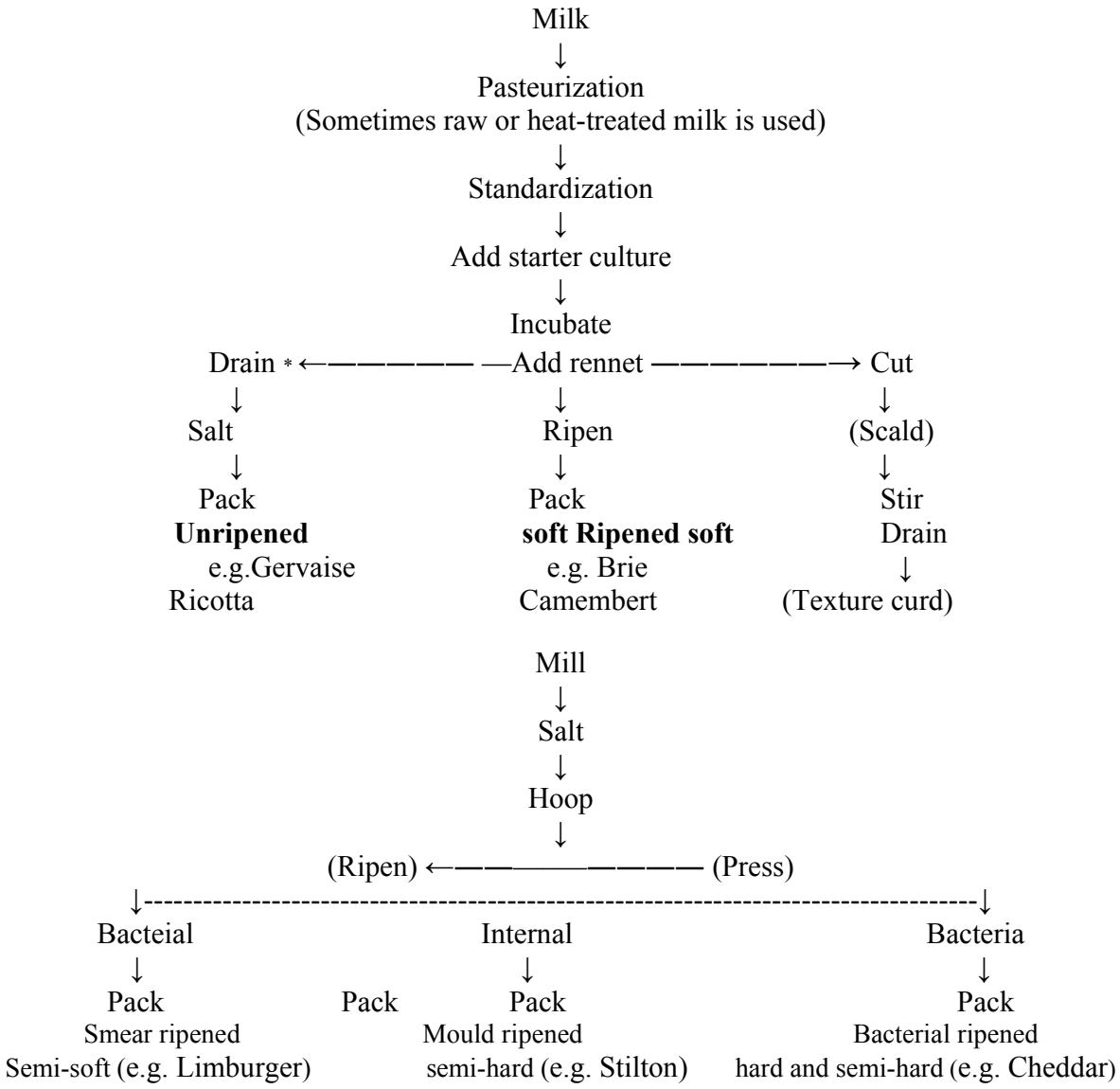
These attributes of cheese are governed by how casein molecules and aggregates of casein molecules interact with each other. In turn, these interactions are influenced by reactions such as proteolysis, denaturation of whey protein, rate and extent of acid development (i.e. pH changes), loss of calcium and ionization of casein. Specifically, casein interaction will be detailed throughout the discussions of both physical and functional cheese defects presented Swearingen, et al, (2004).

The basic technology for the manufacture of all types of cheese is similar, relatively small changes in procedures during manufacture resulting in large perceived differences in the final cheese Fig (1.1) In the next page Fulya Kayagil, (2006) .

1.5 Cheese from Raw or fresh milk

Raw milk cheeses have a very different micro flora at the genus level, as well as in terms of species composition within the same genus. The flavor and the texture of the cheese Elimination of milk microorganisms, denaturation of serum proteins, modification in activity of starter bacteria are properties of milk which may be modified by heat treatment). As a result, raw milk cheeses mature faster and have high flavor intensity, but their flavor is less uniform than the flavor of cheeses from pasteurized milk. Another illustration of these changes might be given by evaluation of the free fatty acid concentrations in milk after cold storage and homogenization.The use of commercial starter cultures to make cheese from pasteurized milk results in loss of the typical characteristics of the same cheese made from raw milk (M.A.Mohamed A. Mehaia , (2002); Francois Morgan and Patrice Gaborit (2001); S. Sablé, et al (1997) ; (2002); Mohamed A. Mehaia, et al,(2002).

Table (1.2) Procedure for cheese production



1.6 Cheese Milk

Cheese may be made from the milk of any species, while cows' milk is most commonly used, in regions where fresh milk is scarce, cheese has been successfully made from recombined anhydrous milk fat Varnam, A.Hand Sutherland J.P., (1996).

1.7 Pasteurization

Pasteurization is very important to kill pathogen microorganisms like *Campylobacter* and *Salmonella.* The optimum pasteurization temperature of milk is 72°C for 15 seconds. Over pasteurization produces too soft a curd and this may or may not be corrected by prior additions of soluble salt $CaCl_2$. For cheese made from raw milk ripening time must be long and for fresh cheese types only pasteurized milk must be used. Fulya Kayagil,(2006)

1.8 Standardization

The composition of the milk is important in determining the characteristic of cheese.
a) Standardization of fat ratio
b) Standardization of protein ratio

Dairy products must have a defined and constant composition. During milk standardization the fat content of milk is adjusted to a legally defined value. In the first step the raw milk is skimmed in a centrifuge to obtain cream and skim milk. The cream is again added to the skim milk to obtain a "standardized" fat content of e.g. 4.5 % fat. The fat content of the standardized milk is determined by the density difference to skim milk upon addition of cream Charles O'Connor, (1993); Goff, H.D.and Hill A.R., (1993).

1.9 Chemical Changes During Curd Formation

Conversion of milk from a fluid to a gel (coagulation) is a basic step common to all types of cheese. Gel formation is a consequence of protein destabilization and may be brought about

either by acid proteinases such as chymosin, the active component of rennet, quiescent acidification to a PH value close to the isoelectric point of the proteins, or by a. combination of acidification and heating.

1.9.1 Action of Rennet

Rennet obtained from the fourth stomach of unweaned calves has been used in the production of cheese. Also papain from fruit of the pawpaw. usually microbial. Proteases may be used at various pH values, and they may be highly specific in their choice of cleavable peptide links or quite non-specific. Proteolysis generally increases the solubility of proteins at their isoelectric points Alan,E.B., and J. T (1965)., Morrison Loewenstein, et al (1980).

Rennet coagulation involves two distinct stages, a proteolytic stage in which the casein micelle is estabilized by hydrolysis of K-casein to yield para- Kcasein micelles, and a secondary, calcium mediated, stage in which paracasein micelles undergo limited aggregation. The secondary stage requires quiescent conditions and a temperature in excess of 20 °C. Hydrolysis of K-casein primarily involves cleavage of the peptide bond, Phe105-Met106, which is uniquely sensitive to hydrolysis by acid proteinases.This cleavage yields a para- K-casein, common to all caseins and a macropeptide unique to each component.

After addition of rennet, usually 30 minutes later for most cheese types, curd is firm enough to be cutted. After cutting curd is subjected to different treatments according to cheese type Coagulation of the casein fraction of the milk to form a gel can be achieved by lowering the milk pH and the addition of "rennet", a mixture containing a specific proteolytic enzyme.. Mol, J. J., (1992).; Coeuret, V.(2003).

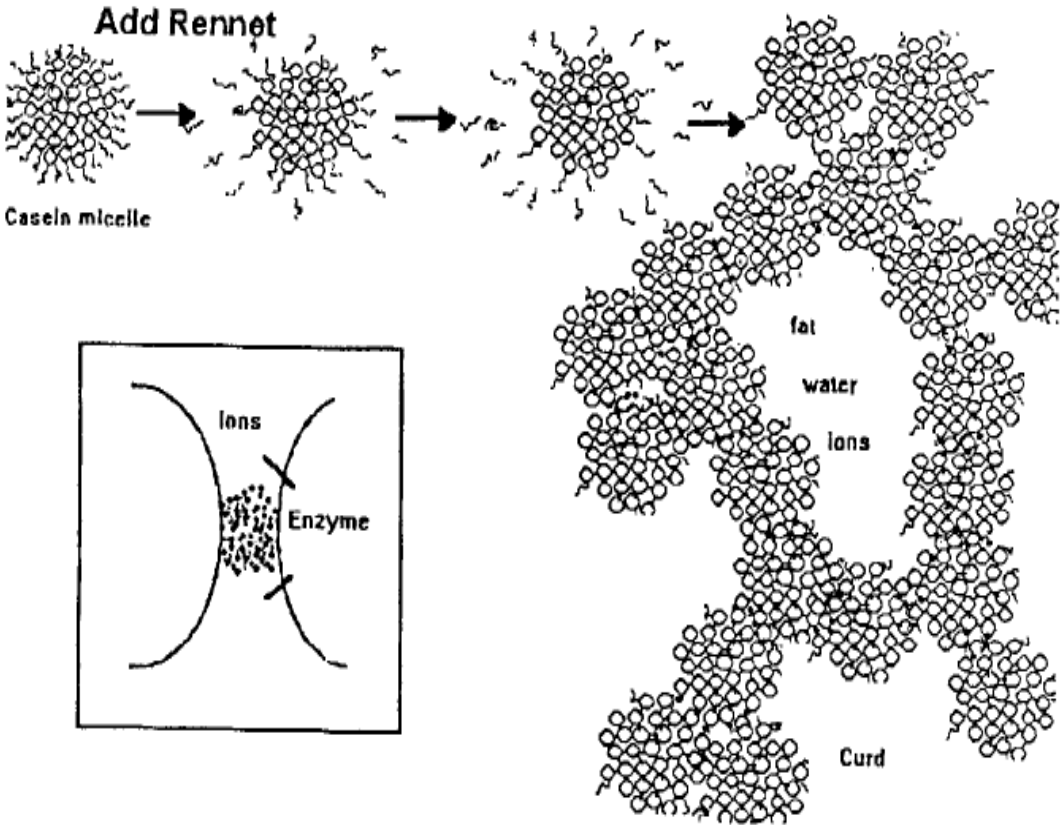


Figure (1.1) Diagram showing the action of rennet on the casein micelle.

The enzyme in rennet cleaves the κ-casein releasing a large peptide. The surface of the micelle changes from being hydrophilic and negatively charged to hydrophobic and neutral. As aconsequence the micelles aggregate to trap fat globules and microorganisms in the developing curd. Law, B.A. (1984).

The four main groups of caseins in milk are the αs1-, αs2-, β- and κ-caseins. These phosphor proteins are held together by micro clusters of calcium and phosphate and exist in milk as micelles of about 100 nm in diameter containing hundreds of molecules of each type of casein. The more hydrophobic regions of these phosphor proteins are believed to be located inside the micelle with the more hydrophilic regions of κ-casein on the outside. The negatively charged car boxy-terminal of the κ-casein molecules is thought to protrude' hair-

like' from the micelle and repel other casein micelles (charge stabilization). In addition to this, the hair-like macro peptide portions of κ-casein are unable to interpenetrate (steric stabilization).

These two mechanisms are thought to enable the micelles to stay in solution as colloidal particles. The addition of rennet (includes any of a range of acid proteinases) leads to the partial proteolysis of κ-casein by cleavage at the Phe105-Met106 bond. The release of the hydrophilic carboxyl-terminal peptide (glycomacropeptide) results in destabilization of the micelles which become less negatively charged and more hydrophobic. These micelles then aggregate (in the presence of calcium and at a temperature above 15°C) to form a coagulum.
A rennet coagulum consists of a continuous matrix of strands of casein micelles, which incorporate fat globules, water, minerals and lactose and in which microorganisms are entrapped as shown in Figure(1.1) Fulya Kayagil, (2006); Law, B.A. (1984)

Another milk component - fat globules - stays with the proteins in the curd. A small number of fat globules, which were exposed during curd cutting, are washed away with the whey. The Fixation in a glutaraldehyde solution preserved the solid constituents allowing water to be removed to show the microstructure of the milk coagulum Biede, S. L., et al. (1979).

1.10 Chemical Changes during Cheese Ripening

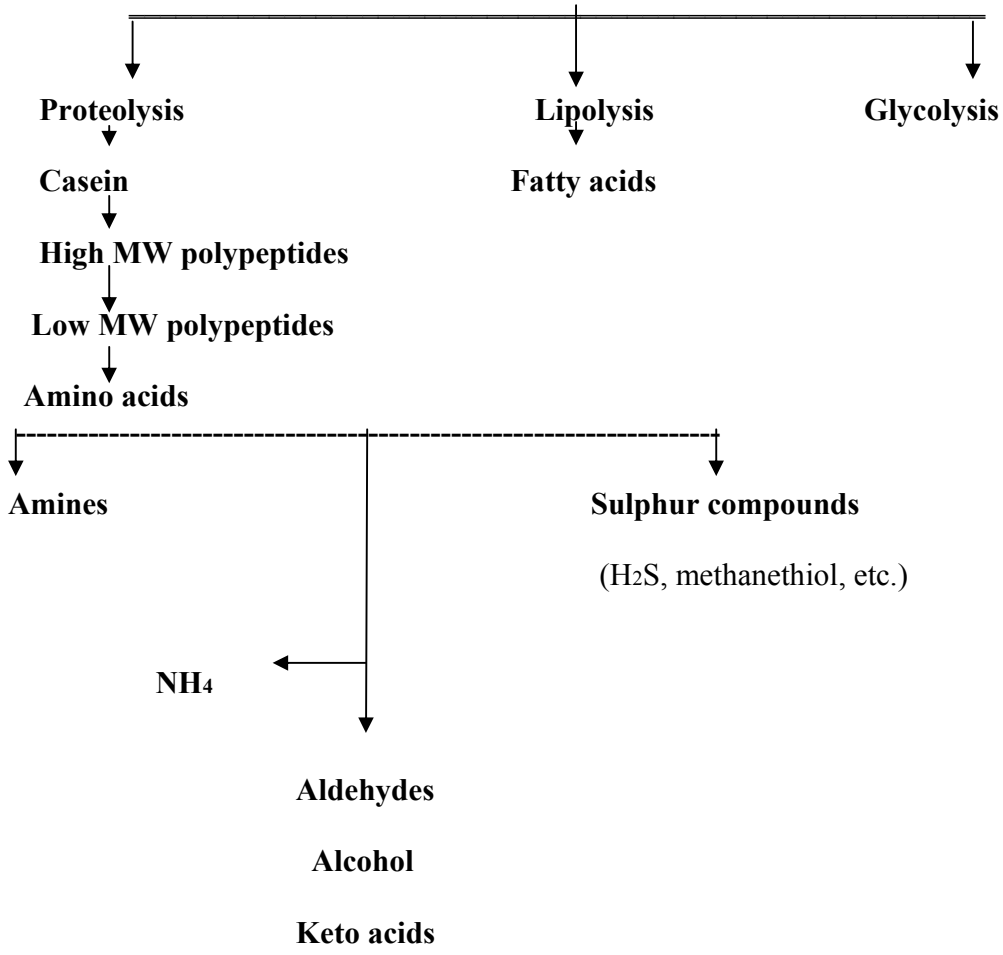
Cheese is chemically, microbiologically and enzymatically a complex and dynamic system. This makes the process of cheese ripening highly complex. Cheese contains a defined microbiological starter flora and an undefined, highly variable, adventitious flora. The diversity of the microflora involved in cheese ripening adds to the complexity of the process;. The nature of the substrate, which consists essentially caseins, fat and carbohydrate in milk; the variety of agents involved in biochemical transformations; the diversity of modifications undergone by constituents of cheese; and large number of products formed all contribute to flavor development in ripened cheese. The major biochemical changes involved during cheese ripening are proteolysis, lipolysis, lactose. Fermentation and production of volatile compounds. Although lipolysis and lactose metabolism are fundamental processes in cheese

making, their contributions to the texture and intensity of flavor of the finished. Proteolysis, however, plays a direct role in development of the desired texture, aroma, and intensity of background flavor in most matured cheeses. Lipolysis in most varieties of cheese is not extensive, but some hydrolysis occurs during cheese ripening. Abd El- Salam, & Zerfiridis., (1993); Forss, D. A. (1979) Harper, W.J. (1959); Morris, H.A. (1978); Fox, P. F., J., et al(1993).

Lipolysis and proteolysis are important in Swiss cheese flavor. Many of the flavor characteristics of Swiss cheese depend on free fatty acids produced by fermentation and lipolysis and on peptides and amino acids produced by proteolysis. The contribution of L. *bulgaricus* to lipolysis and proteolysis was studied by Bide et al. Two of the starter organisms, L. *bulgaricus* and *P. shermanii,* had slight lipolytic activity but not enough to account for the amounts of free fatty acids in Swiss cheese. *Lactobacillus bulgaricus,* however, produced greater quantities of amino acids and peptides than did either P.*shermanii* or *S. thermophilus* In addition to the starter bacteria adjunct nonstarter lactic acid bacteria contribute to cheese ripening Fox P. F. (1989); Omo Ohiokpehai ,(2003) ; Biede, S. L., and E. G. Hammond. (1979) ; Grappin, R., T. C. Rank, and N. F. Olson. (1985).

Primary proteolysis of cheese proteins during Adjunct cultures are nonstarter lactic acid bacteria, consisting mainly of *Lactobacillus* sp., which are used in addition to a standard mesophilic starter to improve and to enhance the flavor of cheese. However, for the role of the adjuncts in cheese ripening to be maximized, the intracellular enzymes must be released from the cells into the cheese matrix, which explains much of the attention given to cell autolysis during ripening There has been considerable interest in using defined strains of nonstarter lactic acid bacteria as adjunct cultures to accelerate and improve flavor and texture development during cheese ripening , (Omo Ohiokpehai ,(2003); Fox, P. F. (1989); Krett. and Stine. (1951); El-Soda, et al. (1993).; Fulya Kayagil,(2006); Biede, S. L., et al. (1979); Fox, P. F.. (1993); Aly, M. (1994); McSweeney, and J. Wallace. (1993); Fox P. F. (1989); Khalid, N. M., and E. H. Marth. (1990); Fox, P. F., J., et al (1993).

Table (1.3).Chemical changes during cheese ripening



1.11 The Classification of Cheese

classified according to its texture (Hard) as following:-

- Hard (26-50% moisture)

internally ripened, no added ripening microorganisms e.g.Cheddar, Blue Cheshire

- Semi-hard (42-52% moisture)

internally ripened, no added ripening microorganisms e.g. Lancashire, Edam

internally ripened, ripening mould added e.g. Stilton, Roquefort

- Semi-soft (45-55% moisture)

surface ripened, ripening bacteria added e.g. Limburger

- Soft (48-80% moisture)

surface ripened, ripening mould added e.g. Brie

- unripened

e.g. Cottage

- Others

e.g. brines varieties, Whey cheese Fulya Kayagil, (2006)

1.12 Starter Cultures

Dairy starters are cultures of harmless, active bacteria, grown in milk or whey, which impart certain characteristics and qualities to various milk products. The culture may be one strain of a microorganism species, called a single-strength culture, or a number of strains and/or species called a multi-strain or mixed-strain culture. Starter cultures are now lyophilized with milk components, nutrients, and energizers and distributed commercially in the dry state or are frozen with liquid nitrogen at - 196ºC and distributed in this state (Charles O'Connor(1993).

In White cheese production usually lyophilized and DVS (Direct Vat Set) cultures are used. Lyophilized cultures need much more equipment, professional personnel and have a contamination risk during reproduction. On the other hand DVS cultures provide the cheese manufacturers the following benefits: Cultures are inoculated directly into the milk in the cheese vat; less batch-to-batch variation; cultures tested (Fulya Kayagil, (2006)

Before use for activity and contamination; more predictable performance; high flexibility; possibility of composing "impossible" mixtures (e.g. mix of thermophilic and mesophilic 10 strains); improved possibilities of product development at the dairy; less risk of contamination and phage attack; and, no cost of bulk starter preparation Therefore, DVS cultures are much more preferred. For example in England in 1995 the DVS culture usage ratio was 40% . Some Bacterial Cultures Used in Fermented Milk Product Manufacture (Kosikowski, F., (1982); Varnam, A.H., Sutherland J.P., (1996); Law, B.A. (1984)

1.12.1 Classification of starter cultures

Cheese starter cultures may be classified in a number of ways. The microorganisms themselves, for example, may be classified according to optimal growth temperature. Mesophilic starters comprise Lactococcus and Leuconostoc and have an optimal growth temperature of ca. 30°C, while thermophilic starters comprise the more widely used Lactobacillus species 12 and Str. salivarius ssp. thermophilus and have an optimal temperature of 40- 45°C).

Starters may be mixed, in which the number of strains is unknown or defined in which a known number of strains are present. Mesophilic defined cultures may consist of single, paired or multiple strains. In recent years it has been found possible to reduce the number of strains in multiple cultures from the six originally used to two or three without any adverse effect on performance. Commercial suppliers of food starter cultures Law, B.A. (1984); Kosikowski, F., (1982); Hansen, E., (2002); Morrison Loewenstein, et al (1980); Richmond, H.D., (1930).

1.12.2 Role of Starter Microorganisms in the Manufacture of Cheese

During pasteurization in addition to pathogens also beneficial microorganisms, which are involved in ripening of cheese, are killed. So to compensate this loss addition of starter culture is a technological must. In modern practice bacteria of the group commonly referred to as lactic acid bacteria (LAB) are added to milk as starter cultures, the key role being the production of lactic acid by fermentation of lactose. Lactic acid is responsible for the fresh acidic flavour of unripened cheese and is of importance in the formation and texturizing of the curd. In addition, starters play other essential roles: the production of volatile flavour compounds such as diacetyl and aldehydes, and the synthesis of proteolytic and lipolytic enzymes involved in the ripening of cheese and the suppression of pathogenic and some spoilage microorganisms. Therefore, starter cultures used in manufacture of cheese are very important in defining the quality of cheese.

Acid production in milk and flavor development during ripening are both related with proteolytic activity of the starter. Proteolytic activity of LAB aims to produce amino acids for their self development. Although LAB show low proteolytic activity when compared with Bacillus, Pseudomonas, Enterococcus, this activity has an important role in cheese ripening. LAB have proteases bound their cell wall which enables them to hydrolyze big protein molecules into small peptides. With the help of peptidases localized outside the cell wall these peptides forms oligopeptides. Oligopeptides which are not longer than 6 amino acid are taken into cell and are hydrolyzed into amino acids. Peptidases are still active in ripened cheeses. Especially they become active after the lysis of LAB. While for ripened hard cheeses starter cultures with high proteolytic activity are used, for fresh cheeses consumed unripened proteolytic strains are not used. Also for semi hard Salted White cheese which is ripened for 2-3 months, low proteolytic activity is required. If the proteases are not in balance with peptidases and are found in cheese at higher ratios, it can cause bitterness and texture defects. However not only the proteases are responsible for bitterness. In addition to them process parameters and enzymes (rennet etc.) added to milk for casein coagulation can cause bitterness. Hugenholtz, J., et al. (1987); Fulya Kayagil, (2006). Species of four genera, Lactobacillus, Lactococcus, Leuconostoc and Streptococcus are most widely used as starters.

1.12.3 Characteristics of Starter Cultures Used in White Cheese Production

- ✓ should have high acid production ability,
- ✓ should produce good taste and smell in desired dose and combination,
- ✓ should not have high proteolytic activity in order to avoid fast ripening and bitterness,
- ✓ should have high antagonistic activity to inhibit pathogens,
- ✓ should be resistant to phages,
- ✓ should have resistance against antibiotics,
- ✓ should grow at cheese production temperature,
- ✓ should be resistant to certain salt concentration

Torres and Chandan(1981) defined that cheeses produced by using lactic acid bacteria, yoghurt culture and lipase enzyme were found to have similar composition after 12 weeks ripening period. However, it was also found that in cheeses ripened by lipase, fatty acid ratio

increased continuously and proteolytic activity was maximum in cheeses produced by using yoghurt culture. Cheeses produced by using lactic acid bacteria were found to be much more acceptable when compared with cheeses produced by using lipase and yoghurt culture (Kirov, N. and Chamakov, K., (1972); Torres, N. and Chandan R.C., (1981); Kehagias, C., Koulouris, A., Samona, etal., (1995).

Davies et al. (1994) defined that in Kesogort cheese production (made in Philippines) usage of 0.5-2 % yoghurt culture increased taste and aroma and gave a better texture. Furthermore it was found that, best quality cheese was obtained with addition of 1.5% yoghurt culture. cheeses produced by using yoghurt culture and without culture from pasteurized milk for 3 months period for alteration of microorganisms in industrial and hygienic aspects and defined that in yoghurt culture used cheeses number of industrially important lactic acid bacteria was high while the number of hygienically important pathogen microorganisms were low when compared with the cheeses produced without using starter culture Giori et al. (1985); P. L. H . Fox, P. F. (1989); Tunail, N. (1999).

1.13Vegetable Rennet:-

Vegetable rennet usually means the enzyme was plant based. The phrase is an oxymoron because rennet implies it is animal derived. To add to the confusion, enzymes produced using microbes are often included in this category. What types of plants have been used to produce these enzymes.

Juice extracts from fruits and plants have long been used as milk coagulants. These include extracts from papaya (papain), pineapple (bromelin), castor oil seeds (ricin) and the latex of the fig tree and the plant Calotropis procera which grows abundantly in many parts of Africa. These extracts are suitable for softer curd cheese which is consumed within a few days. The extracts are not suitable for hard cheese with long maturing periods on account of their excessive proteolytic activity which leads to bitter flavours in the ripened cheese.However, throughout the world there is no industrial production for vegetable rennet Gupta , C.B , et al., (1977).

Ficin is an important component of plants in Ficus family such as fig latex. It is of special significance in medicine and industry because it exhibits activity throughout a wide range of temperature and pH values . Fig tree latex (ficin) was immobilized on Celite by adsorption. The free and immobilized ficin were utilized in the production of teleme (a Turkish milk product) a thiol proteinase present in fig latex. Ficin coagulates milk well. Fig latex contains caoutchouc (2.4%), resin, albumin, cerin, sugar and malic acid, rennin, proteolytic enzymes, diastase, esterase, lipase, catalase, and peroxidase. Öner., et al (1993); Morton, J., (1987).

The carob tree is native to Mediterranean areas and has been used in cooking for over 20 years. Carob is free from the phenylethylamine (which is also present in chocolate), which can trigger migraines. Carob contains vitamins A, B, B2, B3 and D. It is high in calcium, phosphorus, potassium and magnesium and also contains iron, manganese, barium, copper and nickel. Carob contain polysaccharide called Galactomannan. Many legume plants have galactomannan as their sole reserve seed.

The common structural features of carob Galactomannans, derived from legume plants e.g. carob having a linear chain of β-(1→4) linked D-mannopyranose units, forming a backbone to which randomly linked single α-(1→ 6) D- galactopyranose grafts or the side chains, varying in number and frequency are substituted Fig(1.2).

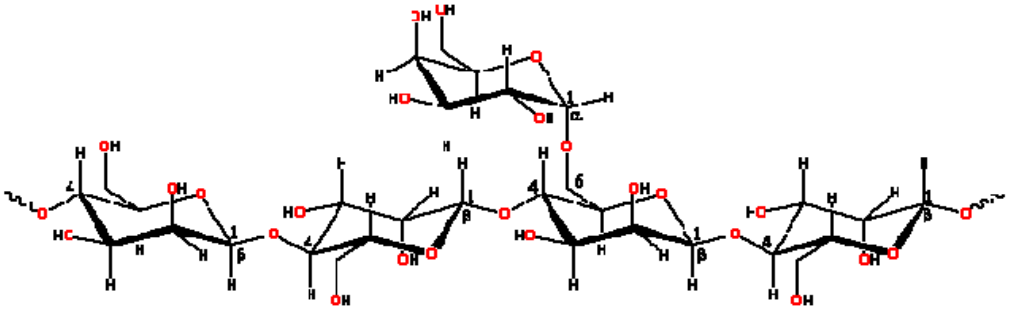


Figure (1.2) Locust Bean Gum (LBG) M: G = 4: 1, Sol-Gel Rheology

the galactomannans from most legume plants, e.g. guar and carob have a high degree of water solubility, because the chain-chain association is very much reduced by high degree by the short grafts, which prevent the linear chains coming closer to cause extensive association of the chains, which can result in crystalline. this related to high molecular weight of carob were its hydrocolloidal polysaccharide, composed of galactose and mannose units combined through glycosidic linkages, which may be described chemically as galactomannan. It is dispersible in either hot or cold water, forming a sol having a pH between 5.4 and 7.0; its main function is as a stabilizer and thickener Morton, J., (1987); Mathur. N.K,(2006).

1.14 Objectives of this Study

In this study search to find out the best method to produce local White cheese from goats milk with good properties determined by analyzing, microbiological chemical and sensory properties of cheese as pH, acidity, salt, fat, moisture, protein contents during days of storage period also to Providing data base regards the physico-chemical changes occurring in Palestine white cheese which made from goat's milk.

In our country the starter cultures are not being used in cheese production until yet, and there isn't any research about suitability of Palestinian White cheese which made from goats milk. So it is good opportunity to doing this search about the white cheese which made from goats and found out how to increase the shelf-life of this cheese with good taste and texture.

Help in improve the economical status of Palestinian farmer who is raising goats which form their major and only income. Also to find trouble shoot for manufacturing of white cheese that’s made from goat's milk and enhance the technical excite procedure towards solving.

Chapter *TWO*

Literature Review

2.1 Introduction:

On reviewing the available literature, it is evident that extensive research has been carried out to address various aspects of factors affecting in quality of white cheese manufacturing from goat's milk.

The primary objective of this chapter is to provide an insight into the theoretical and practical aspects of factors affecting in quality of white cheese manufacturing from goat's milk. This will include an examination of the chemical microbial and sensory tests. Thus the chapter will review and highlight the major work carried out in this field.

2.2 Effect of heat

Ahmet, et al., 2008 investigated the Changes done on the composition and free fatty acid contents of Urfa cheeses (a white-brined Turkish cheese), and found that; Cheese made from raw milk had a higher level of lipolysis than the cheeses made from milk inoculated with mesophilic or thermophilic lactic starters. While Salwa et al.,(2002) found that, thermal pre-treatment does effect of milk to keep the quality of domiati cheese)

These findings are in accordance with Abdel.M Sulieman 2007 who studied the effect of pre-treatment of milk quality characteristics of white cheese. He found that cheese from pasteurized milk have less microbial growth than that made from raw milk while the cheese from raw milk have good sensory properties than cheese from pasteurized milk.

Sameh Awad, 2006 who worked on the texture and flavor development in Ras cheese made from raw and pasteurized milk, reported that; Cheese made from raw milk had a better texture

and flavor than pasteurized milk also founded that moisture content and pH were lower in raw milk cheese than in pasteurized milk cheeses. Levels of water-soluble nitrogen, casein breakdown, free amino groups and free fatty acids were higher in cheese made from raw milk than in that made from pasteurized milk.

Pappa et al. 1990 (studied the influence of types of milk and culture on the manufacturing practices, composition and sensory characteristics of Teleme cheese during ripening). reported that addition of starter culture affect on rate of ripening, flavor of the cheese and also found that moisture content, was higher in cheeses made from cows' milk than goats. He also found that the highest Total Solid, fat content were in cheeses made from ewes' milk and addition of starter culture didn't affect on the total solid, were the highest protein content was in cheeses made from goats' milk.

Belgrade et al., 2005 (Microbiological study of fresh white cheese) ; IDF, Cheese and processes cheese product and A.Hayaloghlu et al.,(2002) (microbiological & bichemical properties of Turkish white cheese) report that the type of the milk used in cheese produced affected on the color, appearance of cheese were the goats cheese seen whiter than cow cheese.

Yun et al.,1993 (Mozzarella cheese: impact of cooking temperature on chemical composition, proteolysis and functional properties) found that heating milk or pasteurized it may affect chemical composition and sensory characteristics of final cheese.

Fox P F et al, (1993) (biochemistry of cheese ripening) found that physico-chemical composition of the cheese effected in heat treatment process where fresh cheese had higher protein & fat than heated milk cheese while pasteurized cheese had unique aroma & flavor.

E. Litopoulou-Tzanetaki et al 1992 (Microbiological study of white-brined cheese made from raw goat milk) found that cheese from raw milk have higher Total Aerobic count than cheese from pasteurized milk and also found that rate of proteolytic and lipolytic organisms in cheese from raw milk were higher than pasteurized one .

Mohan Reddy., et al. 1992 (Effect of Ferric Chloride on Chymosin Hydrolysis & Rennet Clotting Time of Milk) and Swaisgood, H. E. 1982 (Chemistry of milk protein), founded that heating the milk for long temperature effect on cheese curd firming rate were its very soft and it caused reducing in total solid and calcium ion for the cheese.

Kanka, 1989 (effect of pasteurization on some physico-chemical properties of the goat's milk) reported that raw cheese milk had higher percentage of chemical composition (fat and protein) than pasteurized goats cheese.

Zeynep Ustunol, et al.,1985(Effects of Heat Treatment and Post treatment Holding Time on Rennet Clotting of Milk) Founded that pasteurized milk give cheese with good quality (Color,Texture Taste, General Acceptance and Aroma) than cheese from raw milk and also pasteurization effected in shelf-life of the cheese were cheese from pasteurized milk have long shelf-life than cheese from raw milk while cheese from raw milk have higher Total Solid Content, than pasteurized one.

Elein, G. I et al., 1999 (Effect of milk pretreatment and storage condition on the properties and keeping quality of Ras cheese); Kanka, et al., 1989. (Effect of pasteurization on some physico-chemical properties of goat milk) found that cheese from Heat treated milk and pasteurized milk have higher moisture content than that from raw milk, and also found that the moisture content decreased in all cheese types throughout the storage period. The fat % was slightly lower in heat treated and pasteurized milk than in raw milk cheese.

Kroll, S., 1995. (Thermal stability In: Enzymes of psychrotrophs in raw milk.) reported that there's relationship between the high proteolytic count and the low yield of the cheese, were off-flavor, off-odor and abnormal texture caused through the break down of the released proteolytic, also found that cheese from pasteurized milk had significant decrease in total proteolytic count than that cheese from raw and heat treated milk, pasteurized milk cheese showed the lowest values of proteolytic organisms.

Martíín Buffa, et al.,2001, (Lipolysis in cheese made from raw, pasteurized or high-pressure-treated goats' milk) found that the level of lipolysis of cheeses made from Raw milk, was lower than level of lipolysis in cheese made from pasteurized milk. This behaviour could be explained by heat-sensitive and found that no differences in the sensorial attributes between cheeses made from pasteurized or raw milk.

Psoni.L. N. Tzanetakis, E. Litopoulou-Tzanetaki,, 2005, (Characteristics of Batzos cheese made from raw, pasteurized and/or pasteurized standardized goat milk and a native culture) found that the use of pasteurized milk with addition of a starter culture decerease the rate of lipolysis than other sample which is made from raw milk without addition of a starter culture, pasteurized milk without addition of a starter culture.

Elein, G. I. Abd Elghany, L. Youssef and L. Mohamed 1999. (Effect of milk pretreatment storage condition on the properties and keeping quality of cheese).also Kanka, B., S. Joginder and G. Goyal. 1989. (Effect of pasteurization on some physicochemical properties of goat milk) found that yield of cheese increase by pasteurization and heat treatment. This may be attributed to the effect of pasteurization on kappa-casein forming complex with Beta lacto globulin which increased clotting time and subsequent cheese yield.

2.3 Effect of Starter Culture

IOS, International Organization for Standardization, Cheese determination of fat content (Van Guilk method) ISO 3433, 1975.Founded that an adequate starter microorganism, (with out heated) selected from the most numerous microorganisms seems to be the main cause of the lipolytic and proteolytic phenomena and of the development of the flavor characteristics.

Masoud Najaf Najaf et al.,2008 (studies on the effect of starter culture concentration & pH on the Iranian brine cheese yield) said that S.C concentration & PH affected salt content in cheese also as pH increase the fat %will increase.

Dagdemir et al., 2008 (technology characterization of natural lactic acid bacteria artisanal turkish white cheese) found that starter culture increase acidity of the cheese & increase the proteolytic of the cheese protein.

Hamid et al.,2008 (microbiological & chemical quality of traditional lighvan cheese produced in tabriz iran from mixed milk) found that microbial growth for cheese from raw milk was higher than pasturized cheese milk.

Ahmet , et al., 2008 (Changes of composition and free fatty acid contents of Urfa cheeses (a white-brined Turkish cheese). Cheese made from raw milk had a higher level of lipolysis than the cheeses made from milk inoculated with mesophilic or thermophilic lactic starters.

Sert et al., 2007 (effects of starter culture on chemical composition microbiological & sensory characteristics of turkish cheese during ripening)found that starter culture didn't effect in chemical composition of cheese, while it effects much in organoleptic quality &. Microbial growth will decrease.

A. Khosrowshahi , et al., 2006 (Monitoring the Chemical and Textural Changes During Ripening of Iranian White Cheese Made with Different Concentrations of Starter) found that used starter culture in cheese production As ripening progressed, moisture and protein contents of the treatments continuously decreased, whereas their total ash, salt, and salt in moisture contents increased. Fat content and pH of cheeses remained stable during ripening.

A. Goncu et al 2005 (Sensory and chemical properties of white pickled cheese produced using kefir, yoghurt or a commercial cheese culture as a starter) reported that starter culture type affected in sensory and chemical properties of white pickled cheeses produced using Starter culture type had a significant impact on acidity, pH, salt, and fat levels in cheese, as well as on ash level, appearance, and odour properties.

Belgrade et al.2005 (microbiological study of fresh white cheese) reported that starter addition effect the lipolytic and proteolytic characteristics of the cheese.

Sevdakilic et al.2004 (manufacture & some properties of Turkish fresh cheese goats cheese) found that used of S.C in production of cheese give better smell & taste to the cheese.

Dagdemi, et al. 2003 (The effects of some starter cultures on the properties of Turkish White cheese) found that starter culture didn't effect in chemical composition of cheese.

Psoni et al., 2003 (microbiological characteristic of batzos cheese from row goats milk) found that various factors contrite to the decline of M.Os during cheese ripening as addition of starter culture which lead to decrease PH.

Ceylent et al.2003 (the microbiological & chemical quality of skim cheese produced in turkey) found that starter culture decreased in PH so inhibition of pathogens microorganisms.

Hayaloglu, et al.. 2002. (Microbiological, biochemical and technological properties of Turkish White-brined cheese "Beyaz Peynir").Reported that using of a starter culture in the manufacture of brined cheese influenced the chemistry, biochemistry, and sensory characteristics of the cheeses during ripening period. However, the different starters used did not significantly influence the gross composition or the sensory attributes.

Guinee TP et al.2002 (Effect of pH and calcium concentration on some textural and functional properties of mozzarella cheese) using of starter culture in cheese production caused reducing in the Calcium content and a significant decrease in the protein level and increases in the moisture content. Reducing the Calcium concentration also resulted in a more swollen,
Mohamed A. Mehaia, 2002 (manufacture of Fresh Soft White Cheese from ultrafilterd goats milk) found that starter culture govern the flavour body and texture of the cheese also its help to suppress the growth of the pathogenic and spoilage bacteria.

Olarte. et al.,2001(effect of commercial starter culture addition on the ripening of an artisanal goats cheese) found that starter culture didn't effect in chemical composition of cheese while its effect in decreasing microbal growth. organoliphtic quality &the raw milk gave cheese with better aroma color texture than pasteurized cheese.

Marth, E. and J. Steele, 2001 (The typical flavour of goat milk products: technological aspects) found that the typical flavour of goat milk cheese can be controlled by using starter culture; Broome et al.1998,. (Starter peptidase activity in maturing cheese); Lane, et al., 1997. (Role of starter enzymes during ripening of Cheddar cheese made from pasteurised milk under controlled microbiological conditions.) and Law et al., 1992; (Proteolysis and flavour development in Cheddar cheese made with the single strains Lactococcus lactis ssp. lactis UC317 or Lactococcus lactis ssp. cremoris HP) Founded that enzymes originating from starter (i.e., proteinases, peptidases) play a major role in formation of small peptides and the amino acids, which serve as precursors of flavor compounds in cheese.

Urbach, et al.,1997. (The flavour of milk and dairy products) found that using Starter cultures: gave a uniform texture due to the known biochemical activities of their microflora during cheese manufacture and ripening.

Omer A. Hamid et al.,2007 (microbiological properties and sensory characteristics of white cheese collected in zalingei area west Darfur state) found that starter culture significantly affected the flavor saltiness, color and texture of cheese samples.

Memduh Karakul et al., 1995 (Effect of Starter Composed of Various Species of Lactic Bacteria on Quality and Ripening of Turkish White Pickled Cheese) reported that used of starters can solve many problem in cheese production such as non-uniform quality, flavor and texture defects. These problems may be partly attributed to the fact that this kind of cheese is usually made from unpasteurized milk without the use of specific starter culture. Such a method of manufacturing leads to unpredictable biochemical and microbiological. These starter cultures are not specific to the production of traditional cheese, and insufficient flavor and some texture defects are sometimes observed in cheeses prepared by using such starter.

Karakui, et al., 1992. (Microbiological changes during the ripening of Turkish white pickled cheese), observed that used of lactic acid bacteria present in white pickled cheese made from raw milk predominated over other microbial groups throughout ripening.

Abou donia et al.,1986 (Egyptian domiati soft white cheese)found that starter culture govern the flavor, body, texture and help to suppress grouth of pathogenic & spoilage bacteria.

IOS, International Organization for Standardization, Cheese determination of fat content (van Guilk method) ISO 3433, 1975, founded that an adequate starter microorganism, (with out heated)selected from the most numerous microorganisms seems to be the main cause of the lipolytic and proteolytic phenomena and of the development of the flavor characteristics.

2.4 Effect of calcium chloride

El Zubeir et al.,2008 (fresh cheese from camel milk coagulated with camiflok & CaCl2) found that CaCl2 increase cheese yield, decrease time of coagulation & increase the percentage of ash.

McMahon D. J. et al.2005 (Influence of Calcium, pH, and Moisture on Protein Matrix Structure and Functionality in Direct-Acidified Nonfat Mozzarella Cheese) found that addition of calcium chloride to the cheese caused hardness of cheese.
Guinee TP et al.2002 (Effect of pH and calcium concentration on some textural and functional properties of mozzarella cheese) using of starter culture in cheese production caused reducing in the Calcium content and a significant decrease in the protein level and increases in the moisture content. Reducing the Calcium concentration also resulted in a more swollen.

A. F. Wolfschoon-Pombo,.1998 (Influence of calcium chloride addition to milk on the cheese yield) reported that addition of calcium chloride (0.01%) on the cheese milk increase the yield of cheese .

Okigbo. et al. 1985 (interaction of calcium. PH temperature & chymosin during milk coagulation) found that calcium ions control in coagulation mechanism were inceare it.

Ernstrom. et al., 1958. (Effects of reducing rennet and adding calcium chloride on the manufacture and curing of Cheddar cheese) and D. J. Mcmahon et al., 1984 (Effects of Calcium, Phosphate, and Bulk Culture Media on Milk Coagulation Properties) found that Changing the calcium concentration affected not only the rate at which coagulation occurred but also the firmness of the curd. increasing calcium concentration inhibits gelation while enhancing aggregation of para-casein micelles.

Code of Federal Regulations, 1979 Reported that addition at more than 2% (wt/wt) calcium chloride to milk used for cheese making, The quantity of rennet required thus can be reduced by 50%. Cost effectiveness of such action is determined by relative costs of rennet & calcium chloride.

2.5 Effect of Fig Latex

A. Nouanh et al 2009 (Characterization of the purified coagulant extracts derived from artichoke flowers & from the fig tree latex in light of their use in use in the manufacture of traditional cheese in Algeria) found that the use of fig latex in cheese production (coagulation) instead of commercial rennin increased proteolytic activity.

Fernández-Salguero et al., 2008 (Influence of vegetable and animal rennet on proteolysis during ripening in ewes' milk cheese) the amount of protein in cheese produced using plants rennet was more than 28% greater than that in cheese produced using animal rennet).

Bernardo Prieto et al.,2004 (Effect of ripening time and type of rennet (farmhouse rennet from kid or commercial calf on proteolysis during the ripening of León cow milk cheese) reported that cheese undergoes a slight proteolysis and that the rennet type plays a preponderant role in protein degradation.

Barbosa et al.1981 (cheesemaking experiments carried out on some Italian cheeses with vegetable rennet); Walstra,p., et al 1984 Dairy technology. principle of milk properties &

process. Reported that using of plant rennet in cheese curding affect the sensory properties of fresh cheese which produce very strong oder & bitterness.

Öner., et al 1993 (Separation of the Proteolytic Enzymes from Fig Tree Latex and its Utilization in Gaziantep Cheese Production) indicated that the difference between cheese made with rennet and enzyme preparation obtained from ion-exchange chromatography, from fig latex was not significant Organoleptic tests showed that there was no significant difference in acidity, bitterness, creaminess, off-flavour and graininess.

A. Cristina Freitas 1996(Influence of milk type, coagulant, salting procedure and ripening time on the final characteristics of Picante cheese) found that values of water-soluble nitrogen for cheeses coagulated with animal rennet were in general lower than those for cheeses coagulated with plant rennet .

Sgarbieri M.G. 1964, (Separation of the proteolytic enzymes of ficus carica&ficus glabrata lactices) found that used of plant rennet (flowers of Cynara cardunculus) instead animal rennet, effected on the degree of lipolysis were concentrations of free fatty acid in cheese made from plant rennet less than cheese made from animal rennet
He also found that used of pasteurized milk with addition of a starter culture decrease the rate of lipolysis than other sample which made from raw milk without addition of a starter culture, pasteurized milk without addition of a starter culture.

Fahmi K.U, 1973, (Studies of milk clotting enzymes from plant source) found that rennet type effected on the physico-chemical characteristics of cheese (moisture, protein, and water activity values) were higher in the cheeses manufactured with animal rennet), fat and SN (higher in cheeses manufactured with vegetable rennet). There was a significant rising trend in the levels of lactic acid, ash, NaCl, and nitrogen fractions during ripening, while a significant decrease was observed in the moisture, lactose, pH and aw values.

Aworh , O.C. and Nakai , S. (1986)., (Cheese-making properties of vegetable rennet from sodom apple (Calotropis procera) found that cheese made with vegetable rennet had less soluble nitrogen than that made with calf rennet despite the fact that vegetable rennet was more proteolytic in casein solution than calf rennet. also , cheese made with vegetable rennet was harder, less cohesive and more gummy, low proteolytic activity.

2.6 Organization of the Study

This investigation is organized in five chapters as follows:

Chapter 1 introduces the general view about milk and cheese products, justifications of this study, the problems of this study, the questions, the objectives, the assumptions and the literature review of this study.

Chapter 2 the literature review and others related work

Chapter 3 summarizes the methodology of this study.

Chapter 4 contains results and discussions of the factors that affecting in quality of white cheese manufacturing from goats milk in Palestine.

Chapter 5 summarizes the conclusions and recommendations of this study.

Chapter *THREE*

Materials and Methods

3.1 Introduction

Number of factors affecting the quality of goats cheese which is made from goat's milk mixed with cow's milk at different percentage were investigated within this research .This chapter provides an insight into the experimental procedures and techniques applied and presents essential information regards the selected materials and methods.

In this chapter, the cheese sampling procedure and testing method for each analysis type are detailed. There are many points taken into consideration sampling to cover all goals of this research, which will be detailed.

3.2 Materials:

3.2.1 Milk:

Raw milk, from goat and cow, was obtained from “Halhoul” village near Hebron and transported to food processing laboratory at Al-Quds University in ice bags and pasteurized at 72°C for 5 min in first group and heated at 65°C for second group.

The milk which is used was a mixture of goat and cow milk with different ratio, as shown in Table (3.1).

Table (3.1) Mix ration of goats to cow milk which is used in cheese production

Goats milk percent %	Cow milk percent %
0	**100**
30	**70**
50	**50**
70	**30**
100	**0**

The number of cheese samples needed for this investigation is 120. They will be divided into two groups according to the thermal treatment of 60 samples each. All samples will be subjected for the required tests, namely; sensory analysis, microbial analysis, chemical analysis. Each cheese sample was produced by using 3 litres of milk.

The required pasteurization process was done in term of double jacketing heating, by heating the milk in a pot heated by bigger pot full of hot water until reaching the required pasteurization temperature.

3.2.2 Calcium chloride:

Calcium chloride was added to milk with the rennet at 0.15% ratio bought from local market and produced by Marmara Industrial Chemicals.

3.2.3 Starter Culture:

Hetero starter culture was taken from yogurt which is produced from cow milk (Al Jebrini for food Industries in Hebron yogurt). It was added to milk at 1% ratio.

3.2.4 Rennet Enzyme:

Rennet enzyme was used for the coagulation of milk. The power of enzyme is 1/8000. It was added to milk at 0.05% ratio. Rennet and bovine rennet are commercial extracts containing the active enzyme rennin. It is also known as chymosin. Rennet is the aqueous extract prepared from cleaned, frozen, salted, or dried fourth stomachs of calves, or kids of lambs. Bovine rennet is the product from adults of the animals listed above. Both products are called rennet80.

3.2.5 Salt:

Salt was used to prepare the brine solution for preservation purposes. Brine solution was prepared of 15 % solution which prepared by dissolving 1.5Kg salt in 8.5 litre of water. Cheeses were ripened by keeping it in brine solution kept in closed glass containers at 4°C.

3.2.6 Carob fruit (carob latex):

Carob fruit was used to prepare the carob solution. The carob fruit was soaked for an hour, then squeezed manually to get out the extract. An amount of 1ml (2 drops) of the extract will be used each time as required. This amount was considered after testing different concentrations (0.5, 1, and 2ml) and the result came out with best result, in term of acceptable taste and texture, related to 1ml.

3.2.7 Fig fruit (fig latex):

Fig fruit was collected for the purpose of extracting the white material nipping up from stem of the fig. different concentrations (0.5, 0.1, and 0.2ml) were tested in term of producing most acceptable taste and texture on cheese. 0.5ml found to be the required concentration for this investigation.

3.3 Methods

3.3.1 White Cheese Manufacture:

In this study the work was divided into two main parts every parts has 12 groups every group from the twelve has five samples, that's mean 60 samples for every part. 120 cheese samples (for both parts) were made by adding rennet enzymes and the requied materials according to the factor studied, as shown in Table (3.2). The cheese manufacturing steps (flowchart) for cheese produced without pasteurization process and cheese produced with pasteurization process are explained in Figure (3.1) and Figure (3.2) respectively.

Sample. #	starter culture	$CaCl_2$	carob	fig
1				✓
2			✓	
3		✓		✓
4		✓	✓	
5	✓	✓		
6	✓			✓
7	✓		✓	
8	✓			
9				
10		✓		
11	✓	✓		✓
12	✓	✓	✓	

Table (3.2) material which added to milk of cheese

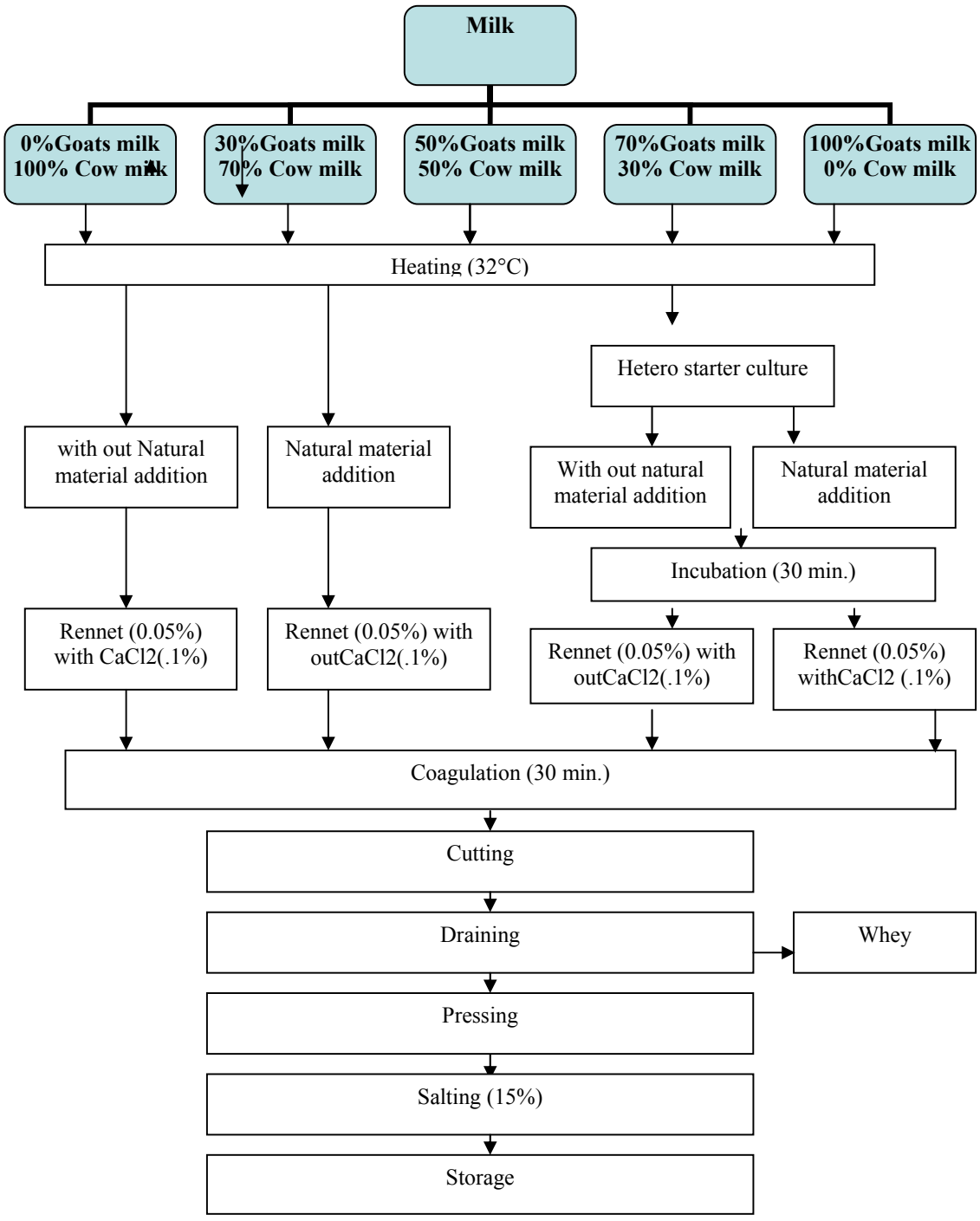


Figure (3.1) Flow chart of white cheese processing from goat's milk mixed with cow milk in different percent with heating only with out Pasteurization process.

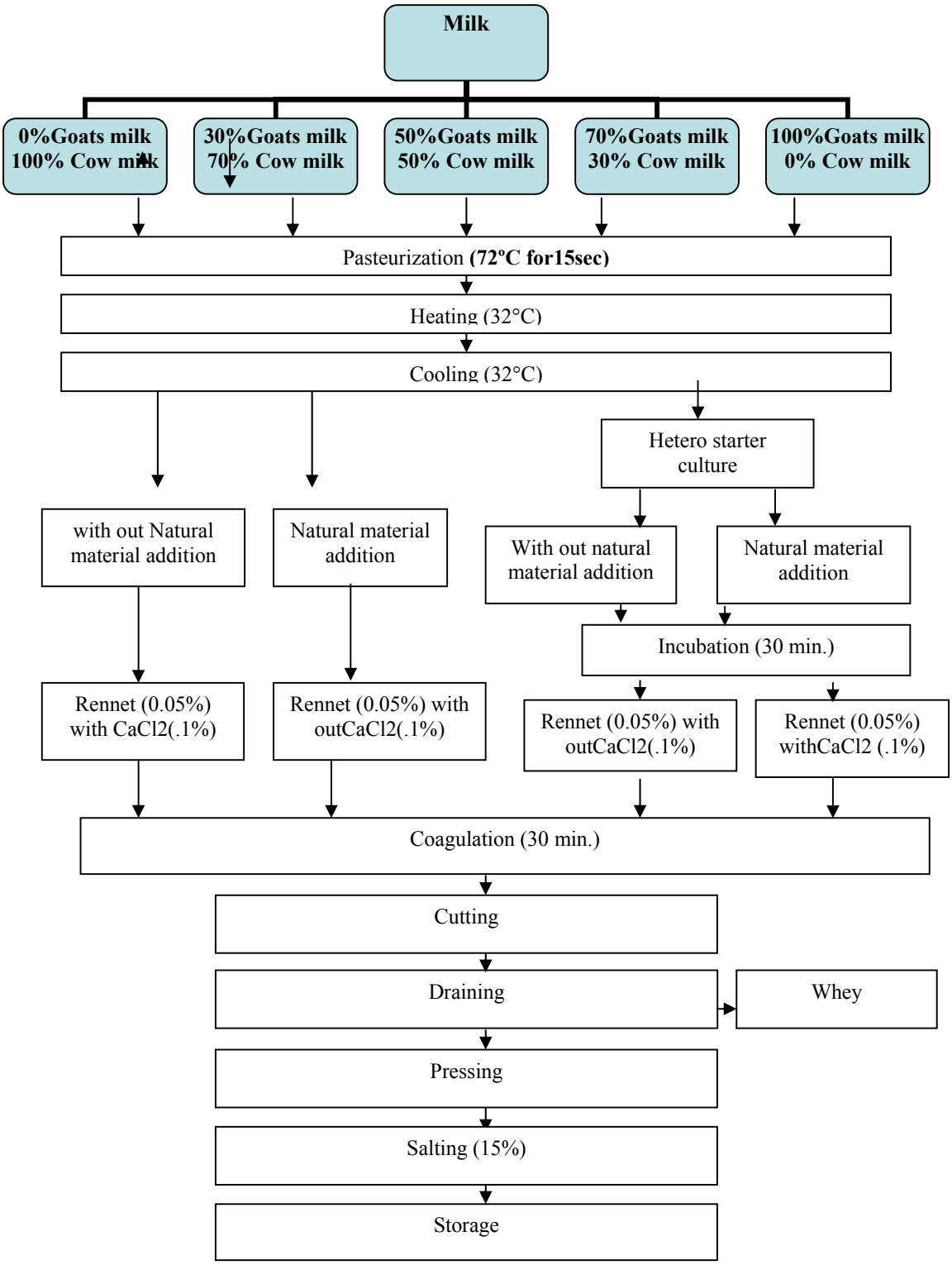


Figure (3.2) Flow chart of white cheese processing from goat's milk mixed with cow milk in different percent with Pasteurization process.

For the coagulation of the milk and the elimination of the whey, the milk was coagulated for 45min. The coagulum was cut and pressed (under a 10 kg weight), overnight cheese was stored in 15 % brine solution. Cheeses were ripened in this solution in glass containers at 4°C for 30 days.

3.4 Chemical analysis

All cheese samples were chemically examined for pH using pH meter (model SA 720); titratable acidity according to AOAC (1997). Moisture, fat, cheese yield; total nitrogen (T.N.), and total solid according to Kuchroo and Fox ,(1982), Guinee and Fox (1993) detailed in appendix one.

All tests carried out at Al-quds University in food processing laboratory. The period for these tests started in April 2007 and ended in December 2008.

3. 5 Sensory Analysis

For sensory analysis of cheeses Hedonic Type scale was used Nelson and Trout (1981). Detailed in appendix two.

3.6 Microbiological Analysis:

The cheese samples were prepared for microbiological examination according to ICMSF, (1996). The treated cheese samples were examined for Coliform (MPN) count; and total mould and yeast detailed in appendix three.

The detailed procedures, equipment, apparatus, techniques, chemicals, calculations, and characteristics of the experimental also the chemical tests, the analytical test, and organoleptic test, were discussed in details in appendix one, appendix two and appendix three respectively.

Chapter *FOUR*

Results and discussion

PART ONE

Part one

4.1 Introduction:

In this study the work is divided into two main parts. Each part has 12 groups, where every group consists of five samples (i.e. 60 samples for each part and they are 120 samples for the whole investigation). All cheese samples in both groups were made generally by adding the rennet enzymes and different additions, each time as studied factors.

Sample which is made by rennet enzymes only (without any addition) is used as standard for other samples in both groups, the results in this study were compared with other paper results.

4.2 Factors affecting the Quality of White Cheese Manufacturing from Goat's Milk:

In this project the work was divided into two main parts every part has twelve groups with different percentages of mixing between the two types of milk cow, goat milk (100:0, 70:30, 50:50, 30:70 and 0:100 Goats milk: Cow milk respectively) every point and factor will be discussed in the two main parts.

In part one cheese was produced without any heat treatment for the milk (raw milk) while in Part two cheese was produced with heat treatment pasteurization temperature (72 ◦C/15sec) for the milk.

The factors studied in the two parts for cheese samples are Addition of Fig Latex, Carob latex, Starter Culture and CaCl2.

4.3 Part one:

In this part cheese was produced without applying heat treatment for milk (raw milk). 12 experiments were made with addition of different materials, as illustrated in Table (4.1).

Table (4.1) material which is added to milk of cheese

Sample. #	starter culture	$CaCl_2$	carob	fig
1				✓
2			✓	
3		✓		✓
4		✓	✓	
5	✓	✓		
6	✓			✓
7	✓		✓	
8	✓			
9				
10		✓		
11	✓	✓		✓
12	✓	✓	✓	

4.4 Chemical Analysis

Chemical analysis include total solid, protein content, fat content, ash content, PH and acidity. All cheese samples were chemically examined for moisture; fat, cheese yield; total nitrogen (T.N.) and total solid according to (Kuchroo and Fox ,1982 ., Guinee and Fox 1993), pH using pH meter (model SA 720); titratable acidity, according to AOAC (1997). All tests were carried out at Al-quads University in food industrial lab. The total period for this test started in April 2007 and was accomplished in December 2008.

4.4.1 Total Solid Content

As shown in Figure (4.1), group number nine was used as reference for the rest of part one groups (eleven groups). The result showed that, the highest total solid percentage was found in group number six and was for the category of 100% goat milk and it was **56.06%** (which was produced by using fig latex and starter culture). This finding was in accordance with El-Zubeir (2004), Abdel.M Sulieman (2007), and Sulieman *et al*, (2005) who worked on *Jibna-beida* and Maddafara cheese and found that, the total solid content in cheeses between **48.76 - 56.48%**.

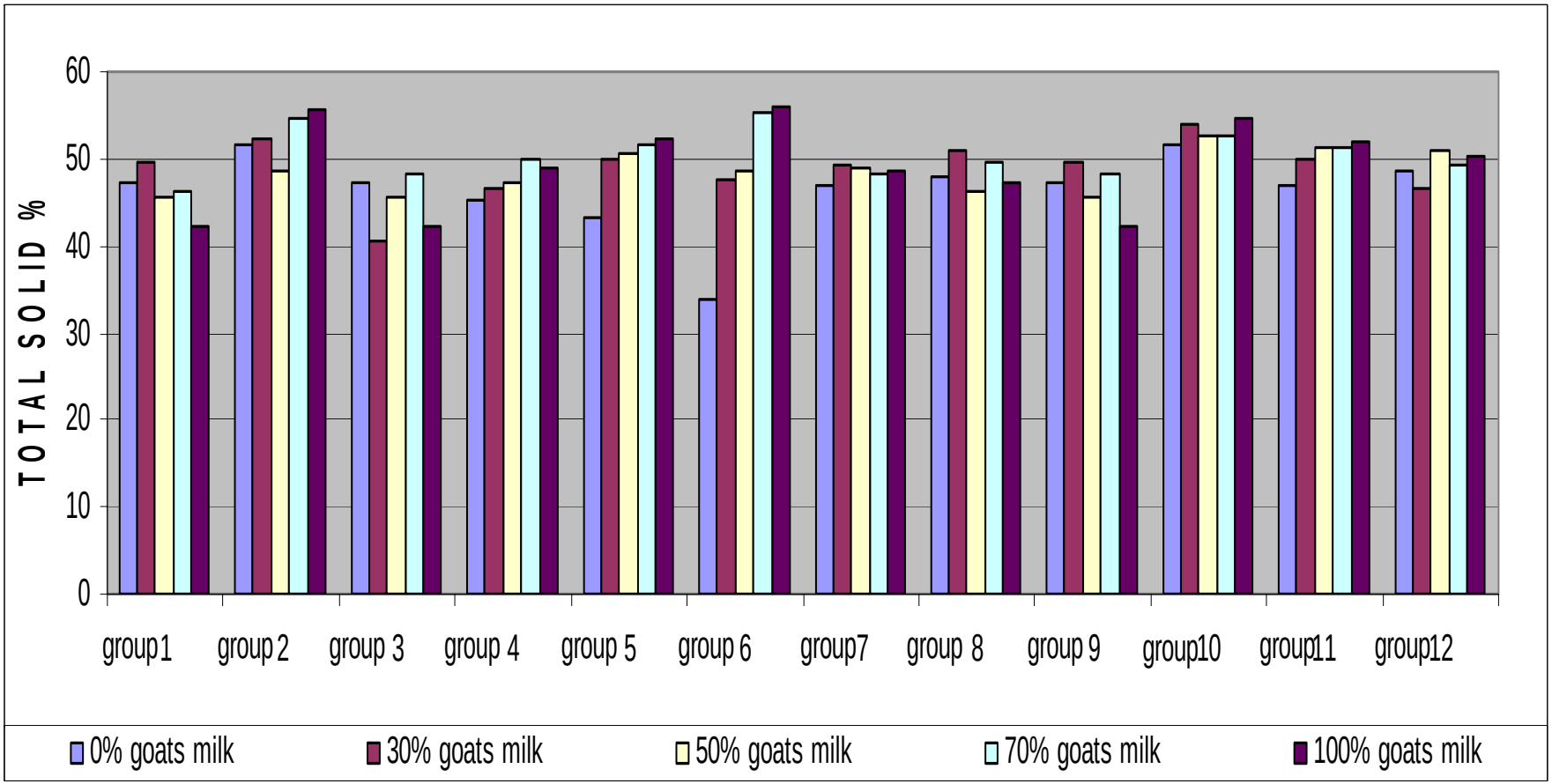


Figure (4.1) total solid % in the 12 groups of cheese samples.

The lowest total solid percentage was found also in group six and it was for cheese made of 0% goat's milk. It was 33.83% which produced by using fig latex and starter culture. This range was very low due to the percentage of milk mixing and also might be due to the microbial enzymatic action.
This finding is in agreement with Masoud Najaf et al, (2008) and Sarfraz Ahmad et al.(2008) who reported that physical properties of the cheese depend on the type of milk, the changes in most of the chemical components of cheese such as proteins and lipid due to the microbial enzymatic action.

Masoud Najaf et al (2008) reported that, total solid content in cheeses was between 36.3 - 42.48%. However, the differences between their results and the obtained results was due to the materials that are added to the milk samples. This explanation is confirmed by Hamid et al (2008) who found that the total solid% range from 38.56 - 44.51% the difference in the results is due to the use of different types of milk and there is no standard method for cheese manufacturing method, in term of curd formation. White cheese should not contain total solid lower than 40% (ISIRI 2344, 2006).

4.4.2 Fat Content

As shown in Figure (4.2), the highest fat percentage was found in group number six (which was produced by using fig latex and starter culture) and was for the category 30% goat milk; the fat content was 26%. The lowest fat percentage was found in group number two and was for the category 100% goats milk, which produced by using carob latex, and group number seven (which produced by using carob latex and starter culture) and was for the category 0% goats milk, it was 11%.

Masoud Najaf et al, (2008) reported that starter culture concentration & PH affected salt content in cheese also as pH increase the fat percentage. Fat percentage in white cheese was between 22.50- 25.13% (Mohamed and Sohair, 2009). The variation between this result and the obtained results may be due to material which was added to the milk samples and also the percentage of milk mixing.

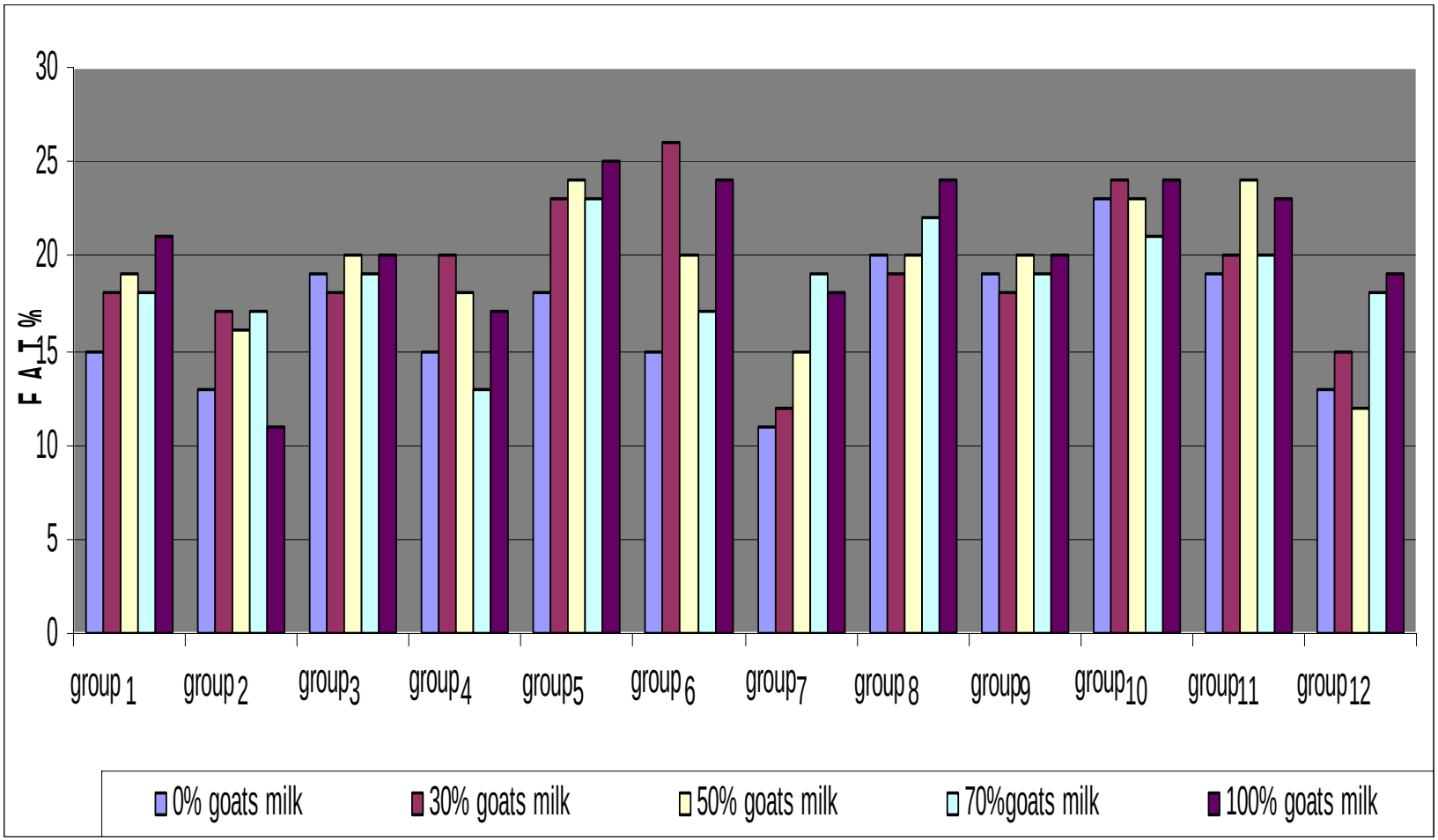


Figure (4.2) fat % in the 12 groups of cheese samples.

Same finding was reported by Hamid et al, (2008) who found that total fat percentage ranged almost between 16-22.

3.4.3 Protein Content

As shown in Figure (4.3), the highest protein percentage was found in group number eight (which was produced by using starter culture) and was for the category 30% goat's milk; it was 25.48%. At the same time the lowest protein percentage was found in group number twelve (which was produced by using starter culture, carob latex, and calcium chloride) at 30% goats milk; it was 11.08%.

Much lower protein percentage was reported by Abdel M. Sulieman (2007) who found that, protein content in white cheese was between 15.40- 20.16%. Close finding was reported by Masoud Najaf et al, (2008) who found that protein content in white cheese was between 16.5 - 21.9%.

This variation between the protein percentage in literature review and this investigation findings is due to materials added to milk for the purposes of curd formation like carob latex , fig latex and starter culture. Hamid et al, (2008) found that protein content in cheese with starter addition only was between 15.40- 22.36%.

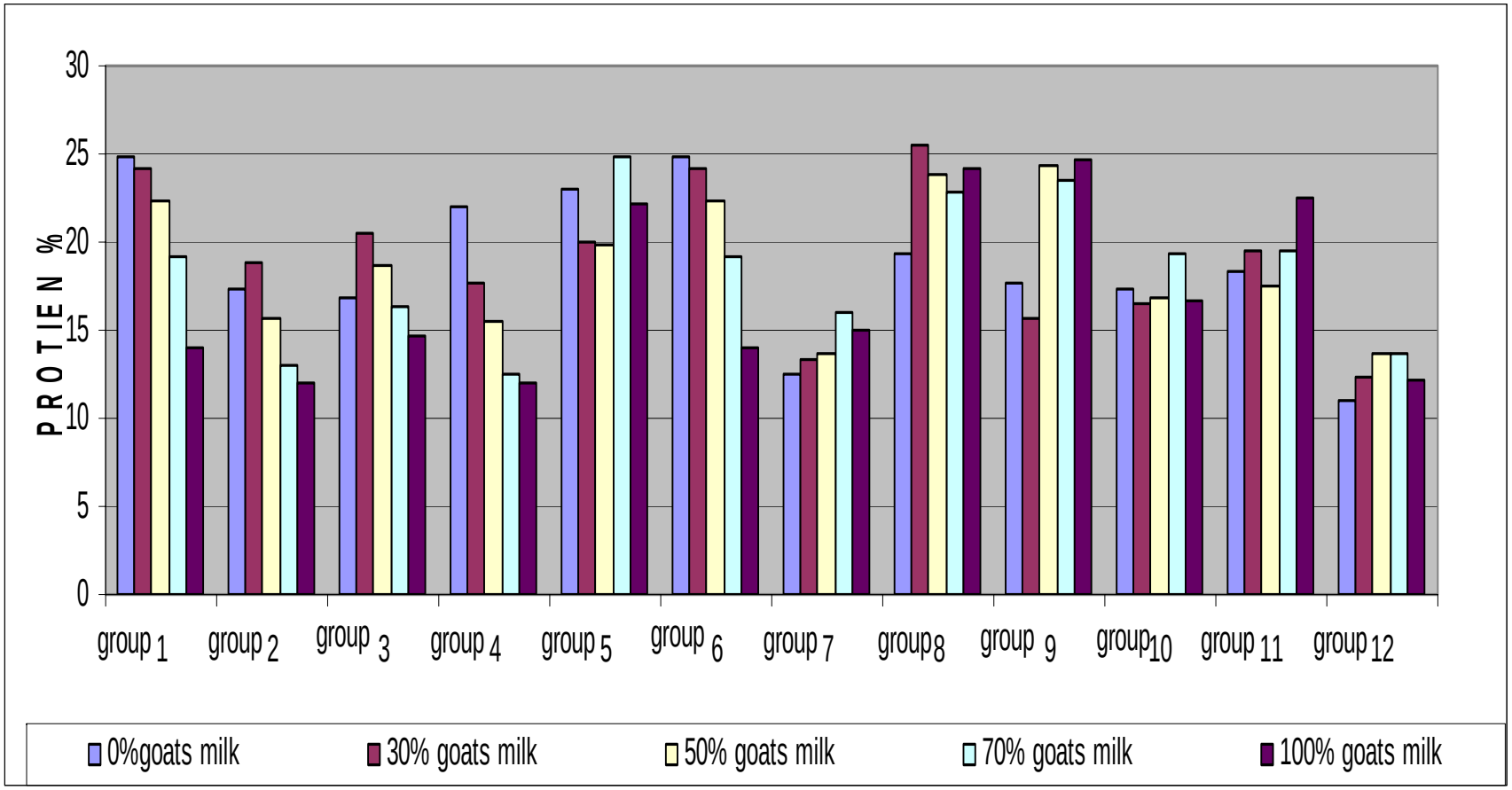


Figure (4.3) protein % in the 12 groups of cheese samples.

4.4.4 Ash Content

The results of ash content were plotted in Figure (4.4). The highest Ash percentage was found in group number two (which produced by using carob latex) and was for the category 0% goats milk; it was 12.41%. The lowest ash percentage was found in group number ten (which was produced by using starter culture) at 50% goat's milk; it was 6%.

This obtained result is very close to the results reported by Sulieman et al, (2005) in Maddafara cheese which made from raw cow milks, it was 12), and greater than the value given by El-Zubeir (2008) who reported a value of 6.5% ash in Jibna-beida from raw cow, while Abdel.M Sulieman (2007) reported that ash percentage in white cheese was between 8.9-12%.

This variation is due to the addition of natural material which enhanced the entrapment of minerals in the curd. Nevertheless, the type of milk, as well as the method of cheese production highly affected this percentage.

On the other hand very low ash percentage (4.92-6.29) was reported by Hamid et al, (2008) for cheese samples prepared by starter culture only.

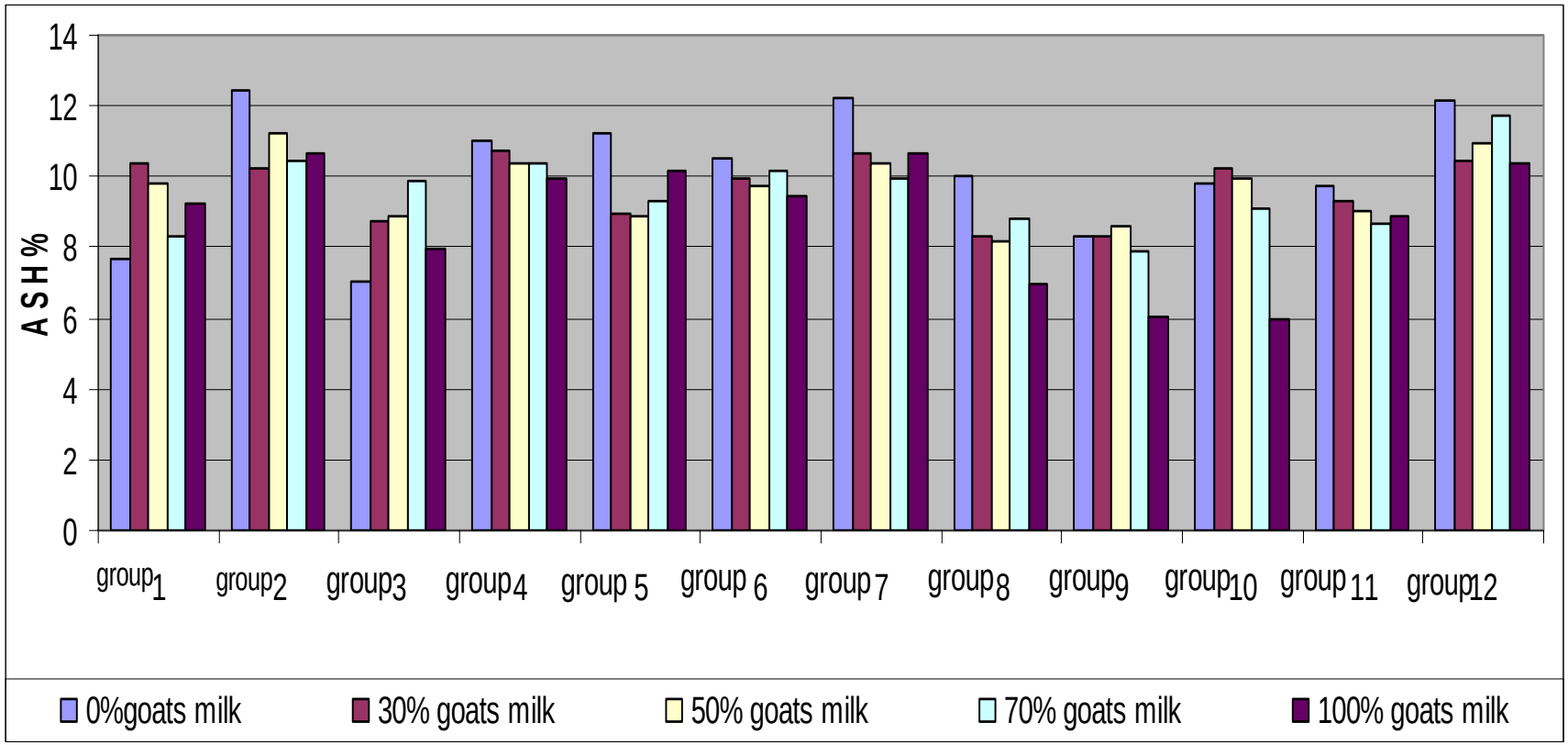


Figure (4.4). Ash % in the 12 groups of cheese samples.

4.4.5 PH

The PH results were fitted on curve, as shown in Figure (4.5). The highest PH percentage was found in group number two and was for the category 30% goats milk it was 6.97 which produced by using carob latex. While the lowest PH percentage was highlighted to group number eleven and was for the category 0%, and 50% goats milk it was 5.39. This group was produced by using fig latex, starter culture, and calcium chloride.

The obtained PH range was 5.39-6.97, which is in agreement with international standard (ISIRI 2344, 2006).

A close finding was registered by Salwa et al (2002) as, PH ranged from 4.90-6.45. Further lower values were confirmed by Hamid et al (2008) who reported that, PH of sample was ranged from 4.22-5.59 during storage. The variations between the obtained results and other results is due to clotting materials, type of milk which used in cheese production, and also the method of cheese making.

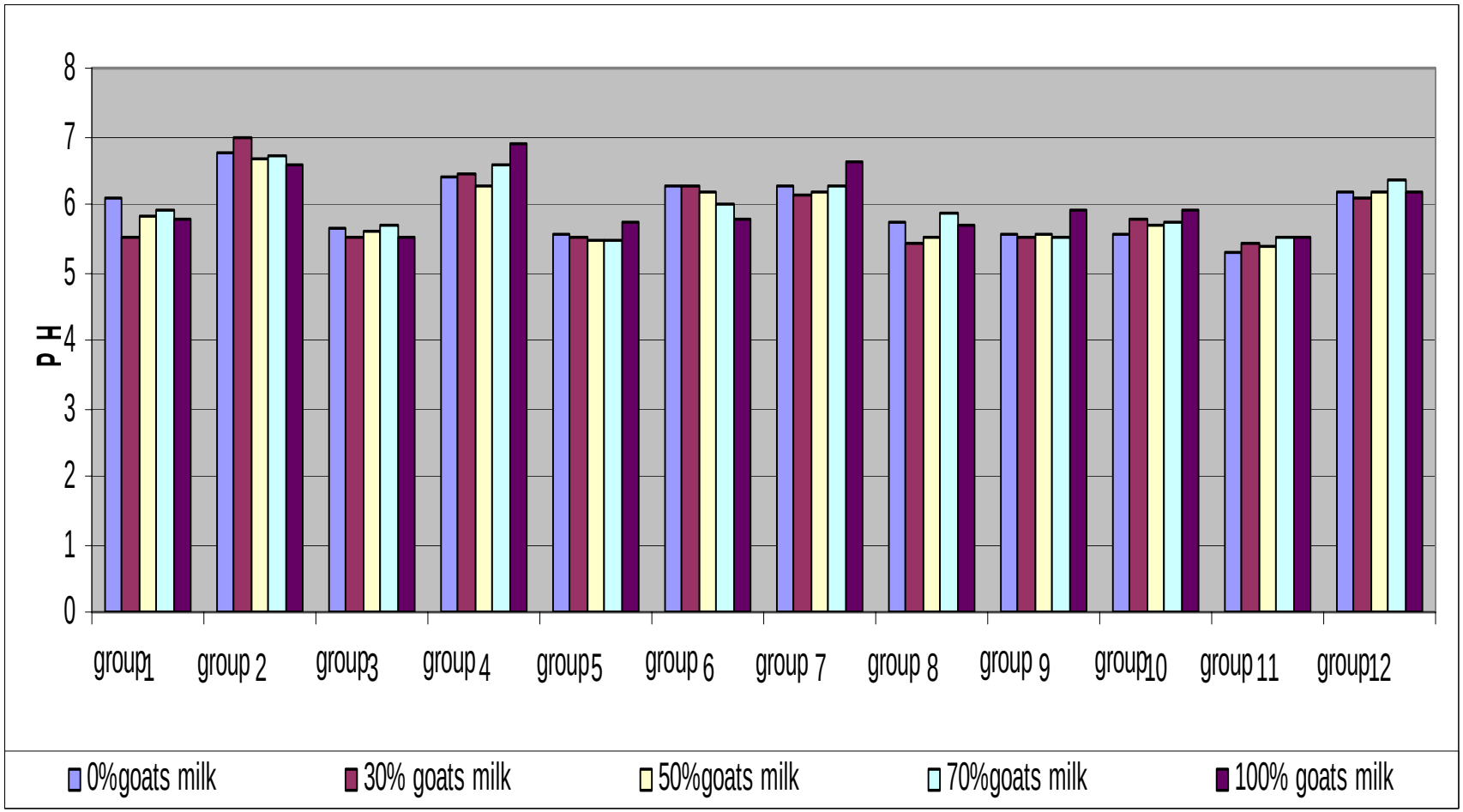


Figure (4.5) pH % in the 12 groups of cheese samples.

4.4.6 Acidity

As shown in Figure (4.6), the highest acidity was found in group number five and was for the category 30% goats milk it was1.83% which produced by using carob latex and calcium chloride. At the same time lowest acidity was found in group number twelve and mainly at 0% goats milk; it was 0.6 % which produced by using starter culture.

Acidity percentage resulted in this investigation is ranged from 0.6 to 1.83% which is in agreement with findings resulted by Abdel.M sulieman (2007) where the values was 1.10% in raw Jibna-beida (White Cheese) and Abdel-Salam (1973) which was 0.8% in Egyptian cheese (Domiati).

Much lower result was reported by Salwa et al., (2002) who found that acidity range from 0.20-0.73%, where the minimum titratable acidity of industrial white cheese is 0.8 (ISIRI,.2344, 2006).

Our findings are much lower than this standard which are may be due to storage time and conditions that lead to increase the raw milk acidity, never mind the differences between natural curd formation material used.

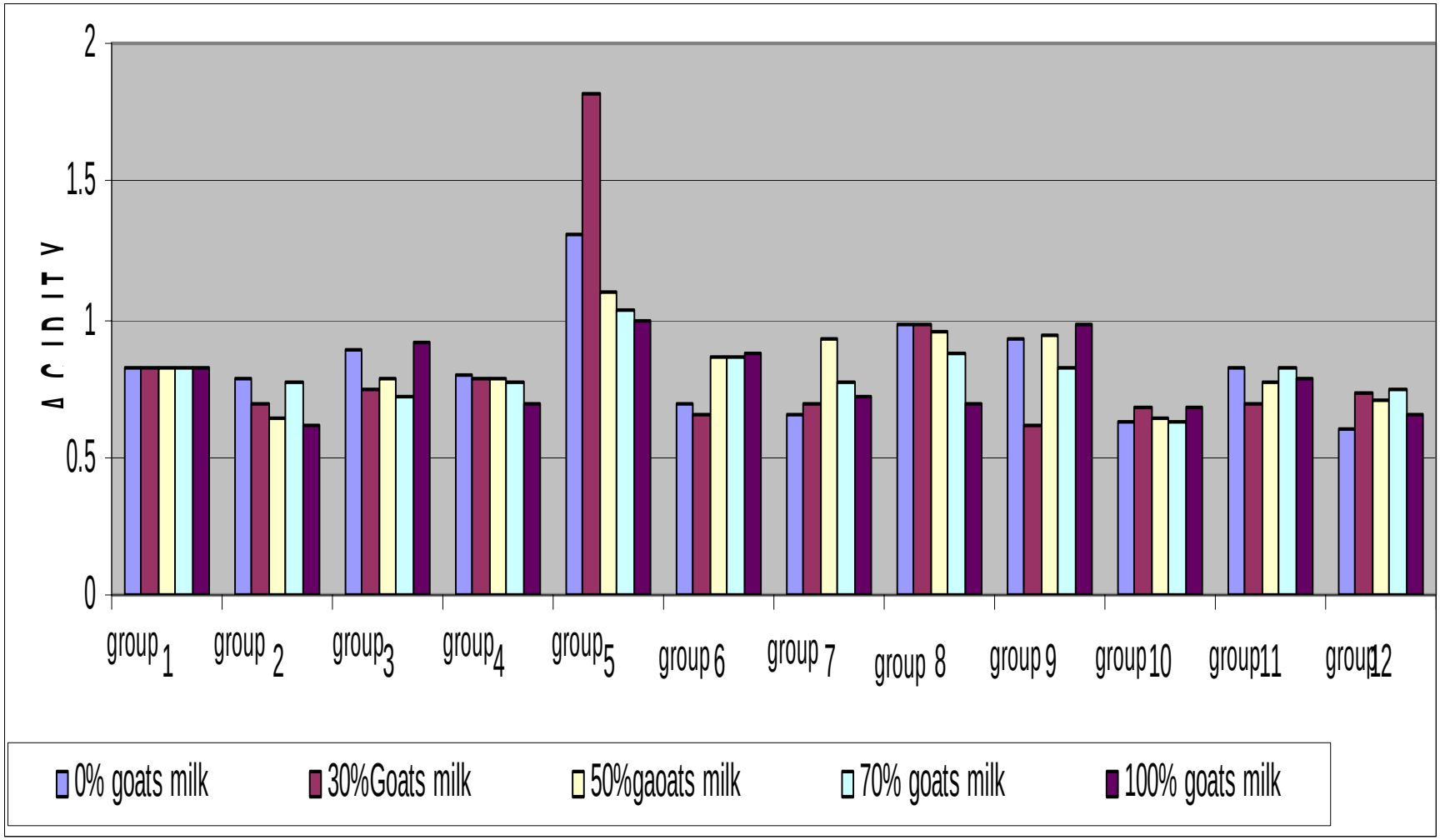


Figure (4.5). Acidity in the 12 groups of cheese samples.

4.5 Sensory Analysis:

The sensory evaluation was reported by a group of four people. Texture, in term of hardness and smoothness structure results are shown in Tables (4.2a and 4.2b).

The results obtained showed that the flavor (for all cheese samples) was improved during the storage time life of this experiment.

The flavor of cheese, prepared by raw milk, had the highest total score compared with cheese obtained from pasteurized milk. This may be due to the natural flora initially present in raw milk which participated in flavor production (Law, B.A., 1980).

The highest Organoleptic score (9) was for group number five at 50% goats milk. It is produced by addition of starter culture and calcium chloride. Same grade was obtained for group number eight at 30 and 50% goat milk. However, this group was produced by the addition of starter culture.

This is due to the role played by the starter culture added, which allowed to produce unique taste and structure, while for other samples; the development of the desirable characteristics was very limited by the action of natural material which interfered negatively with producing required features.

The lowest Organoleptic score (5) was for group number eleven at 70% goats milk. It is produced by addition of starter culture calcium chloride and fig latex and this may be related to addition of fig latex which gave strange taste..

Table (4.2a) Sensory analysis of cheese samples with out pasteurization process.

Group Number	Goats milk %	Symbol	Color	Texture	Taste and Aroma	Strange Taste and Aroma	General Acceptance
	0%	Sample1	8	5	5	6	6
	30%	Sample2	8	6	5	6	6
One	50%	Sample3	8	5	5	6	6
	70%	Sample4	8	6	4	4	6
	100%	Sample5	8	6	4	4	6
	0%	Sample1	7	8	8	9	8
	30%	Sample2	7	8	8	9	8
Two	50%	Sample3	7	8	8	9	8
	70%	Sample4	7	8	8	8	8
	100%	Sample5	7	8	7	8	8
	0%	Sample1	6	6	5	7	6
Three	30%	Sample2	6	6	5	7	6
	50%	Sample3	6	6	5	7	6
	70%	Sample4	6	6	5	7	6
	100%	Sample5	6	6	4	7	6
	0%	Sample1	6	8	8	9	8
Four	30%	Sample2	6	8	8	9	8
	50%	Sample3	7	8	8	8	8
	70%	Sample4	7	8	8	8	8
	100%	Sample5	6	8	6	8	7
	0%	Sample1	8	8	7	8	8
	30%	Sample2	8	9	7	8	8
Five	50%	Sample3	8	9	9	8	9
	70%	Sample4	8	8	9	8	8
	100%	Sample5	8	9	6	8	8
	0%	Sample1	8	4	4	6	6
Six	30%	Sample2	8	4	4	6	6
	50%	Sample3	8	4	4	6	6
	70%	Sample4	8	4	6	6	6
	100%	Sample5	8	4	6	6	6

Table (4.2b). Sensory analysis of cheese samples with out pasteurization process.

Group Number	Goats milk %	Symbol	Color	Texture	Taste and Aroma	Strange Taste and Aroma	General Acceptance
	0%	Sample1	6	8	7	8	7
	30%	Sample2	7	8	7	7	7
Seven	50%	Sample3	6	7	8	8	8
	70%	Sample4	6	7	8	7	7
	100%	Sample5	7	8	7	8	8
	0%	Sample1	7	7	8	9	8
	30%	Sample2	8	9	9	9	9
Eight	50%	Sample3	7	8	9	9	9
	70%	Sample4	7	7	8	9	8
	100%	Sample5	8	8	7	9	8
	0%	Sample1	8	8	8	9	8
	30%	Sample2	8	8	8	9	8
Nine	50%	Sample3	8	8	8	9	8
	70%	Sample4	8	8	9	9	9
	100%	Sample5	8	9	7	8	8
	0%	Sample1	7	7	8	7	7
	30%	Sample2	8	7	7	7	7
Ten	50%	Sample3	7	8	7	7	7
	70%	Sample4	7	7	8	7	7
	100%	Sample5	8	8	7	7	8
	0%	Sample1	9	4	5	5	6
	30%	Sample2	9	5	5	5	6
Eleven	50%	Sample3	8	5	6	4	6
	70%		8	4	5	4	5
	100%	Sample5	9	4	5	4	6
	0%	Sample1	7	9	8	9	8
	30%	Sample2	7	9	8	9	8
Twelve	50%	Sample3	7	9	8	9	8
	70%	Sample4	7	9	8	8	8
	100%	Sample5	7	8	7	7	7

Note: Maximum grade is 9. Data are the average values of 4 people.

4.6 Microbiological Analysis:

In order to define the microbiological structure of cheeses during ripening, 120
Produced cheeses sample were analyzed in microbiological aspects.

4.6.1 Mould and Yeast Enumeration

As shown in Table (4.3) the maximum growth for mould and yeast was found to be 6X$\mathbf{10^7}$ CFU/ml. This number was registered for cheese samples of group number three and was for the category of 100% goat's milk. The cheese was prepared by using carob latex only.
The minimum numbers of mould and yeast was found to be $12x10^4$, and it was for group number eleven (which produced by using starter culture, calcium chloride and fig latex) at 70% goat's milk. This finding is close to results reported by Salwa et al (2002) , it was ($1.9x10^{\mathbf{6}}$) for cheese from raw milk.
Continue studying Table (4.3) shows great variation between samples, which could be related to the stage of ripening and production quality. For instant, numbers of starter culture was decreased in higher PH condition, thus inhibition of pathogens microorganism growth Ceylent et al (2003).
Some cheese samples exposed mould and yeast numbers above the limits allowed for the white ripened cheese (ISIRI 2406, 1994). This is related to the use of raw milk in making cheese.

The total mold and yeast count were significantly higher in cheese made from raw milk in comparison to those prepared from pasteurized milk. This increase may be correlated to the higher acidity of raw milk cheese which may improve their growth. Nearly similar finding were reported by Hamed et al (1992) who found thatmold and yeast in white cheese range $1.9x10^6$ - $6.2x10^6$
Mould and yeast are considered as spoilage organisms resulting in flavor and textural deterioration including softening, discoloration, and slime formation (Besancon et al., 1992).

Table (4.3) Mould and yeast enumeration (CFU/g)

Goat milk %	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12
0	$33x10^{5}$	$45x10^{4}$	$46x10^{4}$	$34x10^{5}$	$41x10^{4}$	$50x10^{4}$	$72x10^{4}$	$54x10^{4}$	$49x10^{4}$	$24x10^{4}$	$33x10^{4}$	$26x10^{5}$
30	$45x10^{5}$	$58x10^{6}$	$32x10^{4}$	$35x10^{4}$	$45x10^{4}$	$63x10^{5}$	$46x10^{4}$	$19x10^{4}$	$55x10^{5}$	$28x10^{4}$	$24x10^{4}$	$12x10^{5}$
50	$62x10^{5}$	$50x10^{5}$	$45x10^{4}$	$61x10^{6}$	$32x10^{4}$	$45x10^{4}$	$21x10^{5}$	$36x10^{5}$	$46x10^{5}$	$32x10^{4}$	$16x10^{4}$	$35x10^{4}$
70	$21x10^{5}$	$46x10^{5}$	$55x10^{4}$	$18x10^{6}$	$52x10^{4}$	$60x10^{5}$	$36x10^{4}$	$37x10^{4}$	$59x10^{5}$	$28x10^{5}$	$22x10^{4}$	$26x10^{4}$
100	$32x10^{5}$	$44x10^{5}$	$6x10^{7}$	$16x10^{6}$	$62x10^{4}$	$42x10^{5}$	$17x10^{6}$	$56x10^{5}$	$48x10^{5}$	$41x10^{4}$	$25x10^{4}$	$19x10^{4}$

4.6.2 Coliform Bacteria Enumeration

As shown in Table (4.4), the maximum number of Coliform count was found to be $37X10^5$. Group number three (which produced by using fig latex, calcium chloride) represented this enumeration and was for category 70% goats milk. The minimum number of Coliform was found to be $12x10^2$ as appeared in group number five at 100% goat milk. This group was produced by using calcium chloride and starter culture, however, this finding is lower than the results which reported by Salwa et al. (2002) and Hamid et al (2008). Many samples were found to have higher numbers above than the limits allowed white cheese ripened cheese (ISIRI 2406, 1994).

The variations among these results and the results appointed by literature is due to materials which were added to milk upon processing. Another logical explanation is the storage in the brine solution. Another factors played a major role in affecting the coliform growth namely; type of raw milk (Bahrami et al 2006). They found that number of coliform of a traditional cheese samples presented in market was higher than the standard limits.

The highest microbial population indicated poor hygienic conditions of milk during milking, collection of samples, containers and other handling steps.

Coliform counts markedly decreased with heat treatment and completely disappeared in cheese made from pasteurized milk. Similar finding was reported by Shehata et al (1984) who found that completely disappeared in cheese made from pasteurized milk.

The obtained results can explain the blowing defects which may appear in cheese made from raw milk due to gas production by Coliform Hamed et al (1992), Elein et al (1999), and Moatsou et al (2001).

The highest total coliform counts implies risk that other enteric pathogens may be present in the sample, according to results obtained, the number of indicators were high. This suggest that contamination of the raw milk during milking has occurred, also unrefrigerated storage and transpiration are contaminating ewes milk directed to making cheese Sulieman (2001), Abdel.M Sulieman (2007) .

Psoni et al (2003) and Zarate , et al (1997) found that various factors contrite to the decline of M.Os during cheese ripening as a result of starter culture addition which lead to decrease PH.

Table (4.4) Coliform Enumeration (CFU/g)

Goat milk %	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12
0	$12x10^3$	$22x10^3$	$45x10^3$	$15x10^4$	$36x10^3$	$31x10^4$	$36x10^4$	$32x10^4$	$40x10^4$	$55x10^2$	$33x10^4$	$15x10^4$
30	$11x10^5$	$43x10^3$	$24x10^3$	$10x10^6$	$34x10^3$	$24x10^4$	$40x10^4$	$28x10^4$	$10x10^5$	$27x10^3$	$22x10^4$	$10x10^3$
55	$30x10^3$	$28x10^3$	$18X10^5$	$50x10^4$	$50x10^3$	$16x10^4$	$37x10^3$	$32x10^4$	$40x10^4$	$36x10^4$	$45x10^4$	$28x10^3$
70	$60x10^3$	$13x10^3$	$37x10^5$	$35x10^3$	$47x10^5$	$12x10^4$	$46x10^4$	$20x10^4$	$19x10^4$	$22x10^3$	$31x10^3$	$30x10^3$
100	$29x10^3$	$22x10^3$	$33X10^4$	$43x10^3$	$12x10^2$	$25x10^4$	$12x10^3$	$18x10^5$	$38x10^4$	$42x10^4$	$22x10^3$	$8.0x10^3$

PART TWO

4.8 Part Two: -

Was produced with heat treatment pasteurization temperature (72 ºC/15sec) for the milk.

12 experiments were made with different materials additions which show below in Table (4.5)

Table (4.5) materials which were added to milk of cheese

Sample. #	starter culture	$CaCl_2$	carob	fig
1`				✓
2`			✓	
3`		✓		✓
4`		✓	✓	
5`	✓	✓		
6`	✓			✓
7`	✓		✓	
8`	✓			
9`				
10`		✓		
11`	✓	✓		✓
12`	✓	✓	✓	

4.9 Chemical Analysis

Which include total solid, protein content, fat content, ash content, PH and acidity. All cheese samples were chemically examined for Moisture; fat, cheese yield; total nitrogen (T.N.) and total solid according to (Kuchroo and Fox ,1982 ., Guinee and Fox 1993) pH using pH meter (model SA 720); titratable acidity, according to AOAC (1997). All tests were carried out at Al-Quds University in food industrial lab. The total period for this test started in April 2007 to December 2008.

4.9.1 Total Solid Content

Referring to group number nine as a reference sample, Figure (4.6) shows that the highest total solid percentage was 55% (resulted in group number six for the category of 100% goat milk). This group was produced by using fig latex and starter culture.

This finding was in accordance with El-Zubeir (2008); Abdel.M Sulieman (2007); and Sulieman et al (2005) who worked on Jibna-beida and Maddafara cheese. They found that; total solid content in cheeses between 48.76 - 56.48%, while Masoud Najaf et al., (2008) found that total solid content in cheeses between 36.3 - 42.48%. very close results reported by Hamid et al (2008) who found that total solid% ranged from 38.56 - 44.51%. However, the ISIRI 2344, (2006.) emphasized that white cheese should not contain total solid lower than 40%.

The lowest total solid percentage was found in group number eight at 50% goat milk, it was 31.49% which was produced by using starter culture only. This range was very low due to the changes in most of the chemical components of cheese such as proteins and lipids that might be due to the microbial enzymatic action, which play a role in this chemical change. These changes include converting of lactose to lactic acid and small amounts of acetic and pyruvic acids in addition to producing CO_2.

The change in protein appears in form of peptides and amino acids. As for lipids, they are hydrolyzed to glycerol and free fatty acids as a result of microbial action (Khalid and Helan, 1987).

Cheese yield was also affected by the pasteurization. The highest cheese yield was found in Cheese from pasteurized milk. This may be attributed to the effect of pasteurization on kappa casein forming complex with Beta lactoglobulin which increased clotting time and subsequent cheese yield (Kanka et al.,1989; Scaffer et. al. 1995; and Elein et al. 1999).

The type of milk plays major role in total solid content. Pappa et al (1990) found that; the highest total solid, fat content was in cheeses made from ewes' milk, were the highest protein

content was in cheeses made from goats' milk. Moreover, the physical properties of the cheese depend on the type of milk (Sarfraz Ahmad et al.2007).

The differences in the results between this study and those cited in the literature may be due to material that added to the milk samples, type of milk which used in cheese production, and the method of cheese production.

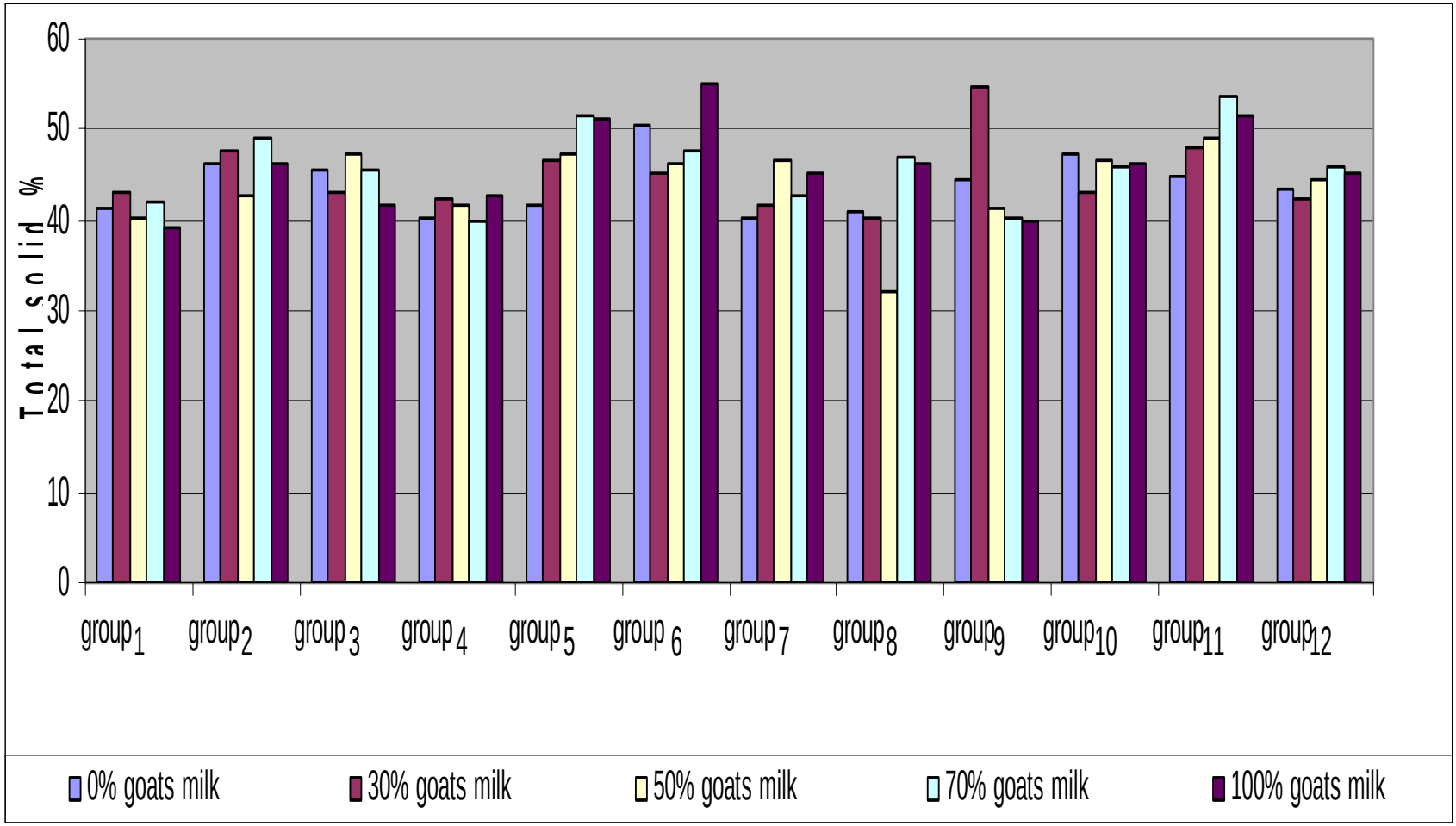


Figure (4.6) total solid % in the 12 groups of cheese sample

4.9.2 Fat Content

As shown in Figure 3.7, the highest fat percentage was 23%. The result was found for the following samples:

- sample produced by using starter culture and calcium chloride (group number five, 100% goat milk),
- sample produced by using fig latex and starter culture (group number six at100% goats milk),
- sample produced by using calcium chloride (group number ten at50% goats milk), and
- sample produced by using calcium chloride, starter culture and fig latex (group number eleven at 50% goats milk)

At the same time the lowest total solid fat percentage was found for several samples

as following:

- group number two at 70% goats milk; which produced by using carob latex,
- group number seven at 30% goats milk; which produced by using starter culture and carob latex, and
- group number twelve at 50% goats milk, which was produced by using carob latex, calcium chloride, and starter culture. The fat percentage was 11% as shown in Figure (4.7).

This wide range of fat content is due to the great variations among cheeses preparation characteristics namely; natural materials added, chemical material added, milk percentage, and type of milk.

Nevertheless, however, working with very limited variations among cheese preparations produced as well a wide range in fat content. Masoud Najaf et al (2008) reported that, fat content in white cheese between 14.3-15.5%.

Wider remarkable range was reported by Hamid et al (2008) who found that fat content percentage range from 16.24-22.15%. This finding is agreed with Mohamed and Sohair (2009) who found that fat content in cheeses between 22.50-25.13%.

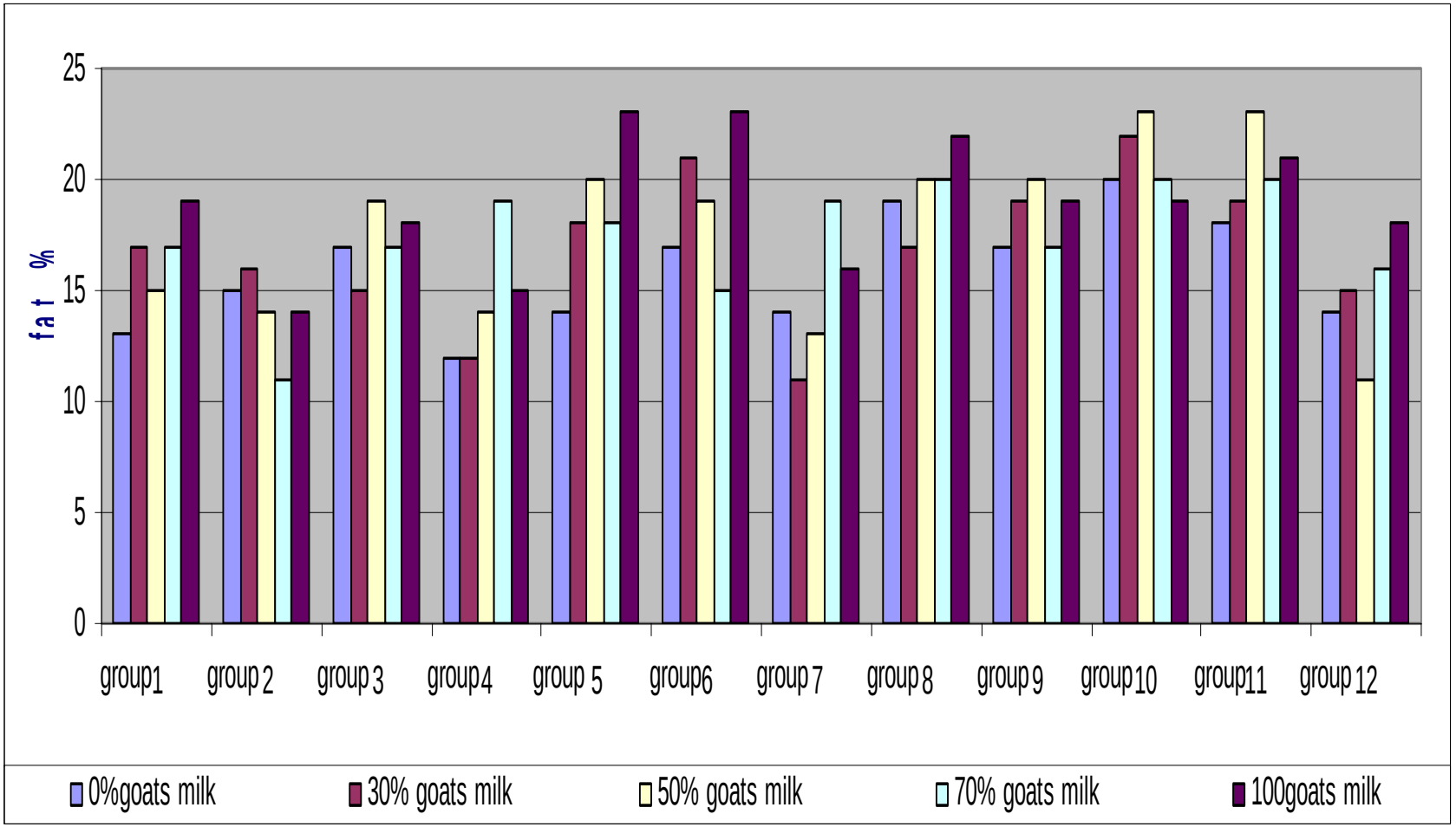


Figure (4.7) fat % in the 12 groups of cheese sample

4.9.3 Protein Content

As shown in Figure (4.8), the highest protein percentage was found in group number six and was for the category 0% and 30% goats milk it was 23.1% which produced by using starter culture and fig latex.

The lowest protein percentage was found in group number seven at 0% goat's milk it was 8.38%. This group sample was prepared by using starter culture and carob latex.

Different range value was reported by Salwa et al (2002) and Abdel.M Sulieman (2007) who found that, protein content in white cheese between 15.40-20.16%. Masoud Najaf et al (2008) found that fat content in white cheese between 16.5-21.90%, while Hamid et al.,2008 found that protein content in white cheese between 15.40- 22.36%.

This variation between obtained results and those reported by others is due to materials which added to the cheese milk samples as starter culture and natural materials.

In general pasteurization had decreased the protein contents. This finding is in agreements with Sameh Awad, (2006); Yun et al (1993) and Fox, P. F., J. Law, et al., (1993) they founded that physico-chemical composition of the cheese affected by heat treatment since cheese prepared by fresh milk had higher protein & fat content than cheese prepared by heated or pasteurized milk.

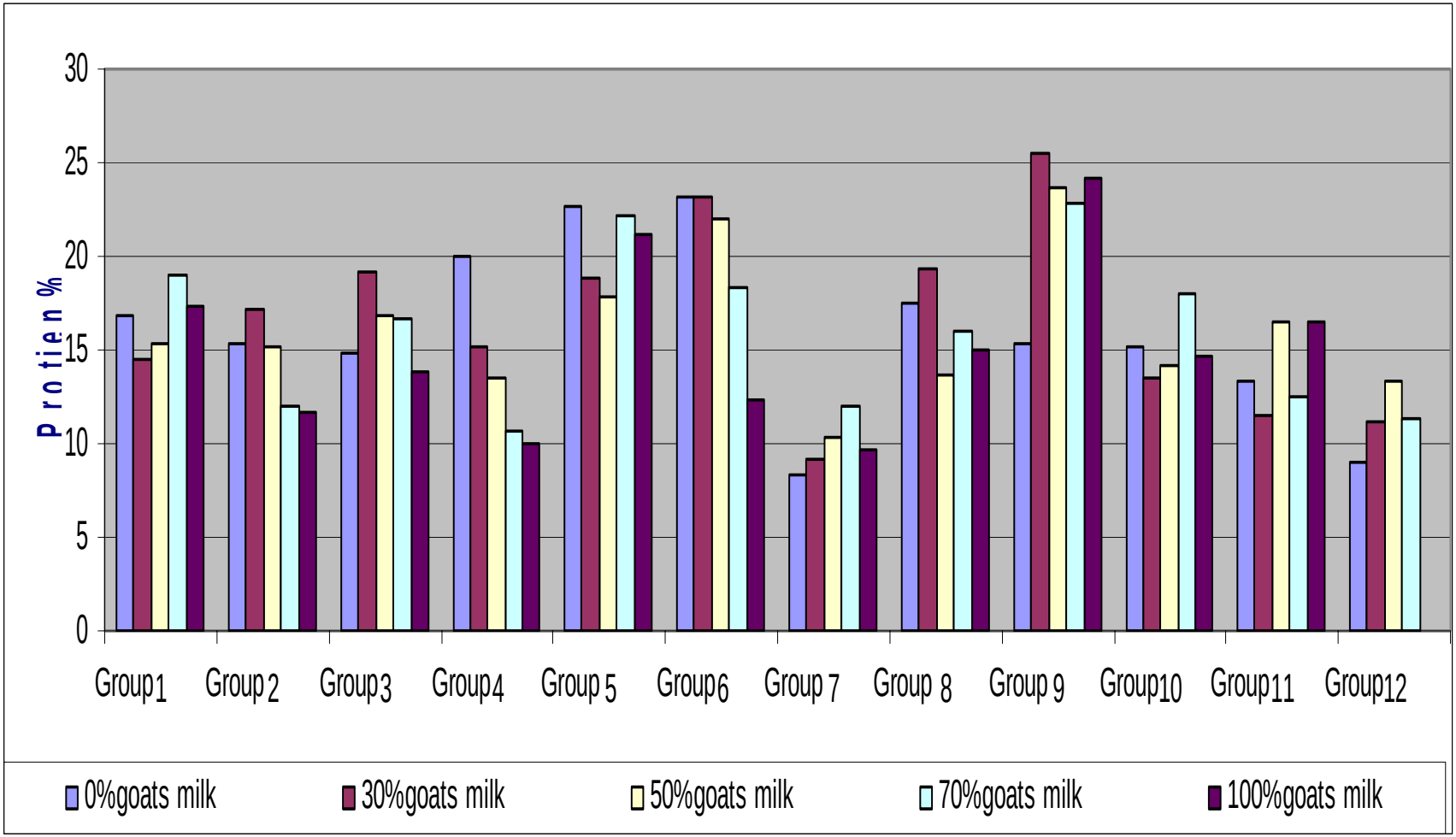


Figure (4.8) protein % in the 12 groups of cheese sample

4.9.4 Ash content

As shown in Figure (4.9), the highest Ash percentage was found in group number seven (0% goats milk**) it was 12%.** This sample was produced by using carob latex and starter culture.

The lowest ash percentage was found in group number one (0% goats milk), that produced by using starter culture and fig latex, it was **6%** which.

This variation can be explained by Hamid et al (2008) who investigated the microbiological & chemical quality of traditional Iranian cheese that produced from mixed milk found that, total ash content percentage was ranged from 4.92-6.29%.

Ash content obtained was ranged between 6%–12%, which was in close agreement to that of Maddafra cheese that contained 12% (Sulieman et al, .2005).

Much lower value was reported by El-Zubeir (2004), who reported a value of ash in Jibna-beida was 6.5%. higher value was pointed by Sulieman.M. (2007) who found that ash % in white cheese between (8.9 – 12%).

However, the effect of thermal treatment on resulted ash content is studied by comparing Figure 4.9 with results in Figure 4.5. The pasteurization process for milk would decrease the ash contents. This results in accordance with Swaisgood, H. E. (1982); Sameh Awad, (2006); Yun et al (1993) and Fox, P. F., J. Law, et al., (1993) who founded that physico-chemical composition of the cheese effected in heat treatment process were freshly milk prepared cheese had higher protein & fat content than heated or pasteurized-milk cheese sample. These results were disagreed with Abdel.M Sulieman (2007) who found that ash content of raw milk cheese product was slightly lower than the pasteurized milk cheese.

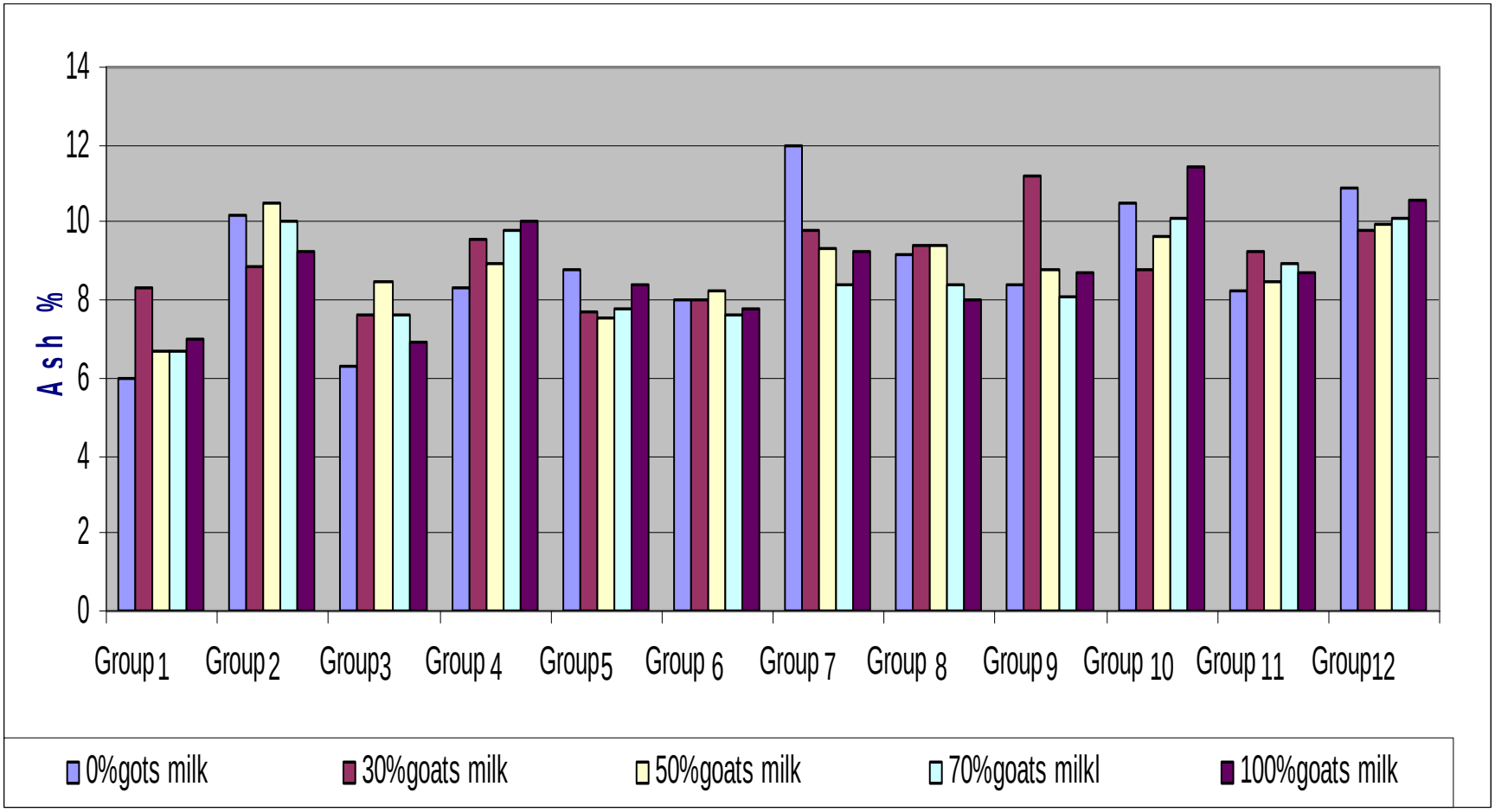


Figure (4.9) Ash % in the 12 groups of cheese sample

4.9.5 PH

As shown in Figure (4.10), highest PH values were found in group number seven at 30% goat milk; it was 6.8%, which produced by using starter culture and carob latex.

The lowest PH value was found in group number ten (50% goat's milk); it was 4.67, which was produced by using calcium chloride only.

The ISIRI 2344, (2006.)Limit the titratable acidity of industrial white ripened cheese minimum 0.8%.

Salwa et al (2002) found that PH ranged from 4.90-6.45, while Hamid et al (2008) found that the PH of the cheese sample ranged from 4.22-5.59, and during storage, the pH of all cheese samples decreased and the acidity increased.

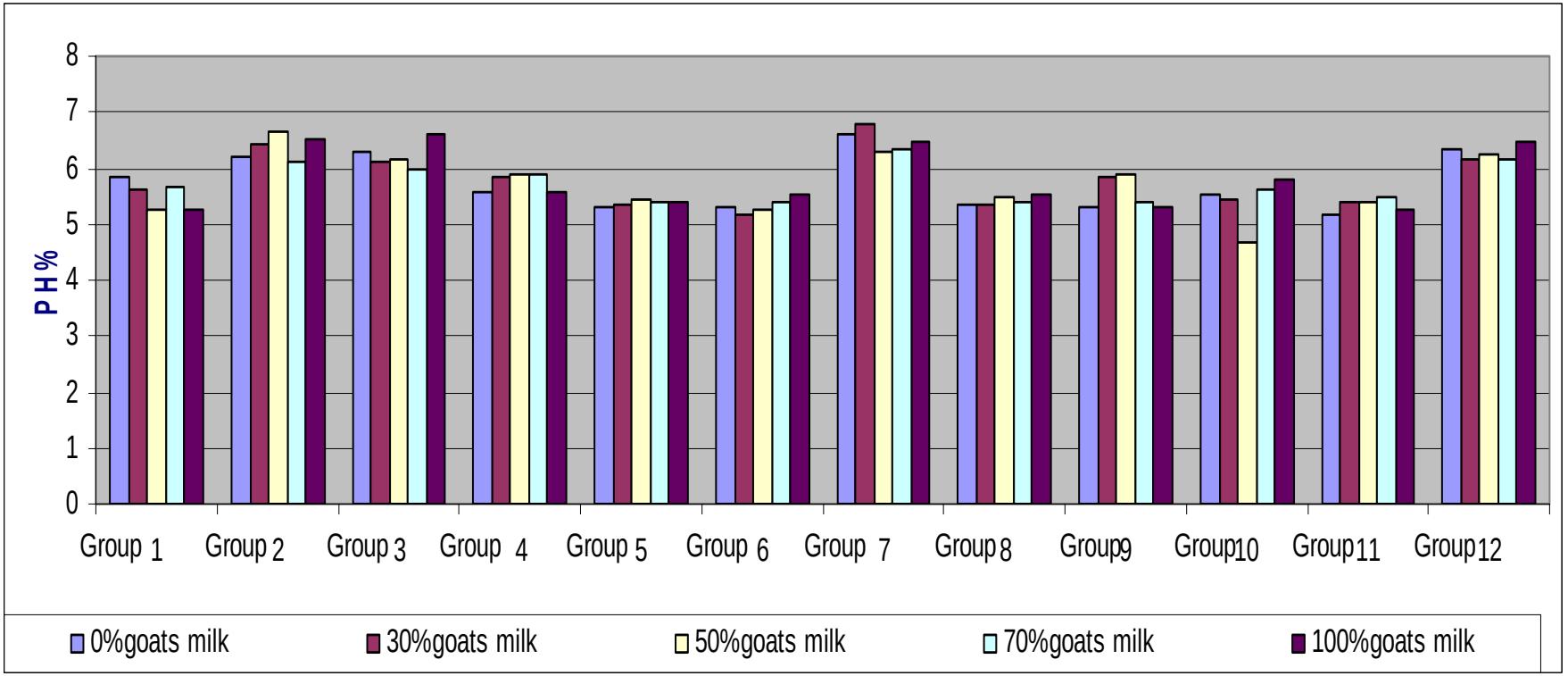


Figure (4.10)pH % in the 12 groups

4.9.6 Acidity

The highest acidity was found in group number five (30% goats milk), as plotted in Figure 3.11. The acidity percentage was 1.63%, noting that the sample was produced by carob latex and calcium chloride. While the lower acidity was found in group number two (30% goats milk) it was **11 %** and sample was produced by using carob latex only.

Acidity percentage obtained ranged from 1.63-11%, which is confirmed by Abdel.M Sulieman (2007) of who measured the acidity for row cheese and found it to be 0.92-1.10%. The differences in the result due to material which was added to the cheese milk.

While Abdel-Salam (1973) found that acidity value was 0.8%, Salwa et al (2002) found that acidity range from 0.20-0.73%.

At the same time the titratable acidity of industrial white cheese must be not less than 0.8% for white ripened cheese (ISIRI,.2344, 2006), however, for all samples, and during storage, the pH was decreased and the acidity increased.

Titrtable acidity was slightly higher in Cheese from raw milk, compared with that of pasteurized milk. However, the determined acidity values were higher if compared with the value 0.8% reported by Abdel-Salam (1973) for Egyptian cheese (Domiati).
During storage of processed cheeses, many changes occurred and these changes might be visual or not visual. Obvious visual changes were seen in texture, which became smoother and more uniform.

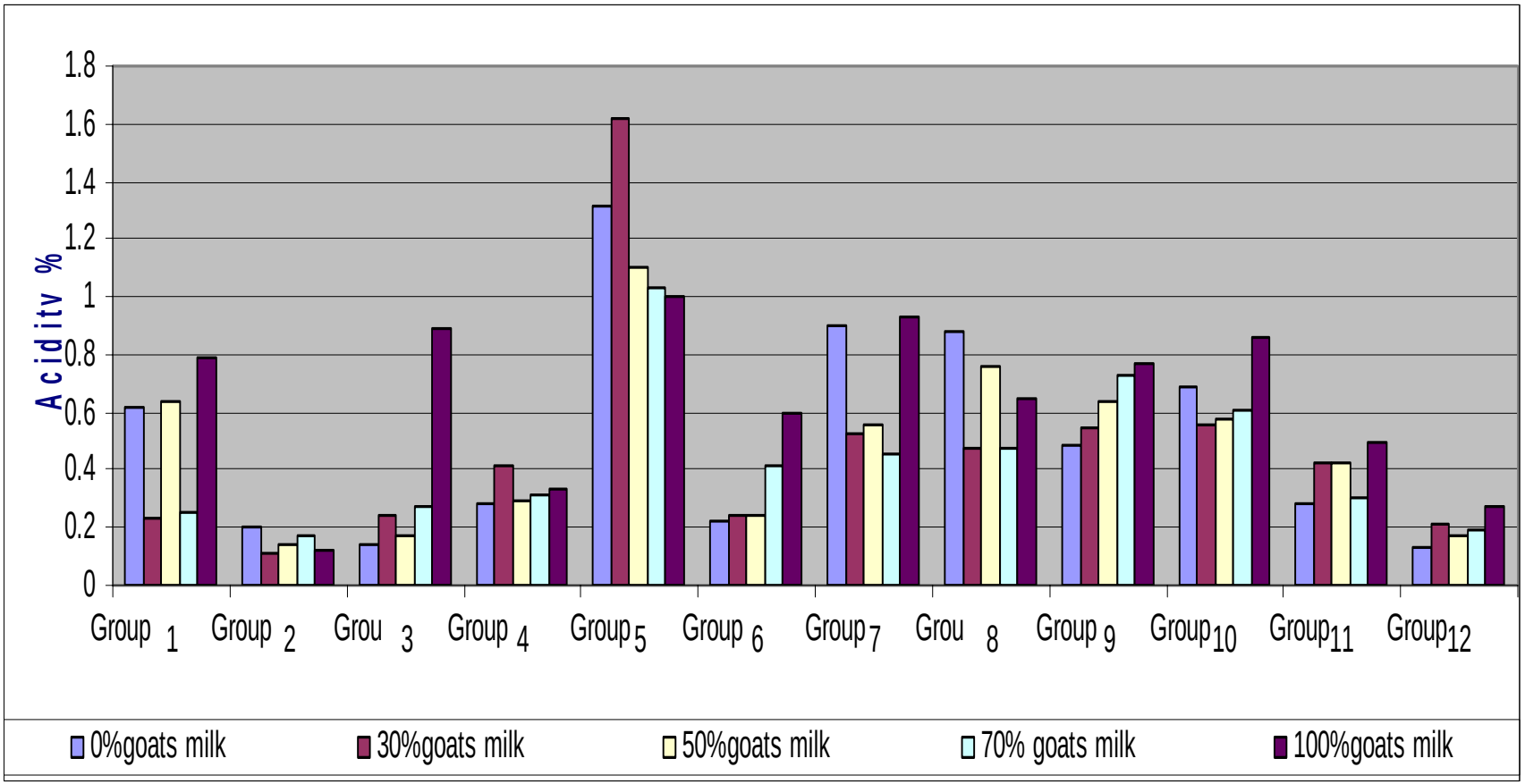


Figure (4.11)acidity in the 12 groups

3.10 Sensory Analysis

Evaluation was done by a group of 4 people. Texture was evaluated by looking to the hardness and smoothness structure of cheeses. The results are given in Table (4.6).

Data illustrated in Table (4.6a and 4.6b) showed that the organoleptic total score of pasteurized and refrigerated stored cheese made from pasteurized milk, as follow; the flavor in all types of cheese was improved during storage period. The flavor of raw milk cheese had the highest total score compared to pasteurized cheese. This may be due to the natural flora initially present in raw milk which participate in flavor production this result close to of Law and B.A. (1980), while Zeynep Ustunol,etal (1985) found that, pasteurized milk produced cheese with better quality (Color, Texture, Taste, General Acceptance and Aroma) than cheese from raw milk. Also pasteurization effected in shelf-life of the cheese were cheese from pasteurized milk have long shelf life than cheese from raw milk Zeynep Ustunol,et al (1985).

The highest Organoleptic score (8) was for group number five at 30 and 0% goats milk. It is produced by addition of starter culture and calcium chloride. Same grade was obtained for group number eight at 30% goat milk. However, this group was produced by the addition of starter culture and group number ten in 03, 50 and 70% goats milk this group was produced by the addition of calcium chloride.

This is due to the role played by the starter culture and calcium chloride added, which allowed to produce unique taste and structure, while for other samples; the development of the desirable characteristics were very limited by the action of natural material which interfered negatively with producing required features.

The lowest Organoleptic score (5) was for group number three at 0, 30, 70 and 100% goats milk. It is produced by addition of calcium chloride and fig latex and this may be related to addition of fig latex which gave strange taste.

Table (4.6a) Sensory analysis of cheese samples with pasteurization process.

Group Number	Goats milk %	Symbol	Color	Texture	Taste and Aroma	Strange Taste and Aroma	General Acceptance
	0%	Sample1	**5**	**6**	**6**	**5**	**6**
	30%	Sample2	**5**	**6**	**6**	**6**	**6**
One	50%	Sample3	**5**	**7**	**5**	**6**	**6**
	70%	Sample4	**5**	**6**	**6**	**6**	**6**
	100%	Sample5	**5**	**8**	**5**	**6**	**6**
	0%	Sample1	**6**	**6**	**8**	**7**	**7**
	30%	Sample2	**6**	**5**	**7**	**7**	**7**
Two	50%	Sample3	**6**	**6**	**7**	**7**	**6**
	70%	Sample4	**6**	**5**	**7**	**7**	**7**
	100%	Sample5	**6**	**7**	**7**	**6**	**7**
	0%	Sample1	**5**	**4**	**6**	**6**	**5**
Three	30%	Sample2	**4**	**6**	**5**	**5**	**5**
	50%	Sample3	**5**	**6**	**5**	**6**	**6**
	70%	Sample4	**5**	**5**	**5**	**6**	**5**
	100%	Sample5	**5**	**5**	**5**	**5**	**5**
	0%	Sample1	**4**	**5**	**5**	**6**	**6**
Four	30%	Sample2	**5**	**7**	**6**	**7**	**7**
	50%	Sample3	**5**	**7**	**7**	**7**	**7**
	70%	Sample4	**6**	**8**	**6**	**7**	**6**
	100%	Sample5	**7**	**8**	**6**	**7**	**7**
	0%	Sample1	**6**	**8**	**5**	**8**	**8**
	30%	Sample2	**8**	**8**	**7**	**7**	**8**
Five	50%	Sample3	8	8	7	7	7
	70%	Sample4		**8**	**6**	**7**	**7**
	100%	Sample5	**8**	**7**	**7**	**7**	**7**
	0%	Sample1	**7**	**7**	**6**	**6**	**6**
Six	30%	Sample2	**6**	**7**	**7**	**8**	**7**
	50%	Sample3	**6**	**7**	**7**	**8**	**7**
	70%	Sample4	**7**	**7**	**7**	**8**	**7**
	100%	Sample5	**5**	**6**	**7**	**7**	**7**

Table (4.6b) Sensory analysis of cheese samples with pasteurization process.

Group Number	Goats milk %	Symbol	Color	Texture	Taste and Aroma	Strange Taste and Aroma	General Acceptance
	0%	Sample1	**5**	**6**	**7**	**7**	**7**
	30%	Sample2	**5**	**7**	**6**	**6**	**7**
Seven	50%	Sample3	**5**	**7**	**6**	**7**	**7**
	70%	Sample4	**5**	**7**	**6**	**7**	**7**
	100%	Sample5	**5**	**7**	**6**	**8**	**7**
	0%	Sample1	**5**	**8**	**6**	**8**	**7**
	30%	Sample2	**9**	**7**	**7**	**7**	**8**
Eight	50%	Sample3	**8**	**7**	**7**	**6**	**7**
	70%	Sample4	**7**	**7**	**7**	**7**	**7**
	100%	Sample5	**7**	**7**	**7**	**7**	**7**
	0%	Sample1	**7**	**6**	**6**	**6**	**6**
	30%	Sample2	**9**	**8**	**8**	**8**	**8**
Nine	50%	Sample3	**9**	**8**	**8**	**7**	**8**
	70%	Sample4	**8**	**7**	**8**	**7**	**8**
	100%	Sample5	**8**	**7**	**7**	**7**	**7**
	0%	Sample1	**8**	**7**	**7**	**7**	**7**
	30%	Sample2	**8**	**7**	**7**	**8**	**8**
Ten	50%	Sample3	**8**	**7**	**7**	**8**	**8**
	70%	Sample4	**8**	**7**	**7**	**8**	**8**
	100%	Sample5	**8**	**7**	**7**	**7**	**7**
	0%	Sample1	**6**	**7**	**6**	**6**	**6**
	30%	Sample2	**6**	**4**	**6**	**6**	**6**
Eleven	50%	Sample3	**6**	**5**	**6**	**6**	**6**
	70%	Sample4	**6**	**5**	**7**	**6**	**6**
	100%	Sample5	**5**	**4**	**7**	**7**	**6**
	0%	Sample1	**5**	**4**	**7**	**6**	**6**
	30%	Sample2	**8**	**8**	**6**	**7**	**7**
Twelve	50%	Sample3	**8**	**8**	**6**	**7**	**7**
	70%	Sample4	**8**	**8**	**6**	**7**	**7**
	100%	Sample5	**7**	**8**	**6**	**7**	**7**

Note:* Maximum grade is 9. Data are the average values of 4 persons.

Sameh Awad, (2006) who worked on the texture and flavor development in Ras cheese made from raw and pasteurized milk, reported that; Cheese made from raw milk had a better texture and flavor than pasteurized milk also found that, level of lipolysis of cheeses made from raw milk, was lower than level of lipolysis in cheese made from pasteurized milk. This behavior could be explained by heat-sensitive and found that no differences in the sensorial attributes between cheeses made from pasteurized or raw ones.

Belgrade, et al (2005) and A. Hayaloglu et al (2002) reported that type of the milk used in cheese produced affected on the color ,appearance of cheese where the goats cheese seen whiter than cow cheese

Mohan Reddy et al (1992) and Swaisgood, H. E. (1982), reported that heating the milk for long temperature effect on cheese curd firming rate; where it's very soft and it caused reducing in total solid and calcium ion of the cheese also found that applying milk pasteurization with addition of a starter culture would decrease the rate of lipolysis than other sample (made from raw milk without addition of a starter culture).

In general the flavor of pasteurized cheese was less intensive than that for raw milk; and this may be related to the micro flora which presented in raw milk.

4.11 Microbiological Analysis

In order to define the microbiological structure of cheeses during ripening, 120 Produced cheese samples were analyzed in microbiological aspects.

4.11.1 Mould and Yeast Enumeration

The maximum number of mould and yeast count as it illustrated in Table (4.7) in the next page was found to be 50 $x10^4$ for group number one at 30% goat milk, which produced by using fig latex only.

The minimum number of mould and yeast count was found to be $10x10^3$ in group number five at 0%, goat milk, which produced by using starter culture and calcium chloride,

The great variation was observed between samples, which could be related to the stage of ripening and production quality. Ceylent et al. (2003) found that starter culture decreased the PH so inhibiting of pathogens microorganisms.

The investigation results were close to the results obtained by Salwa et al., (2002) in fresh domiati cheese.

Table (4.7) Mold and Yeast enumeration (CFU/g)

Goat milk %	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12
0	$30x10^4$	$33x10^4$	$35x10^4$	$36x10^4$	$10x10^3$	$23x10^4$	$25x10^4$	$42x10^3$	$30x10^3$	$15x10^3$	$19x10^4$	$28x10^4$
30	$50x10^4$	$21x10^4$	$12x10^4$	$12x10^4$	$19x10^4$	$36x10^3$	$31x10^3$	$10x10^4$	$39x10^4$	$12x10^4$	$24x10^4$	$15x10^4$
50	$42x10^4$	$20x10^3$	$36x10^4$	$39x10^4$	$13x10^3$	$21x10^4$	$12x10^4$	$20x10^4$	$22x10^4$	$21x10^3$	$36x10^3$	$11x10^4$
70	$39x10^4$	$18x10^3$	$39x10^4$	$19x10^4$	$8x10^3$	$31x10^3$	$19x10^4$	$35x10^3$	$44x10^4$	$33x10^3$	$48x10^3$	$18x10^3$
100	$28x10^4$	$12x10^4$	$25x10^4$	$12x10^4$	$12x10^4$	$18x10^3$	**$33x10^4$**	$33x10^3$	$32x10^4$	$15x10^4$	$32x10^3$	$16x10^3$

4.11.2 Coliform Bacteria Enumeration

The maximum number of Coliform count was found to be $29X10^4$ and was for group number four at 50% goats milk which produced by using carob latex and calcium chloride. This result was close to the results obtained by Hamid et al (2008) in traditional lighvan cheese produced in tabriz iran from ewes milk

Coliform was seen in five samples out of 60 samples. This was may be related to contamination.

Salwa et al., (2002) found that, no coliform in pasteurized cheese samples. More of the samples were above limits allowed By National Standard described for the Iranian Industrial White cheese ripened cheese (ISIRI 2406, 1994.)

Bahrami et al.(2006) reported that number of coliforms was 80 CFU of traditional cheese samples present in city market and was higher than standard limits.

As comparing results in Table (4.8) with results in Table (4.4), Coliform counts markedly disappeared in cheese made from pasteurized milk. However, similar finding was reported by Shehata et al (1984) who found that completely disappeared in cheese made from pasteurized milk.

Coliform counts markedly decreased with heat treatment and completely disappeared in cheese made from pasteurized milk. Similar finding was reported by Shehata et al (1984) who found that completely disappeared in cheese made from pasteurized milk.

The obtained results can explain the blowing defects which may appear in cheese made from raw milk due to gas production by Coliform Hamed et al (1992), Elein et al (1999), and Moatsou et al (2001).

The obtained results can explain the blowing defects which may appear in cheese made from raw milk due to gas production by Coliform (Hamed et al., 1992.; Elein et al., 1999; Moatsou et al 2001; and E. Litopoulou-Tzanetaki et al 1992) who found that cheese from raw milk have higher total aerobic count (include aerobic bacteria and lactic acid bacteria) than cheese prepared from pasteurized milk.

Also found that rate of proteolytic and lipolytic organisms in cheese from raw milk were higher than pasteurized one

Kroll, S., (1995) studied the thermal stability of Enzymes of psychrotrophs in raw milk.) They reported that there was a relationship between the high proteolytic count and the low yield of the cheese.

The off-flavor, off-odor, and abnormal texture caused through the break down of the released proteolytic, also found that cheese obtained from Pasteurized milk had significant decrease in total proteolytic count than that came from raw or even heat treated milk, pasteurized milk cheese showed the lowest values of proteolytic organisms.

Table (4.8) coliform enumeration (CFU/g)

Goat milk %	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Group 11	Group 12
0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
30	$20x10^2$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
55	$32x10^3$	ND	ND	$29x10^4$	ND	ND	ND	ND	ND	ND	ND	ND
70	$27x10^3$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
100	ND	ND	ND	ND	$16x10^1$	ND	ND	ND	ND	ND	ND	ND

4.12 Illustration for the Effect of Additions on Cheese:

In this section we illustrated the effect of different additives to the cheese samples

4.12.1 Effect of Fig Latex Addition

The analytical composition of fig latex revealed that they contain caoutchouc (2.4%), resin, albumin, serine, sugar and malic acid, rennin, proteolytic enzymes, diastase, esterase, lipase, catalase, and peroxidase (Öner., et al 1993). Therefore, fig latex affected the physico-chemical characteristics of cheese where it increased the ash, PH, acidity and protein, while it decreased slightly the total solid and fat. This results approved by data reported by A.Nouanh et al (2009) in the manufacture of traditional Algeria cheese from goats milk by coagulant extracts derived from artichoke flowers & from the fig tree latex.

The effect of type of curd formation agents on the amount of protein in cheese was found to be varied. Using plants rennet show greater amount of protein resulted in comparison with cheese produced using animal rennet (Fernández-Salguero et al., 2008 and A. Cristina Freitas 1996).

The sensory properties of the cheese affected by the addition of fig latex were found to be;

- strong odor and bitterness,
- less cohesive and more gummy, and
- hard texture

These obtained characteristics were reported by Bernardo Prieto et al.,(2004) and Barbosa et al.(1981). On the other hand Öner., et al (1993) reported that there's no significant difference between cheese made with rennet enzyme (obtained from ion-exchange chromatography) and commercial enzyme in acidity, bitterness, creaminess, off-flavor and graininess.

Despite the fact that cheese made with vegetable rennet had less soluble nitrogen than that made with calf rennet or commercial rennet which reported by Okigbo.l. et al. (1985)

In term of the effect of fig Latex Addition on total mold and yeast count, the results revealed that the total mold and yeast count was markedly increased with fig latex addition. This may be explained by the decrease in pH values as a result for fig latex addition.

4.12.2 Effect of Carob Latex Addition

This study was the first study about addition of carob latex to the cheese

Carob latex found to have a certain effect on physico-chemical characteristics cheese as; it increased ash, PH, and total solid, while it decreased protein, fat and acidity.

Nevertheless, carob latex also affected the Organoleptic properties of cheese, since it produced cheese with off-white color. This is related to the color of carob latex, taste, and aroma. The effect net result was positive. While the effect on texture seems to produce very hard texture. This is related to high molecular weight of carob where it's hydrocolloidal polysaccharide composed of galactose and mannose units combined through glycosidic linkages. This may be described chemically as galactomannan. It is dispersible in either hot or cold water, forming a solution having a pH between 5.4 and 7.0; its main function is stabilizer and thickener (R. W. Owen, et al., 2003).

The total mold and yeast count were slightly higher in cheese made by the addition of carob latex. This increase may be correlated to the higher acidity of raw milk cheese which may improve their growth, as also reported by Hamed et al., (1992). Yeast and mold are considered as spoilage organisms resulting in flavor and textural deterioration including softening, discoloration and slime formation (Besancon et al., 1992).

Coliform count, was found to be markedly decreased with carob latex addition. This may be explained by the low pH value, as a result for this addition.

4.12.3 Effect of starter culture Addition

Starter culture addition had affected the physicochemical characteristics of cheese, since it increased ash, PH, acidity, fat, and total solid, but it had decreased the protein content. These results were in agreement with results obtained by Dagdemir et al (2008) and A. Khosrowshahi , et al.,(2006)

On the other hand, Sert et al., (2007) reported that starter culture had no effect on chemical composition of cheese but it had an effect on organoleptic quality, however, the microbial growth will be decreased.

A. Hayaloglu, et al (2002) reported that, using of a starter culture in the manufacture of brined cheese influenced the chemistry, biochemistry, and sensory characteristics of the cheeses during ripening period. However, different starter cultures used did not significantly influence the gross composition or the sensory attributes.

Addition of starter culture had also affected the Organoleptic properties of the cheese. It had a role to produce cheese with white color, taste and aroma were uniform, the texture was very good, and even more the cheese had no longer the goat's odor.

This finding is in agreement with finding reported by Sevdakilic et al. (2004), Mohamed A. Mehaia, (2002), and Mohamed A. Mehaia (2002) who found that starter culture govern the flavor, body, and offer better smell and taste to the cheese. It also suppressed the growth of the pathogenic and spoilage bacteria.

Same finding revealed by Broome et al (1998). Lane, et al., (1997), and Law et al., (1992) who found that enzymes originating from starter (i.e., proteinases, peptidases) played a major role in formation of small peptides and the amino acids, which serve as precursors of flavor compounds in cheese. Moreover, Omer A.Hamid et al., 1997 found that starter culture significantly affected the saltiness flavor, color, and texture of cheese samples.

Contradicting finding reported by (Urbach, et al, 1997)who reported that, typical flavor of goat milk cheese can be controlled by using starter culture. While the role of starter culture was bonded to gave a uniform texture due to the known biochemical activities of their micro flora during cheese manufacture and ripening.

Using of starter cultures could solve many problems in cheese manufacturing such as; non-uniform quality, flavor, and texture defects. These problems may be partly attributed to the fact that this kind of cheese is usually made from unpasteurized milk, thus the curd formed due to the growth of non homogenous micro flora as well starter culture.

Such method of manufacturing leads to unpredictable biochemical and microbiological activities, this result same as the resulted by Memduh Karakui et al., (1994).

The total mold, yeast, and coliform count were lower in cheese made from starter culture in comparing to that produced without starter culture addition. This is may be related to the action of starter culture that increased the acidity and decreased pH. This is confirmed by Law (1999) who found that raw milk used to prepare cheese is more likely to serve as a vector for food borne illness.

Psoni et al., (2003) found that various factors contribute to the decline of micro organisms count during cheese ripening, since starter culture leaded to decrease PH.

This result in agreement with Ceylent et al (2003) who found that starter culture decreased the PH, thus inhibiting the pathogen micro-rganism growth.

4.12.4 Effect of $CaCl_2$ Addition

Calcium chloride addition affected the physicochemical characteristics of cheese where it increased ash, PH, fat, total solid, and protein, while it decreased the acidity and time of coagulation also effect on shelf-life of the cheese where it increased.

Same results founded by El Zubeir et al (2008) and A. F. Wolfschoon-Pombo (1998). Also D. J. McMahon et al.2005 who worked on Mozzarella Cheese found that the addition of calcium chloride to the cheese caused hardness of cheese and increase of shelf-life.

Calcium chloride addition also effect the organoleptic properties of cheese, where it helped in producing cheese with white color, very hard texture. This result also reported by D. J. McMahon et al. (2005).

5–20 grams of calcium chloride per 100 kg of milk are normally enough to achieve a constant coagulation time and result in sufficient firmness of the coagulum. Excessive addition of calcium chloride may make the coagulum so hard that it is difficult to cut.

Addition of calcium chloride effected on coagulation mechanism of the milk were the samples which prepared by addition of calcium chloride coagulated faster than other samples which prepared without calcium chloride addition and this result is conformed with Okigbo. et al. (1985) who found that calcium ions control in coagulation mechanism where it increased.

Ernstrom. et al., (1958).worked on cheddar and D. J. Mcmahon et al., (1984) found that the addition of calcium chloride increases cheese coagulation and the firmness of the curd, where increasing calcium concentration inhibits gelatin while enhancing aggregation of para-casein micelles.

Code of Federal Regulations, (1979) Reported that the addition of more than 0.2% (wt/wt) of calcium chloride to milk used for cheese making, the quantity of rennet required thus can be reduced by 50%. Cost effectiveness of such action is determined by relative costs of rennet & calcium chloride.

Chapter FIVE

Conclusion and Future Work

5.1 Conclusion

1) During ripening period there was an increase in total solid in group number eleven for the category of 70% goat milk which produced by using calcium chloride, fig latex and starter culture, group number six and mainly for the samples were prepared from 0, 100% goat milk However, this sample was produced by using fig latex and starter culture only, group number five and mainly for the samples were prepared from 70, 100% goat milk this sample was produced by using calcium chloride and starter culture, group number eleven for the category of 100% goat milk its was(51.61%), which produced by using calcium chloride, fig latex and starter culture.

2)The highest fat % was found in group number six and was for the category 30, 100% which produced by using fig latex and starter culture, group number five and was for the category 100% it was (25%) which produced by $CaCl_2$ and starter culture , group number ten and was for the category (30, 100%) which produced by using $CaCl_2$, group number eight and was for the category 100% which produced by using starter culture , group number eleven and was for the category50, % which produced by using $CaCl_2$,starter culture and fig latex.
In general $CaCl_2$ and starter culture increased fat contents.

3) The highest protein % was found in group number eight and was for the category 100,30% goats milk which produced by using starter culture. group number five and was for the category 70% goats milk which produced by using $CaCl_2$ and starter culture, group number six and was for the category(0,30 100%) goats milk which produced by using fig latex and starter culture.

4) The highest Ash % was found in group number two and was for the category 0, 30% goats milk which produced by using carob latex, group number seven and was for the category 0% goats milk which produced by using starter culture and carob latex , group number twelve and was for the category 0, 70% goats milk which produced by using $CaCl_2$, starter culture and carob latex, , group number five and was for the category 0% goats milk which produced by using $CaCl_2$ and starter culture. group number four and was for the category 0% goats milk it was (11%) which produced by using $CaCl_2$and carob latex.
As a result starter culture, $CaCl_2$ and carob latex were increased ash contents also $CaCl_2$ with carob latex increase ash contents.

5) The highest PH% was found in group number seven at 0, 30% goats milk which produced by using starter culture and carob latex, group number two at 50, 30, 100 % goats milk which produced by using carob latex, group number three which produced by using calcium chloride and carob latex, group number twelve at 100% goats milk which produced by using starter

We found that all groups which scored the highest pH range have carob latex as additive to the cheese and this maybe related to the natural and structure of carob latex culture, $CaCl_2$ and carob latex.

6) The highest acidity was found in group number five which was produced by adding starter culture and calcium chloride. also in group number eight which produced by using starter culture.

7) In the sensory analysis Group number five at 50,70% goats milk which produced by addition of starter culture and calcium chloride and Group number eight at 30 and50% goats milk, which produced by addition of starter culture were the most appreciated ones.

8) The flavour in all types of cheese was improved during storage period. The flavor of raw milk cheese had the highest total score compared to pasteurized cheese respectively. This may be due to

the natural flora initially present in raw milk which participates in flavor production Law, B.A., (1980).

9) The bad Organoleptic quality were found in Groups which produced by addition of fig latex.

10) The sensory properties of the cheese were affected by the addition of fig latex, where strong odor & bitterness, less cohesive, more gummy and harder texture.

11) The cheese which was produced by carob latex produced cheese off- white colour and this may be related to the colour of carob, also gave cheese very hard texture this related to the structure of carob.

12) Some cheese samples which was produced by addition of calcium chloride have hard texture.

13) Coliform was seen in five samples from 60 samples in part two (with pasteurization process) and this may be related to contamination in manipulation.

14) used of starters can solve many problems in cheese production such as non-uniform quality, flavor and texture defects.

15) Starter culture increases the protein. Also use of fig latex with starter culture increase protein contents.

16) Pasteurized milk cheese has high quality and safety, free from pathogenic microorganisms, better acid during manufacturing and storage and with high cheese yield.

The disadvantage of pasteurization process may be the increase in cost and the flavor development is slower and not as that of raw milk cheese. Advantages of pasteurization process of milk cheese are strongly outweighing the disadvantages. On the other hand, in spite of the better flavor and high quality of heat treated milk cheese, some pathogenic and spoilage contaminants may survive the sub-pasteurization process leading to economical and public health hazard to the producer.

5.2 Future Work

I suggest completing research in other products of goat's milk such as yogurt, labana.
Also the use of starter culture in cheese production to solve many problems.

Suggestion was drawn to extract rennet enzymes from fig and carob so the strong odor and bitterness will be removed.

The adequate starter microorganism, selected from the most numerous microorganisms seems to be the main cause of the lipolytic and proteolytic phenomena and of the development of the flavor characteristics.

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APPENDIXES

1Total Solid Content

Total solid content of the cheeses were determined by using oven drying Method. The difference in weight before and after drying for 4 hours at 100ºC gives the results of solid content.

1.1 Apparatus:

1.1.1Analytical balance with a readability of 0.1mg
1.1.2desiccator
1.1.3drying oven, thermostatically controlled at 10-22C°
1.1.4metal dishes about 2cm deepand 6-8cm in diameter with well –fitting lids
1.1.5water bath
1.1.6pipette
1.1.6tissue paper

1.2 Procedure

1.2.1 Dry the dish and the lid in oven at 102±2C° for at least 1 hour .allow the dish with the lid on to cool to room temperature in a desiccator. Weigh the dish and lid to the nearest 0.1mg

1.2.2 Put 5gm in to the dish, cover the dish and weigh.

1.2.3 Uncover the dish and place it into a boiling water bath for 30 minutes. Dry in the oven at 102±2C° for 2 hours with the lid placed beside the dish.

1.2.4 Cover the dish, remove from the oven and allow to cool to room temperature in the desiccator and weigh.

1.2.5 Dry in the oven for 1hour as before.Cool and Reweigh .repeat the drying until the difference in

weight between two successive weighing is not more than 1mg

1.3Calculatios

1.3.1the total solids content, expressed as a percentage by mass is equal to:

$$\frac{Mn-M_0}{M_1-M_2} \times 100$$

Where :

M_0=the mass in gram, of the dish and lid

M_1=the mass in grams, of the dish, lid and test portion

M_2=the mass in grams, of the dish, lid and dried test portion

2 Fat Content

2.1Apparatus

2.1.1babcock centrifuge

2.1.2water bath at 55 C°

2.1.3 distilled water

2.1.4 glymol

2.1.5 torion balance 9 and 18g weights

2.1.6 babcock shaker

2.1.7 glassware:50%paley bottles 17.5ml cylinders, 17.6ml pipette

2.1.8 reagents:- babcock sulphuric acid (d=1.825)

2.1.9 N-butyl alcohol

2.2Procedure:

2.1.1 Temper cheese sample to 20° C and mix. grind cheese to small particles

2.1.2 weight 9g of cheese sample into 50%paley bottle and add 10 ml of distilled water at 60 C°

2.13 Add17.5ml sulphuric acid in at least three increments. Mix until color is uniform chocolate brown and all cheese particles are dissolved

2.1.4 Centrifuge 5 min

2.1.5 Add distilled water at 60° C to bring contents to within one quarter inch of base of neck.dont mix. Centrifuge 2 min

2.1.6 Add water at 60° C to float fat into neck don't mix.centrifuge 1 min

2.1.7 Temper bottles in water bat at 55° C for 5min

2.1.8 Place 4-5 drops glymol on the fat column from the demarcation between fat and glymol to the bottom of the lower meniscus

2.1.9 Report fat in percent by weight.

3 Ash Content

3.1 Apparatus

3.1.1 Platinum dish

3.2 .1 Analytical balance with a readability of 0.1mg

3.3 .1 drying oven, thermostatically controlled at 10-22°C

3.3 .1 muffle furnace

3.2 Procedure:

3.2.1 Weigh the empty platinum dish **(W1)**

3.2.2 weight about 5g of prepared sample into suitable platinum dish an Samples were Dried in oven for1 h

3.3.3 Weigh the sample after its cooled to room temperature in the desiccator **(W_2)**

3.2.4 burn the Samples in ash oven at 550ºC until all black color disappears.

3.2.5 Cool the Samples in desiccator, and weigh them. **(W_3)**.

3.3 Calculations

3.3.1the ash content, expressed as a percentage by weight is equal to:

$$\frac{M_3 - M_1}{} \text{ X } 100\%$$

M_2

Where:

M_1=the weight in gram, of the crucible and lid

M_2= the weight in gram, of the sample

M_3= the weight in gram, of the final sample

4 Acidity percentage test

4.1 Apparatus

4.1.1 Hot plate with magnetic stirrer.

4.1.2 10ml graduated cylinder.

4.1.3 50 ml purit.

4.1.4 purit handle

4.1.5 Clamp

4.1.6 250 ml Erlenmeyer flask.

4.1.7 Analytical balance with a readability of 0.1mg

4.2 Reagents

4.2.1 Ethyl alcohol 96%.

4.2.2 0.1N aqueous sodium hydroxide.

4.2.3 Phenolphthalein solution (1%in 96%ethanol).

4.3 Procedure

4.3.1 3 g cheese was weighed

4.3.2 Crushed cheese with 10 ml water in porcelain mortar.

4.3.3 Transferred cheese solution into an Erlenmeyer flask (250ml)

4.3.4 Add 5 drops phenolphthalein into cheese solution

4.3.5 Titrated with 0. 1 N NaOH to the first permanent color change to pink.

4.3.1Calculation

4.3.1.1 %Acidity = $\frac{\text{NaOHamount (ml) X 0.009}}{\text{Cheese amount}}$ X100 (for 0.1N NaOH)

5. PH

Results were measured with a pH-meter. (Enolab)

5.1Apparatus

5.1.1 pH-meter. (Enolab)

5.1.2 Buffer (pH7)

5.1.3 Buffer (pH4)

5.1.4 Bottle of distilled water

5.1.5 Tissue paper

5.1.6 thermo-meter

5.2Procedure

5.2.1 Mixing of cheese sample by mechanical stirring

5.2.2 A PH meter (with suitable glass electrodes) should be calibrated by the use of two buffers, One higher (pH7) and one lower (pH 4) then the expected pH range of the samples to be measured

5.2.3 Ensure that the buffers and the samples are at the same temperature (25C°)

5.2.4 Using pH meter, determine the PH value of the sample

5.2.5 Claen the electrode after each determination with distilled water (from a wash bottle) and wipe them with a tissue paper

5.2.6 Express the results as the pH of the cheese samples, stating the temperature of the measurements .

6 Protein Content

Protein content was determined by Kjeldahl method AOAC, [1997].

6.1 Reagents

6.1.1 Potassium sulphate.

6.1.2 Mercuric oxide, red.

6.1.3Sulphuric acid, concentrated (density 1.84 at 20 C°)

6.1.4 Sodium hydroxide solution, 500g sodium hydroxide and 12g sodium sulphate (NaS_2, 9H2O) dissolved in 1000 ml of distilled water.

6.1.5 Hydrochloric acid, 0.1N.

6.1.6 Indicator, 2g methyle red and 1g methylene blue dissolved in 1000ml ethanol (96%v/v).

6.1.7 Sodium tetrabonate for the standardization of the hydrogenous substances

6.2Apparatus

6.2.1 Analytical balance, sensitivity 1mg.

6.2.1 Digestion apparatus to hold the Kjeldahl flash in an inclined position and with a heating device which will not heat the part of the flask above the surface of the liquid contents.

6.2.1 Kjeldahl flask of 100 ml capacity.

6.2.1 Liegig condenser with straight inner tube.
An outlet tube with safety bulb connected to the lower end of the condenser by soft rubber stoppers.

6.2.1 Conical flask of 500ml capacity.

6.2.1 Graduated cylinder, 25, 50,100and 150ml.

6.2.1 Burette of 50 ml capacity in 1/10ml.

6.2.1 Substances to facilitate boiling.

6.2.1 For digestion:pieces of hard porcelain or glass beads.

6.2.1 For distillation: freshly calcined: pieces of pumice.

6.3 Procedure

6.3.1Preparation of the sample

Prior to the analysis bring the sample to 20±2 C° and mix carefully. If the fat cannot be evenly dispersed, heat the sample slowly to 40 °C, mix gently and cool to 20±2 C°.

6.3.2 Determination

6.3.2.1 Place successively the Kjeldahl flask afew glass beads or small pieces of porcelain, about 10 g potassium sulphate, .5g mercuric oxide and about 5g of cheese to an accuracy of 1mg.

6.3.2.2 Add20 ml of sulpharic acid and mix the contents of the flask .

6.3.2.3 Heat the Kjeldahl flash carefully on the digestion apparatus until the foaming stops and the contents from time to time

6.3.2.4 Allow the liquid to boil vigorously for one and half hours after it has become clear avoid local over heating.

6.3.2.5 Allow the contents of the flask to cool to room temperature, add about150ml distilled water a few pieces of pumice, mix and allow to cool again.

6.3.2.6 Measure 50ml of the boric acid solution into the conical flask, add4 drops of the indicator and mix.

6.3.2.7 Place the conical flask under the condenser so that the tip of the outlet tube is below the surface of the boric acid solution .measure 80ml of the sodium hydroxide solution into the Kjeldahl flask, holding the flask in an inclined position so that the hydroxide solution runs down the side and does not mix with the contents .

6.3.2.8 Connect the Kjeldahl flask with the condenser by means of the splash head.

6.3.2.9 Mix the contents of the Kjeldahl flask by swirling. heat to boiling. Avoid frothing .continue the distillation until the contents of the flask start bumping.. regulate the heating so that the distillation takes at least 20 minutes. Cool the distillate well and do not let the solution of the boric acid become warm.

6.3.2.10 Shortly before the end of the distillation, lower the conical flask so that the tip of the outlet tube is no longer immersed in the boric acid solution

6.3.2.11 Stop heating and remove the outlet tube, rinsing its outer and inner walls with a little distilled water titrate the distille with 0.1 N hydrochloric acid.

6.3.3 Blank test

Carry out blank test s determination above using 5ml of distilled water in place cheese.

6.3.4Expression of the results

6.3.5Method of calculation

6.3.5.1 Calculate the total nitrogen content by means of the formula:

6.3.5.2 Total nitrogen content % $= \frac{1.40 \text{ X N } (v_1 - v_0)}{P}$

6.3.5.3 N= normality of the hydrochloric acid.

6.3.5.4 V_1= number of the ml of the hydrochloric acidused in the determination

6.3.5.5 V_0= number of the ml of the hydrochloric acid used in the blank test

6.3.5.6 P=weight (in gram) of the cheese taken for analysis.

6.3.6 Accuracy of the determination

The maximum deviation between duplicate determinations should not exceed .005%of nitrogen.

Appendix two **Sensory Analysis**

For sensory analysis of cheeses Hedonic Type scale was used Nelson and Trout (1981). Evaluation was done by a group containing 4 people. Example of the Hedonic Type scale is given below in table (2.1) .the grade from 4to 9

Table 2.1 Hedonic Type Scale

For every experiment

Name:……. . Sample No:…….. Date:……

Color	Very good 9-8	Good 7-6	Average 5-4-3	Not good 2-1
Texture	Very good 9-8	Good 7-6	Average 5-4-3	Not good 2-1
Taste and Aroma	Very good 9-8	Good 7-6	Average 5-4-3	Not good 2-1
Strange Taste and	No 9-8	Very few 7-6	Sensible 5-4-3	A lot 2-2
Salt Content	Normal 9-8	A little Salty 7-6	salty 5-4-3	Very much Salty 2-1
General Acceptance	Very good 9-8	Good 7-6	Average 5-4-3	Not good 2-1

Number of group:…….. Number of experiments…… . Date:……

Notes to specify:……..

Appendix three **Microbiological tests**

1Microbiological Analysis

The cheese samples were prepared for microbiological examination according to ICMSF, (1996). The treated cheese samples were examined for Coliform (MPN) count; and total mold and yeast.

1.1 Sampling Procedure

10 g sample was taken from cheeses and homogenized in sterile 90 ml of 0.1 % peptone water. Serial 6 fold dilutions in sterile 0.1 % peptone water were prepared for bacterial analysis. Two measurements were carried out and average values are represented.

1.1.1 Preparation of peptone water

1.2 Yeast and Mould Enumeration

Potato Dextrose Agar was used for yeast and mould enumeration. Plates were incubated at 25°C for 5 days.

1.2.1Compostion of media (Potato Dextrose Agar Formula (grams per liter))

1.2.1.1 Potato infusion from 200

1.2.1.2 Dextrose 20.0

1.2.1.3 Agar No.1 15.0

1.2.2 Preparation of media

1.2.2.1Suspend 39 gm in 1000ml distilled water.

1.2.2.2 Heat to boiling to dissolve the medium completely.

1.2.2.3 Sterilize by autoclaving at 15 minutes.

1.2.2.4 Mix well before dispensing.

1.2.2.5 in specific work, when pH3.5 is required, acidity medium with sterile 10% tartaric acid.

1.2.2.6 The amount of acid required for 100ml of sterile cooled medium is approximately 1ml

1.2.2.7 Don't heat the medium after addition of the acid.

1.2.3Apparatus

1.2.3.1 Mechanical blender or stomacher device

1.2.3.2 Sterile blending bag.

1.2.3.3 Balance 20000 g capacity, weigh up to 0.01 g tolerance.

1.2.3.4 Sterile beaker, 250 ml.

1.2.3.5 Sterile graduated pipette. 1, 10 ml .

1.2.3.6 Peptone water or phosphate buffered as dilution water sterilized in bottle to yield final Volume of 90 ml or 99 ml.

1.2.3.7 Sterile knives, forks, spatulas, forceps, scissors.

1.2.3.8 Hot plate with magnetic stirrer.

1.2.3.9 Autoclave

1.2.3.10 oven

1.2.3.11 Incubator

1.2.3.12 Petri dishes

1.2.3.13dilution bottles (capacity of 150 ml)

1.2.3.14 test tube (20-50 ml capacity) .

1.2.3.15 pipettes; 1, 2, 5, 10 20 ml volumes

1.2.3.16 clean working area (Laminar flow) .

1.2.3.17 media,

1.2.3.18water bath with cover

1.2.3.19diluents

1.2.3.20 bent glass rods.

1.2.4Procedure

1.2.4.1 Tare the empty sterile blender bag then weigh 10 _+0.1 g or, from cheese samples

1.2.4.2 Add to the blender bag 90 ml of dilution water (peptone water), this to provide 1/10 dilution.

1.2.4.3 Blend the food and dilute promptly, Start at low speed and then gradually switch to high speed within
a Few seconds. Time the blending carefully to permit 2 minute at high speed. Wait min for foam to
disperse.

1.2.4.4 Measure 1 ml of 1/10 dilution of the blended material avoiding foam, into 9 ml dilution tube to get 1/100or1/100 respectively.

1.2.4.5 Shake this and all subsequent dilutions vigorously 25 times in 30 cm arc. Repeat this process using the progressively increasing dilution to prepare dilution of 1/10, 1/100, 1/1000, 1/10000, 1/100000 and 1/100000

1.2.4.6 Inoculate duplicate Petri- dishes by transferring 1 ml aliquot or so from the dilution.

1.2.4.7 Pour 15-20 ml tempered media into the plate, mix well, let to solidify, then

1.2.4.8 Incubate at the suitable temperature for specific time, inverted.

1.2.4.9 At the end of incubation period , count the total colony forming units (CFU) on
each plate

1.2.4.10 Calculate the average and compute the CFU per gram or Ml of food sample by multiplying the number of colonies by the dilution factor as follow:

Count = number computed X 1/ dilution factor

1.3 Coliform Bacteria Enumeration

Violet Red Bile Agar was used for the enumeration of coliforms. Plates were incubated at 37°C for 24 h.

1.3.1compostion of the media

Violet Red Bile Agar Formula (grams per liter)

1.3.1.1 Bacto- Yeast extract 3.0

1.3.1.2 Bacto- Peptone 7.0

.1.3. 1.3 Bacto- Bile Salts No.31.5

1.3.1.4 Bacto- Lactose10.0

1.3.1.5 Sodium Chloride5.0

1.3.1.6 Bacto- Agar15.0

1.3.1.7 Bacto- Crystal violet

1.3.2 Preparation of media

1.3.2.1 Suspend 23.118 gm in 1000ml distilled water.

1.3.2.2 Heat to boiling to dissolve the medium completely.

1.3.2.3 Sterilize by autoclaving at 15 minutes.

1.3.2.4 Mix well before dispensing.

1.3.3Apparatus

1.3.3.1 Mechanical blender or stomacher device

1. 3.3.2 Sterile blending bag.

1. 3.3.3 Balance 20000 g capacity, weigh up to 0.1 g tolerance

1. 3.3.4 Sterile beaker, 250 m.

1. 3.3.5 Sterile graduated pipette. 1, 10 ml .

1. 3.3.6 Peptone water or phosphate buffered as dilution water sterilized in bottle to yield final Volume of 90 ml or 99 ml.

1. 3.3.7 Sterile knifes, forks, spatulas, forceps, and scissors.

1. 3.3.8 Hot plate with magnetic stirrer.

1. 3.3.9 Autoclave

1. 3.3.10 bent glass rods.

1. 3.3.11 Incubator

1. 3.3.12 Petri dishes

1. 3.3.13dilution bottles (capacity of 150 ml)

1. 3 .3.14 test tube (20-50 ml capacity) .

1. 3.3.15 pipettes; 1, 2, 5, 10 20 ml volumes

1. 3.3.16 clean working area (Laminar flow) .

1. 3.3.17 media,

1. 3.3.18water bath with cover

1. 3.3.19diluents

1. 3.3.20 oven

1.3.4 Procedure

1.3.4.1 Tare the empty sterile blender bag then weigh 10 _+0.1 g or, from cheese samples

1.3.4.2 Add to the blender bag 90 ml of dilution water (peptone water), this to provide 1/10 dilution.

1.3.4.3 Blend the food and dilute promptly, Start at low speed and then gradually switch to high speed within
a Few seconds. Time the blending carefully to permit 2 minute at high speed. Wait min for foam to disperse.

1.3.4.4 measure 1 ml of 1/10 dilution of the blended material avoiding foam, into 9 ml dilution tube to get 1/100or1/100 respectively.

1.3.4.5 Shake this and all subsequent dilutions vigorously 25 times in 30 cm arc. Repeat this process using the progressively increasing dilution to prepare dilution of 1/10, 1/100, 1/1000, 1/10000 and 1/100000

1.3.4.6 Inoculate duplicate Petri- dishes by transferring 1 ml aliquot or so from the dilution.

1.3.4.7 Pour 15-20 ml tempered media into the plate, mix well, let to solidify, then

1.3.4.8 Incubate at the suitable temperature for specific time, inverted.

1.3.4.9 At the end of incubation period, count the total colony forming units (CFU) on each plate

1.3.4.10 Calculate the average and compute the CFU per gram or Ml of food sample by multiplying the number of colonies by the dilution factor as follow:

Count = number computed X 1/ dilution factor

Appendix four **Chemical and Suppliers**

Chemicals	Supplier
Potato Dextrose Agar	LAB M
Violet Red Bile Agar	Difco
Rennet Enzyme	Trakya Peynir Mayası
Calcium Chloride	Marmara Industrial Chemicals
Amyl alcohol	Sigma company
Phenolphthalein	Sigma company
H_2S0_4	Sigma company
Acetic acid)	Sigma company
K_2CrO_4 (5%)	Sigma company
$AgNO_3$ (0.1 N)	Sigma company
NaOH.1 N	Sigma company
Sodium acetate 1 M	Sigma company
Peptone water	Sigma company

Appendix five **Results of physicochemical parameters of samples**

PART ONE **WITH OUT HEAT**

(Table1.1a) Results of physicochemical parameters of samples in part one

exp.#	goat milk%	total solid%	FAT%	Protein%	ASH%	PH	Acidity	M&Y	Coliform
	0	41.12	15	20.8	7.66	5.83	0.82	$33x10^5$	$12x10^3$
	30	43.23	18	22.1	10.35	5.64	0.82	$45x10^5$	$11x10^5$
1	50	40.35	19	18.33	9.82	5.27	0.82	$62x10^5$	$30x10^3$
	70	42.1	18	20	8.34	5.65	0.82	$21x10^5$	$60x10^3$
	100	41.19	21	16.65	9.24	5.27	0.82	$32x10^5$	$29x10^3$
2	0	46.31	13	17.41	12.41	6.21	0.79	$45x10^4$	$22x10^3$
	30	47.65	17	18.9	10.2	6.42	0.69	$58x10^6$	$43x10^3$
	50	44.72	16	15.62	11.24	6.65	0.64	$50x10^5$	$28x10^3$
	70	48.92	17	13.01	10.43	6.13	0.77	$46x10^5$	$13x10^3$
	100	46.34	11	12.03	10.66	6.53	0.62	$44x10^5$	$22x10^3$
3	0	45.36	19	16.8	7.04	6.3	0.89	$46x10^4$	$45x10^3$
	30	43.14	18	20.5	8.72	6.09	0.74	$32x10^4$	$24x10^3$
	55	47.2	20	18.73	8.86	6.16	0.79.	$45x10^4$	$18X10^5$
	70	45.58	19	16.29	9.87	6	0.72	$55x10^4$	$37x10^3$
	100	45.16	20	14.66	7,99	6.6	0.91	$60x10^6$	$33X10^4$
4	0	40.21	15	22.04	11	5.59	0.8	$34x10^5$	$15x10^4$
	30	42.3	20	17.73	10.7	5.83	0.78	$35x10^4$	$10x10^6$
	50	41.53	18	15.46	10.4	5.91	0.79	$61x10^6$	$50x10^4$
	70	40	13	12.44	10.4	5.89	0.77	$18x10^6$	$35x10^3$
	100	42.61	17	12	9.93	5.57	0.69	$16x10^6$	$43x10^3$
5	0	41.7	18	23.01	11.24	5.32	1.31	$41x10^4$	$36x10^3$
	30	46.6	23	20.01	8.94	5.37	1.82	$45x10^4$	$34x10^3$
	50	47.2	24	19.8	8.87	5.45	1.1	$32x10^4$	$50x10^3$
	70	51.7	23	24.9	9.28	5.41	1.03	$52x10^4$	$37x10^3$
	100	51.1	25	22.12	10.14	5.4	1	$62x10^4$	$1.2x10^3$
6	0	50.49	15	24.8	10.51	5.3	0.69	$50x10^4$	$33x10^4$
	30	45.29	26	24.1	9.93	5.17	0.66	$63x10^5$	$24x10^4$
	50	46.26	20	22.33	9.74	5.27	0.86	$45x10^4$	$16x10^4$
	70	47.79	17	19.25	10.17	5.38	0.86	$60x10^5$	$12x10^4$
	100	52.1	24	14.08	9.42	5.55	0.88	$42x10^5$	$25x10^4$

(Table1.1b) Results of physicochemical parameters of samples in part one

exp.#	goat milk%	total solid%	FAT%	Protein%	ASH%	PH	Acidity	M&Y	Coliform
7	0	40.07	11	12.5	12.2	6.62	0.66	$72x10^4$	$16x10^4$
	30	41.53	12	13.26	10.67	6.8	0.69	$46x10^4$	$12x10^4$
	50	46.42	15	13.7	10.41	6.27	0.93	$21x10^5$	$2.7x10^3$
	70	42.63	19	16.06	9.94	6.33	0.77	$36x10^4$	$16x10^4$
	100	45.27	18	15.02	10.64	6.47	0.72	$17x10^6$	$12x10^4$
8	0	40.9	13	19.41	9.99	5.37	0.98	$54x10^4$	$1.2x10^5$
	30	40.4	17	25.48	8.33	5.37	0.98	$19x10^4$	$28x10^4$
	50	31.95	18	23.89	8.19	5.48	0.96	$36x10^5$	$32x10^4$
	70	39.8	22	22.89	8.78	5.39	0.88	$37x10^4$	$7.0x10^4$
	100	41.34	24	24.13	6.95	5.54	0.69	$56x10^5$	$18x10^4$
9	0	42.6	19	17.66	8.32	5.3	0.93	$49x10^4$	$7.0x10^4$
	30	44.61	18	15.74	8.31	5.83	0.61	$55x10^5$	$1.0x10^2$
	50	43.3	20	24.35	8.57	5.88	0.94	$46x10^5$	$4x10^4$
	70	46.36	19	23.45	7.92	5.38	0.83	$59x10^5$	$9x10^4$
	100	45	20	24.65	6.04	5.31	0.98	$48x10^5$	$8.0x10^4$
10	0	47.19	23	17.26	6.78	5.55	0.63	$24x10^4$	$5.5x10^2$
	30	42.93	24	16.45	7.21	5.44	0.68	$28x10^4$	$2.7x10^3$
	50	46.53	23	16.77	5.92	4.67	0.64	$32x10^4$	$16x10^4$
	70	45.86	21	19.4	9.1	.5.64	0.63	$28x10^5$	$9.0x10^3$
	100	46.34	24	16.66	6	5.8	0.68	$41x10^4$	$9.0x10^4$
11	0	44.81	17	18.4	9.77	5.18	0.83	$33x10^4$	$50x10^4$
	30	47.9	16	19.5	9.31	5.39	0.69	$24x10^4$	$63x10^5$
	50	49.14	24	17.45	9.01	5.4	0.77	$16x10^4$	$45x10^4$
	70	53.68	20	19.53	8.7	5.5	0.82	$12x10^4$	$60x10^5$
	100	51.61	23	22.48	8.88	5.27	0.79	$25x10^4$	$42x10^5$
12	0	43.26	13	11.08	12.13	6.32	0.6	$26x10^5$	$1.5x10^2$
	30	42.47	15	12.32	10.42	6.14	0.73	$12x10^5$	$1.0x10^2$
	50	44.53	12	13.74	10.95	6.23	0.71	$35x10^4$	$18x10^2$
	70	46.04	18	13.6	11.7	6.15	0.75	$26x10^4$	$1.0x10^2$
	100	45.32	19	12.21	10.39	6.46	0.66	$19x10^4$	$8.0x10^3$

Appendix five **Results of physicochemical parameters of samples**

PART TWO **WITH HEAT**

(Table1.2a) Results of physicochemical parameters of samples in part two

exp.#	goat milk%	total solid%	FAT%	Protein%	ASH%	PH	Acidity	M&Y	Coliform
1	0	47.21	13	16.88	6	6.08	0.62	$30x10^4$	ND
	30	49.5	17	14.51	8.32	5.49	0.23	$50x10^4$	$20x10^2$
	50	45.5	15	15.27	6.65	5.83	0.64	$42x10^4$	$32x10^4$
	70	46.22	17	19.03	6.7	5.92	0.25	$39x10^4$	$27x10^4$
	100	42.1	19	17.26	7.03	5.8	0.79	$28x10^4$	ND
2	0	51,62	15	15.34	10.19	6.77	0.2	$33x10^4$	$15x10^2$
	30	52,41	16	17.23	8.83	6.97	0.11	$21x10^4$	ND
	50	48,44	14	15.1	10.52	6.68	0.14	$10x10^3$	ND
	70	52,62	11	12.01	10	6.72	0.17	$18x10^3$	ND
	100	55,77	14	11.75	9.23	6.59	0.12	$12x10^4$	ND
3	0	47,2	17	14.8	6.3	5.65	0.14	$35x10^4$	$35x10^4$
	30	49,5	15	19.22	7.62	5.52	0.24	$12x10^4$	ND
	50	45.5	19	16.87	8.44	5.62	0.17	$36x10^4$	$10x10^5$
	70	48.2	17	16.59	7.63	5.7	0.27	$39x10^4$	$24x10^4$
	100	42.1	18	13.78	6.94	5.5	0.89	$25x10^4$	ND
4	0	45.3	12	20.04	8.32	6.38	0.28	$36x10^4$	ND
	30	46.6	12	15.23	9.54	6.44	0.41	$12x10^4$	ND
	50	47.33	14	13.56	8.95	6.26	0.29	$39x10^4$	$39x10^4$
	70	49.92	19	10.74	9.82	6.56	0.31	$19x10^4$	ND
	100	48.8	15	10.73	10.01	6.89	0.33	$12x10^4$	ND
5	0	43.17	14	22.71	8.76	5.57	0.79	$30x10^3$	ND
	30	50.11	18	18.91	7.67	5.53	0.56	$19x10^4$	ND
	50	50.7	20	17.88	7.58	5.46	0.9	$32x10^4$	$32x10^4$
	70	51.5	18	22.19	7.75	5.46	0.77	$47x10^4$	$33x10^4$
	100	52.24	23	21.12	8.37	5.72	0.89	$32x10^4$	$16x10^5$
6	0	33.84	17	23.1	7.99	5.87	0.22	$23x10^4$	ND
	30	47.7	21	23.1	8.01	5.52	0.24	$36x10^3$	ND
	50	48.46	19	22	8.26	5.91	0.24	$21x10^4$	ND
	70	55.14	15	18.34	7.65	5.92	.0.41	$31x10^3$	ND
	100	56.09	23	12.33	7.78	5.82	0.6	$18x10^3$	ND

(Table1.2b) Results of physicochemical parameters of samples in part two

exp.#	goat milk%	total solid%	FAT%	Protein%	ASH%	PH	Acidity	M&Y	Coliform
7	0	47.01	14	8.32	11.43	5.23	0.9	$25x10^4$	ND
	30	48.42	11	9.11	9.82	5.33	0.53	$31x10^3$	ND
	50	48.8	13	10.35	9.33	5.72	0.56	$12x10^4$	ND
	70	47.31	19	12	8.43	5.9	0.46	$19x10^4$	ND
	100	48.56	16	9.65	9.25	5.66	0.93	$33x10^4$	ND
8	0	47.1	19	175	9.15	5.74	0.88	$42x10^3$	ND
	30	48.8	17	19.26	9.43	5.43	0.48	$10x10^4$	ND
	50	44.2	20	13.7	9.41	5.5	0.76	$20x10^4$	ND
	70	50.7	20	16.06	8.42	5.87	0.48	$35x10^3$	ND
	100	49.3	22	15.02	8.01	5.68	0.65	$33x10^3$	ND
9	0	47.2	17	15.41	8.37	5.57	0.49	45x103	ND
	30	49.5	19	25.48	11.17	5.52	0.55	50x103	ND
	50	45.5	20	23.75	8.82	5.56	0.64	43x103	ND
	70	48.2	17	22.89	8.08	15.49	0.73	45x104	25x104
	100	42.1	19	24.13	8.74	5.91	0.77	45x103	ND
10	0	51.7	20	15.09	10.5	5.56	0.28	$15x10^3$	ND
	30	53.8	22	13.45	8.79	5.76	0.42	$12x10^4$	ND
	50	52.6	23	14.11	9.62	5.67	0.42	$21x10^3$	ND
	70	52.5	20	18	10.11	5.75	0.3	$33x10^3$	ND
	100	54.8	19	14.65	11.43	5.76	0.5	$15x10^4$	ND
11	0	46.82	18	13.4	8.27	5.3	0.69	$19x10^4$	ND
	30	49.8	19	11.5	9.24	5.4	0.56	$24x10^4$	ND
	50	51.45	23	16.45	8.47	5.39	0.58	$36x10^3$	ND
	70	51.22	20	12.53	8.95	5.51	0.61	$48x10^3$	ND
	100	52.03	21	16.48	8.73	5.53	0.86	$32x10^3$	ND
12	0	48.5	14	9	10.92	5.34	0.13	$28x10^4$	ND
	30	42.61	15	11.12	9.83	5.22	0.21	$15x10^4$	ND
	50	51.1	11	13.33	9.98	5.61	0.17	$11x10^4$	ND
	70	48.3	16	11.36	10.11	5.47	0.19	$18x10^3$	ND
	100	50.12	18	10..54	10.55	5.43	0.27	$16x10^3$	ND

العنوان:

العوامل المؤثرة على الجبنة البيضاء المصنعة من حليب الماعز

اعداد:
هديل سعدي احمد القرجة

اشراف:
د. ابراهيم عفانة

الملخص:

تعتبر صناعة الجبن مثالاً تطبيقاً لعلوم الكيمياء الحيوية والبيولوجية ومن هذا المنطلق يمكن تعريف الجبن بأنه الناتج الصلب الذي يتم الحصول عليه بتجبن الحليب بأحد الانزيمات المجبنة سواء كانت حيوانية (المنفحة) او مايكروبية او نباتية او عن طريق اضافة الحامض الى الحليب، ثم بعد ذلك يتم تركيز بعض محتويات الحليب بأزالة كمية من الشرش وتمليحه، ثم وضع الناتج تحت ظروف مناسبة للتسوية.

ويعتبر تحويل الحليب من الحالة السائلة الى خثرة او هلام خطوة اساسية في صناعة جميع انواع الجبن. وتتكون الخثرة نتيجة اضعاف البروتين والذي يمكن احداثه بواسطة استخدام بدائل عن المنفحة الحيوانية وهي المخثرات النباتية او الميكروبية ، وبما ان صناعة الجبن شهدت تطور كبير وأدخلت فيها تقنيات عالية لتحويل كميات هائلة من الحليب يومياً الى الجبن بأنواعه المختلفة وبالنظر لزيادة كمية الحليب المتوفرة لصناعة الجبن في العالم

يوجد في فلسطين نسبة كبيرة من الماعز حيث انه لا يتم استغلال حليبها في تصنيع الجبنة البيضاء، وذلك لان حليب الماعز لا يُعطي كمية كبيرة من المواد الصلبة ، كما ان مدة صلاحيتها قصيرة جدا مقارنة مع انواع الجبنة الاخرى المصنعة من حليب البقر، ومن ذلك المنطلق وجدنا انه من الضروري البحث في مشكلة تصنيع الجبنة البيضاء من حليب الماعز، ومعالجتها من خلال اضافة بعض المواد وكذلك عن طريق خلط حليب الماعز مع حليب بقري.

اثبتت البحوث العلمية ان لحليب الماعز فوائد كثيرة مقارنة بانواع الحليب الاخرى ، فحليب الماعز يساعد على التخلص من امراض فقر الدم، وامرا ض هشاشة العظام، وغيرها من الأمراض. كما ان حليب الماعز سهل الهضم والامتصاص مقارنة مع حليب البقر وذلك يعود لنوعية البروتين و نسبته وللدهون الموجودة في حليب الماعز وحجمها الصغير.

في هذا البحث تم تقسيم العمل الى قسمين: القسم الاول تم فيه تصنيع الجبنة من حليب غير مبستر(خام) تم تسخينه فقط لدرجة 32م وهي درجة نشاط انزيم الرنين بينما في القسم الثاني تم تصنيع الجبنة من حليب مبستر، هذا القسم يحتوي على (12) مجموعة، وكل مجموعة تحتوي على (5) عينات مصنعة من حليب الماعز المخلوط مع حليب البقر بنسب مختلفة هي: (100:0)، (70:30)، (50:50)، (30:70)، (0:100) نسبة الماعز: البقرباضافة انزيم الرينين الى كل عينة و التحكم في اضافة المواد الاخرى (عصارة التين،عصارة الخروب، كالسيوم كلورايد والبادئة من لبن الرايب المصنع من حليب البقر، وتم معرفة تأثير هذه المواد في جودة الجبنة البيضاء من خلال الفحوص الكيميائية والميكرو بيولوجية والفحوص الحسية لهذه الجبنة).

القسم الثاني تم فيه تصنيع الجبنة من حليب مبسترعلى درجة 72م لمدة 15ثانية ،هذا القسم يحتوي على (12) مجموعة، وكل مجموعة تحتوي على (5) عينات مصنعة من حليب الماعز المخلوط مع حليب البقر بنسب مختلفة هي: (100:0)، (70:30)، (50:50)، (30:70)، (0:100) نسبة الماعز: البقرباضافة انزيم الرينين الى كل عينة و التحكم في اضافة المواد الاخرى (عصارة التين،عصارة الخروب، كالسيوم كلورايد والبادئة من لبن الرايب المصنع من حليب البقر.

بعد الانتهاء من تصنيع عينات الجبنة تم تخزين كل عينة على حدى بمحلول ملحي مركز بتركيز 15% على درجة حرارة 4 مئوي لمدة 30يوم ثم بعد ذلك تم اجرءء الفحوصات المختلفة (الفحوص الكيميائية والميكرو بيولوجية والفحوصات الحسية) لهذه العينات من الجبنة

الفحوصات الكيميائية التي تم تنفيذها خلال هذه الدراسة تشمل: نسبة المواد الصلبة ،نسبة الدهن ، نسبة البروتين، نسبة الحموضة و القاعدية للجبنة ،نسبة الرطوبة و نسبة الملح للجبنة اما بالنسبة للفحوصات الميكرو بيولوجية فتشمل فحص الكوليفورم والخمائر والفطريات، و كذلك تم عمل الفحوص الحسية وتشمل فحص اللون والطعم والرائحة والقوام والشكل

ومن خلال الدراسة تبين عدة نتائج، ومن اهم هذه النتائج ان خلط حليب الماعز بالحليب البقري يقلل من الرائحة التي تظهر في منتوج الجبنة، وكذلك يؤدي الى زيادة المواد الصلبة والبروتين،كما انه وجد ان عينات الجبنة التي تم تصنيعها من الحليب الطازج غير المبستر نضجت في وقت اقل من الجبنة المصنعة من الحليب المبسترة، وكان بها نكهة وطعم قويان اكثر من الجبنة المصنعة من الحليب المبستر.

ان اضافة البادئة الى الجبنة يؤدي الى توحيد الرائحة في منتوج الجبنة، وكذلك اضافة كلورايد الكالسيوم الجبنة يؤدي الى زيادة صلابتها، واضافة عصارة التين الى الحليب لتصنيع الجبنة البيضاء يزيد من كمية البروتين النهائي في الجبنة، ولكنه يؤثر سلبا على الصفات الحسية للجبنة حيث انه اعطى رائحة وطعم التين القوية وقوام مطاطي للجبنة .

اضافة عصارة الخروب الى الحليب لتصنيع الجبنة البيضاء يزيد من كمية المواد الصلبة في الجبنة كما انه يؤثر على الصفات الحسية للجبنة مثل اللون الابيض الباهت المائل للصفرة و قوام صلب وذلك يعود لخصائص الخروب الكميائية .