Goats Dairy Products as a Potentially Functional Food [Review Article]

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Abstract: Caprine milk production is largely increased in the last decade and it has significant importance to the economy in many countries in the world. It has a nutritional behavior, biological goats attitude and specific technological properties when it is compared with cows or buffaloes milks. So, goats dairy products possessed the same importance and formed a part of meals in developed countries according to their healthy benefits and functional properties. This article was located to throw some light upon some goats dairy products such as cheeses, yoghurt, labneh and butter.
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1. Introduction:

The importance of goats around the world as essential food in meat and dairy products has been discussed and documented in many recent proceedings of national and international conferences. Goats (*Capra hircus*) milk production has significant importance to the economy and survival of large populations of many countries in the world in developing countries (i.e. Asia, Africa, the Middle East, Mediterranean countries and South America) as well as in developed countries (i.e. Europe, North America and Oceania) (Billon, 2003 and Albenzo *et al.,* 2006).

Milk production of goats is likely to be much greater than which reported in these official statistics, because of the large amounts of unreported home consumption, especially in developing countries (Haenlein, 2004). Goat milk and its processed products are greatly useful as functional foods, maintaining nourishment and health for young and elderly, especially those who have cow milk allergy.

Goats milk has nutritional properties and lower allergenicity in comparison to cows milk, especially in non sensitized children. (Alberzio and Santillo, 2011), which led to an increased interest in goats milk as a functional food, and it now forms a part of the current trend to healthy eating in developed countries. (Olalla *et al.,* 2009 and Abbas *et al.,* 2014). Thus, the use of milk with particular nutritional properties (e.g., goats and mares milk), alone or in combination with bacterial strains having probiotic properties and producing physiologically active metabolites, represents one of the technology options for manufacturing new dairy functional food (Minervini *et al.,* 2009).

Haenlein (2004) reported that the use of goats milk as an excellent food source is undeniable. It has beneficial effects for health maintenance, physiological functions, in the nutrition of children and elderly people, and according to some authors, can be consumed without negative effects by people suffering cows milk allergy.

Goats milk shows great variability in biochemical composition, technological properties and bacteriological quality (Anifantakis *et al.,* 1980) depending on genetic factors, environment conditions, and goat farming practices (Morgan *et al.,* 2000).

2. Manufacture of fermented goats milk

Goats Yoghurt:

Since ancient times, milk from cows, buffaloes and goats has been fermented by certain oriental people to produce yoghurt. Goats milk is suitable as cow's milk for culture growth (Renard, 1983; Prekoppova *et al.,* 1986 and Abbas *et al.,* 1995), while the biochemical activity of culture starter is greater in goats milk than cows milk (Telles 1988). For example, goats milk took 148 min. to reach pH 4.4 against 174 min. for cows milk during yoghurt preparation (Duitschaever 1978). However, Bozanic *et al.*(1998) mentioned that culturing of goats milk took approx. 50 min shorter than that of cows milk which lasted approx. 5.4 hrs during yoghurt preparation.

Although goat yoghurt is prepared by a technique similar to that used with cows milk, it differs in some aspects:

1) Organoleptic properties: goats yoghurt was less viscous, has softer consistency & goaty flavour and produced higher acidity during storage (Bozanic *et al.,* 1998 and Novakovic *et al.,* 1998).
2) Goats yoghurt has more free caproic, caprylic, lauric and myristic acids. While palmitic and stearic acids were approx. equal; but oleic,

linolenic and palmitic acids were lower when compared with cows yoghurt (Rasic and Vuvurovic, 1973 and Boccignone *et al.,* 1981).

3) Amino acids composition of goats yoghurt showed that Gly and Pro presented 4 mg/100g; but Lys. Threo. Ser., Glu. and Ala. acids presented 2 mg/100g; while His., Asp. acids and Leu presented 1-2 mg/ 100g. However low concentration of Arg., Val., Meth and Phe. < 1 mg/100g was observed (Rasic *et al.,* 1971).
4) Some flavour components and aromatic compounds (ppm) of goats yoghurt were differed in cows, sheep and buffaloes determined by Yaygin (1983) as follows:

Milk type	Acetaldehyde	Acetoin	Ethanol
Goats	9.73	14.6	125.50
Cows	12.54	11.43	92.80
Sheep	13.82	12.5	82.85
Buffaloes	13.42	15.87	71.92

Improvement of goats yoghurt quality

Some investigators suggested different ideas for overcome goats yoghurt criticisms.

a) Addition of sugar or flavours increased the preference from 32% to 72% (Duitschaever, 1978).
b) Addition of different fruit syrups to produced flavoured yoghurt (Araujo *et al.,* 1986).
c) Addition of dried skim milk (1-3%) to raise TS and improve the consistency (Bozanic *et al.,* 1998 and Novakovic *et al.,* 1998).
d) Application of UF or RO techniques to rise TS to 15-17% (Abbrahamsen and Holman, 1981; Marshal and El-Bagoury 1986 and Baltadjeva *et al.,* 1989).
e) Using of homogenization process (Abbrahamsen and Holman, 1981; Renard 1983; and Abou-Dawood *et al.,* 1993).
f) Using of different stabilizers and heating treatments under vacuum (Abou-Dawood *et al.,* 1993).

Eissa, *et al.* (2011) showed that the gross nutrients of fresh goats milk changes after yoghurt processing. Fermentation significantly decreased the lactose content and pH of the fresh milk in both types of yoghurt (cows and goats). Cows milk yoghurt was more viscous than goats milk yoghurt. Cold storage resulted in significant changes in gross composition of both types of yoghurt. The number of total bacteria and yeast increased significantly within 10 days of storage, decreasing thereafter. *Staphylococcus aureus* and salmonella spp. were absent. Coliform and faecal coliforms were detected in both yoghurt types. They disappeared after 5 days of storage. Goats milk yoghurt showed significantly lower sensory scores than cows milk yoghurt.

Bano *et al.* (2011) concluded that mixing 75% goats milk and 25% sheep milk in manufacture of yoghurt improved color, flavor and texture scores of the resultant yoghurt.

In attempt to improve the properties of goats yoghurt; yoghurt sample were manufactured from goat's milk and supplemented with 30g/L of whey protein concentrate (WPC). The textural properties of the yoghurt were evaluated during the shelf-life of the product and the textural characteristics of yoghurt made from cow's milk were used as a reference. The instrumental analyses used were the puncture test, stress relaxation test and texture profile analysis. The addition of WPC to goats, milk enhanced the textural characteristics of yoghurt. These advantages attributes included increased firmness, hardness and adhesiveness. These attributes were quantitatively similar ($P > 0.05$) to those obtained from yoghurt made from cow's milk. In addition, the textural properties were maintained constant throughout the shelf-life of the product (Herrero & Requena, 2006).

Pala *et al.*(2006) showed that drinkable yogurts made from different goat breeds milk and made with normal and probiotic cultures were evaluated for their sensory characteristics. Milk of Turkish Saanen, Maltese and Turkish Hair goats obtained during the beginning, middle and end of lactations were used to produce drinkable yogurt. Using descriptive sensory analysis technique, common terms were developed as "goaty", "creamy", "fermented", "cooked", "throat burn", "sweet", "salty", "sour and "astringent". Breeds, lactation periods and using regular and probiotic types of starter cultures affected the sensory characteristics of drinkable yogurts. Drinkable yogurts made by cow milk had weaker intensities of flavor attributes including goaty creamy, throat burn and salty than that made by goat milks of the three breeds. Drinkable yogurts made from Turkish Saanen breed had goatier flavor than those made from Turkish Hair and Maltese goat breeds. The products made by milk provided at the end of lactation period had the highest intensities of goaty flavor. In addition, the intensities of goaty, creamy and cooked flavors in the products made by regular yogurt cultures were higher than those of drinkable yogurts with probiotic cultures.

Yoghurt manufacture with cows and with goats milk (100%, 75%, 50% and 25%) substitution blend with cow's milk revealed that goats milk yoghurt (100%) had the highest protein content (4.2%) fat (4.27%) and caproic (c6), caprylic (c8) capric (c10) and total solids (16.22%). Generally, goats milk yoghurt samples (100%), (75%), (50%) were mostly significantly preferred to 25% goats milk yoghurt sample at ($P > 0.05$) Ehirim and Onyeneke (2013).

Goats Labneh

Labneh is a delicious popular cultured dairy product which produced from yoghurt coagulates. Few investigations were carried out for goats labneh (Roa *et al.,* 1987; Tamime *et al.,* 1991; El-Sayed *et al.,* 1993 and Abbas *et al.,* 1999).

Goats labneh was significantly higher in ash, but fat and protein contents were the same as cows labneh (Roa *et al.,* 1987). Another data recorded by El-Sayed *et al.* (1993) showed that goats labneh had lower values of TS, fat, TP, ash, NPN contents as well as pH values than those of cows labneh. Goat labneh had higher values of titratable acidity, TVFA but it had lower values of diacetyl, acetaldehyde, total carbonyl compounds as well as total essential amino acids, protein efficiency ratio and biological value. It possessed strong acid flavour with homogeneous soft and acceptable body when compared with cows labneh (Abbas *et al.,* 1999).

Mehaia (2005) studied the chemical composition and sensory evaluation of fresh labneh made from goats milk, using ultrafiltration (UF) and traditional processes. Yields, recovery of fat, protein and total solids of fresh labneh were also evaluated. Labnehs prepared by using the UF process has lower contents of protein, fat, total solids and pH and higher contents of acidity compared with traditionally made labneh. An increase of 14.5% in labneh yields, 11.7% in fat recovery, 13.2% in protein recovery and 12.9% in total solids recovery was achieved by UF process. Moreover, the UF process showed 75% reduction in the total process time and 12.5 and 62.5% reduction in the starter culture used for the labneh produced by UF before fermentation, respectively. The mean score for consistency of labneh made by UF before fermentation or by traditional process. However no differences were found in appearance, flavor and overall acceptability between labnehs made using UF or traditional process. Sensory characteristics of both traditional and UF process labnehs were considered to be acceptable.

Al-Abdulkarim *et al.* (2013) showed that a sample of dried fermented goats milk product (Oggtt) obtained from the local market of Riyadh city in the Kingdom of Saudi Arabia, was stored for 6 months at 4 °C and subjected to chemical composition analysis before and after storage. The result showed that the sample moisture increased significantly ($P \leq 0.05$) after storage from 7% to 10%, total ash decreased non-significantly ($P \leq 0.05$) from 8% to 7.6%, total carbohydrates decreased non-significantly ($P \leq 0.05$) from 35.5% to 33.8%, protein increased non-significantly ($P \leq 0.05$) from 16 to 16.1 g/1, fat content was found to have the same values in all samples before and after storage at 5%, lactose increased ($P \leq 0.05$) non-significantly from 28.4% to 29%, acidity decreased ($P \leq 0.05$) significantly from 0.45% to 0.39%, and pH decreased ($P \leq 0.05$) non-significantly from 4.3% to 4%. On the other hand, mineral composition showed ($P \leq 0.05$) non-significant results before and after storage. Ca concentration decreased from 118 to 114 mg/kg and K concentration increased from 185.8 to 188.8 mg/kg. While Mg increased from 105 to 123 mg/kg, Zn increased from 8.3 to 8.6 mg/kg, Mn and Fe were found to have the same values of concentrations before and after storage which were 0.2 and 0.1 mg/kg, respectively. Accordingly, we can conclude that Oggtt is a stable product and have a good nutritional value in comparison to daily required amounts for healthy human life.

Ebrahim *et al.* (2013) manufactured labeneh from goats milk to investigate the possibility of using Chufa tubers at different levels in Zaraibi goat rations and its effects on the resultant milk and labeneh as well as feed utilization and economical return. Milk produced by goats fed different diets was used for the preparation of the concentrated yoghurt Mediterranean dairy product "labneh". Supplementation with Chufa tubers, at different levels, did not significantly affected the yield, moisture content, titratable acidity, fat content, salt content, total nitrogen, and soluble nitrogen of labneh after processing or during storage. Higher non-protein nitrogen content was observed in labneh of G1 (control) and G2 (5% chufa tubers). Total volatile fatty acids were increased with increasing supplementation rate of Chufa tubers from 5% (G2) to 15% (G4). The highest score in the assessment of organoleptic characteristics of Labneh was for G3 (10% Gufa), followed by G4 (15% Chufa tubers), then G2 (5% Chufa tubers). The feed utilization efficiency (kg feed intake/kg milk production) based on DM or CP was better with increasing Chufa tubers levels (0, 5, 10 and 15 g/h/day) in goat rations as improvement in G4 reached approximately 12.6 and 14.8% more than G1 (control), respectively. Accordingly, the economic efficiency (%) was higher due to using Chufa tubers at levels 5, 10 and 15 g/head/day compared with the control one.

Cais-Sokabinska *et al.*(2014) evaluated the fermented permeat of goats milk cold stored for 3 weeks. The permeates characteristics are based on the results determination of basic composition, Ca, Na, K and P content, measurement of selected physical and chemical properties and sensory profile. The obtained permeat as a result of goats milk ultrafiltration was cultured with thermophilous bacteria for milk fermentation. It has been noted that while storing the acidified permeat, its active and potential acidity increased significantly. The value of permeat's color saturation (r=0.91) decreases proportionally to the storage period. It has been found that as a result of general desirability, the perception of sour taste is mostly affected by turbidity level and the ability of metal taste disappearance.

Goats Cheeses

There are three categories of cheese which produced from goats milk. 1) The first includes traditional cheeses which produced on farms and prepared mainly for home consumption. 2) The second includes the cheeses produced on farm scale under improved conditions as in France; the only country in the world which produced more than 90 varieties of goats cheese. 3) The third group is produced from mixed sheep and goat milks and it is practically produced in all Mediterranean countries except France (Kalantzopoulos, 1993).

The production of cheese from goats milk has a very long history. In recent years, the production of cheeses from goats or ewes milk has commercial advantage in several Western European countries because there are no impositions for these kinds of milk or their products as for cows milk products (Kalantzopoulos, 1993 and Abbas *et al.,* 2014). In France, the production of goats cheeses increases by 13% (in the same year) whereas that of cows cheeses increased only 1% and the consumption of goats cheeses expanded approx. 20% / year (Pape and Le-Pape, 1997).

Many traditional dairy products (mainly cheeses) that are accepted by the consumers worldwide are made from sheep's or goats milk or from their mixtures. As the composition of cheese milk affects the characteristics and therefore the acceptability of the final product, there is as increased demand for genuine and accurately labeled dairy products, which necessitates protection against adulteration of milk kinds. The substitution of sheep's milk by goats' milk in the dairy products is a frequent problem, because sheep's milk has a higher price. In addition to that, there are mixed flocks of goats and sheep's that results in accidental or fraudulent substitution of sheep's milk by caprine and vice-versa (Pappas *et al.,* 2008).

All differences in chemical and structural composition of goats milk are affected its rennetability (Calvo and Balcones 1998). It could be concluded that rennet clotting time of goats milk is markedly shorter and the complete forming curd time is lower than cows milk (Puri and Parkash, 1962; Allgower & Bochmann, 1990 and Abbas *et al.,* 1995).

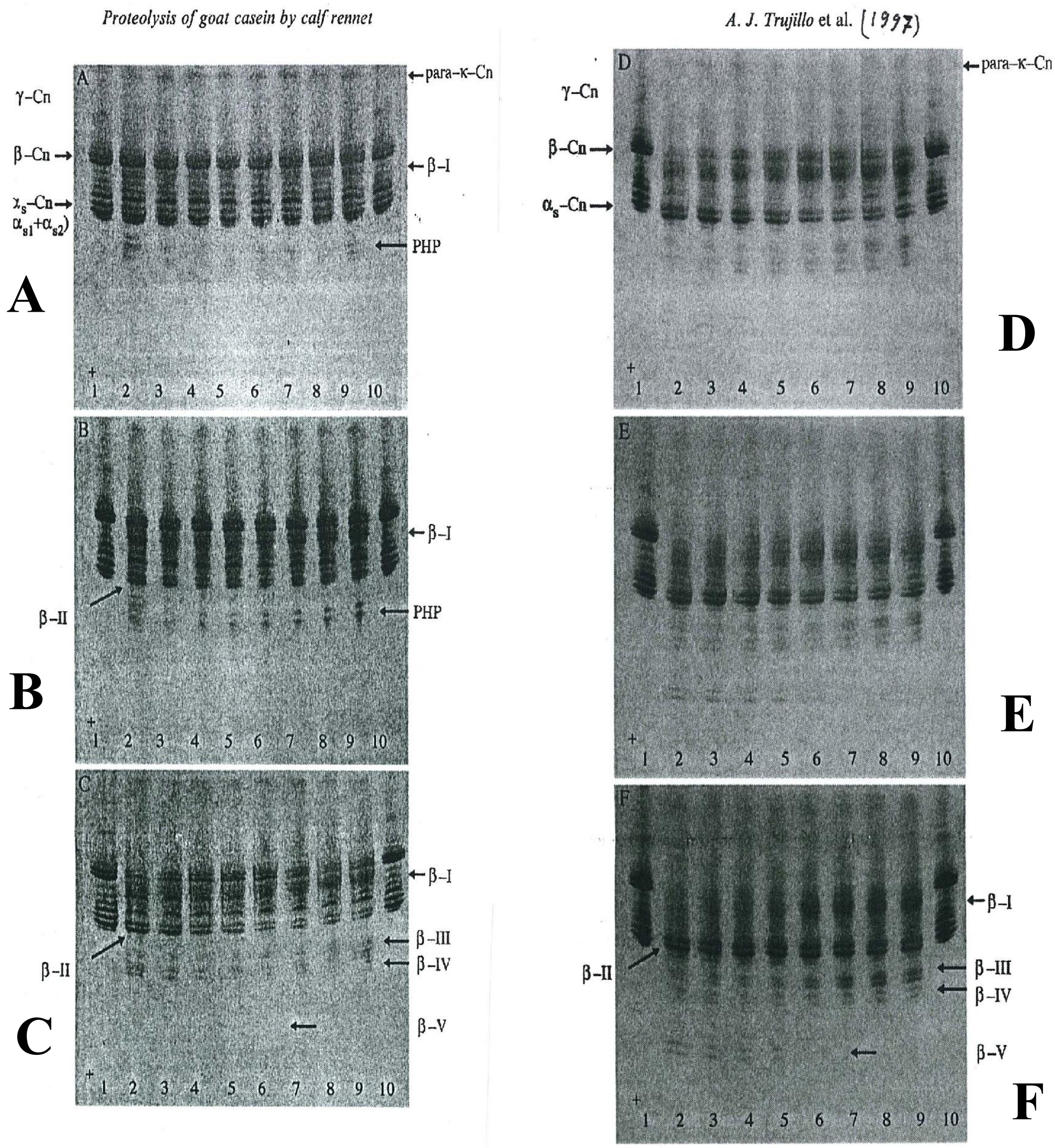
The proteolytic activity of calf rennet on goats casein showed that it was hydrolysed to give characteristic breakdown products from individual caseins [β_1 to BV for, B–CN; Primary hydrolysed products from αs_1-CN; Para–K–CN from K–CN and other degradation products of αs_2–CN (Fig. 1). Both goat β-CN and αs_1-CN more sensitive to hydrolysis than their bovine counterparts under the same conditions (Trujillo *et al.,* 1997). They mentioned that the electrophoretic patterns of hydrolysates produced from whole rennet goats milk after prolonged incubation time were similar to those produced from isolated goats B–CN showing that B–CN and its degradation products are quite resistant to proteolysis compared with αs_1–CN and its primary hydrolysis products as in cows counterparts.

The possibility of improving the yield and rennetability of goats milk was carried by application of high pressure. High pressure causes disruption of micelles into smaller particles, increasing amount of serum casein, denaturation of B-lg, enhancing protein in curd but did not improve the rennet properties (Law *et al.,* 1998 and Lopez *et al.,* 1998).

Compositional and characteristic changes of goats milk closely affected cheese processing steps and consequently affected the properties and quality of the resultant cheese.

Many investigations concerning production of various types of goat cheese were achieved by different means and different attitudes such as blue veined cheese hard cheese and mozzarella cheese (Ali *et al.,* 1993; Garballo *et al.,* 1994; Freitas *et al.,* 1995; El-Koussy *et al.,* 1995; Calandrelli *et al.,* 1997; Cerutti 1997; Ahmed and Abdel Razig, 1998; Gomes and Malcato 1998; Lopez *et al.,* 1998; and Le-Queré *et al.,* 1998).

Goats milk Gouda cheese is generally made in small artisanal units by traditional technology Seifu *et al.* (2004) and has a special taste and flavour very different from that of cow's milk cheese (Kalantzopoulos, 1993). But chesses made under these conditions may not have the minimum hygiene and sanitary standards necessary to obtain consistent product quality (Emaldi, 1995). Most reports of processing of goats milk do not include pasteurization (Loewenstein, *et al.,* 1980). The consumption of cheese made from unpasteurized goats milk has been identified as the cause of epidemics of brucellosis (Wallach, *et al.,* 1994), listeriosis and food poisoning due to enterotoxin production by *Staphylococci.* (Parente and Mazzatura, 1991). To save the healthy benefit of goats milk many cheese made from raw milk, raw goats milk cheese represents a significant proportion of ripened cheeses in most Mediterranean countries (Trujillo *et al.,* 2002).



pH pH

Fig. 1. **Urea—PAGE electrophoretograms of whole goat casein hydrolysed by calf rennet at 30°C for (A) 1, (B) 4, (C) 15, (D) 30, (E) 48 and (F) 72 h. Unrenneted controls (lanes I and 10) and samples hydrolysed at pH 3.8, 4.2, 5.0, 5.4, 5.8, 6.2 and 6.6 (lanes 2-9), respectively.**

Alichanidis and Polychroniadou (2008) reported that traditional cheeses represent a heritage and are the result of accumulated empirical knowledge passed on from generation to generation. Pedoclimatic conditions in most parts of the East-Mediterranean and neighbouring countries are characterised by relatively small and irregular precipitations, hot and dry summers, and a largely hilly terrain. Such environmental conditions are not very favourable for cattle but suitable for sheep and goats. Thus, the majority of traditional cheeses in these countries were – and most of them still are – made from the milk of these two animals. The relatively high ambient temperature, the lack of refrigeration facilities and the fact that most of the cheeses were produced in family enterprises or in small artisanal units let the cheese market to be dominated (> 50%) by "white brined cheeses" (WBC), which are ripened and stored under brine until consumption, e.g. Feta, Domiati and Beyaz-Peynir. WBC have no rind, no gas holes and are soft to semi-hard with an acidic (pH – 4.5), salty and, some of them piquant taste. To improve keeping quality, the drained curd of some WBC is additionally scalded at very high temperatures (90-100 °C), e.g. Halloumi and Nabulsi. Traditional cheeses of the region also include pasta filata semi-hard cheeses (e.g. Kashkaval), the curd of which after draining and acidification (pH – 5.2) is subjected to a texturising process (heating, kneading and stretching at ~ 75 °C). They usually have a flat-cylindrical shape, no holes and straw-yellow to yellow colour. Whey cheese production (e.g. Myzithra, Manouri, Lor, Anari, Urda and Skuta) was developed very early in this area, since the whey from sheep's and goat's milk cheese is very rich in protein. The yield can be improved if the milk of these small ruminants and/or cream is added to the whey.

Karagozlu *et al.* (2009) studied the chemical and microbiological compositions of some Cimi Tulum cheeses, which are made from goats milk, were investigated during 90 day of ripening period. Cimi Tulum cheese contains 57.73% total solids; 30.01% fat; 3.51% salt; 22.27% protein; 2.92% water soluble nitrogen and 1.75% lactic acid. Amounts of total solids, fat, salt, protein, water soluble nitrogen and free fatty acids have increased during ripening period. During the same period salt and fat ratios within the total solids have decreased. Average percentages of fatty acid composition of these cheeses were determined for ripening period of 90 days. Oleic acid took the first place with 31.73% and was followed by palmitic acid with 24.19% and myristic acid with 9.32%. Microbiological changes were also monitored during ripening period. In Cimi cheese 8.361 log cfu/g total bacteria were detected. In addition, average amounts were determined as; 7.301 log cfu/g for Lactobacilli; 7.278 log cfu/g for Streptococci; 0.176 log cfu/g for Enterococci; 5.716 log cfu/g for Coliform; 7.000 log cfu/g for Psychrophilic group; 7.000 log cfu/g for Lypolitic bacteria; 4.173 log cfu/g for Staphylococci genus and 1.623 log cfu/g for yeast. According to these results, difficulties of producing a standard final product out of goat milk alone in traditional conditions and especially likely health hazards were observed, and therefore, not recommended for consumption. However, since this cheese is commonly consumed, standard industrial production conditions should be established.

El-Sheikh *et al.* (2011) studied the effect of ripening conditions on the properties of blue cheese produced from cow's and goat's milk and concluded that blue cheese (Style Roquefort) can be successfully made from goats milk, the resultant cheese had a similar properties compared with that made from cow's milk. Also, this cheese had acceptability over than that made from cow's cheese and was also, ranked the highest total score during ripening.

Rita de *et al.* (2013) compared the nutritional, textural and sensory characteristics of Coalho cheese made from goat's (CGM) or cow's milk (CCM) and their mixture (CCGM) during cold storage for 28 days. Among the assessed physiochemical parameters, the type of milk used during production only influenced ($P < 0.05$) the moisture, fat and salt contents of the cheeses. CGM and CCGM showed higher content of short- and medium-chain fatty acids ($P < 0.05$), such as C6, C8 and C10 and C12, and long-chain polyunsaturated fatty acids C18:2n6c, and lower content of C16 and C16:1. All cheeses presented satisfactory sensory characteristics for most of the assessed parameters. However the addition of cow's milk to goat's milk improved sensory acceptability, mainly through the reduction of goat's milk odor and flavor. Coalho cheese made with the mixture of cow's and goat's milk maintained particular positive nutritional characteristics of goat's cheese, especially with respect to the fatty acids profile, with improved acceptability. All the cheeses maintained, in general, their properties throughout storage time.

Main goat cheese types can be classified as follows: (Yangilar, 2013).

1) Fresh and soft cheese: Fresh type prepared by acid curdling with a small dose of rennet. It is consumed the day following preparation; and it contains 60-80% moisture. The great taste is not strong with fine texture such as Queso-Blance (Latin America). While soft cheese produced as fresh cheese but ripened for 10 to 30 days and it has 55 to 60% moisture, such as Gibna Beida (Sudan), Feta (Greece) and Saint Mareá and Cammenbert (France).

   Saint Moreé is surface ripened cheese prepared by a 24h coagulation step at 17-20°C after addition of mesophilic lactic culture (20 ml/L) and a rennet solution (6 ml/100L). Moulding was operated by manual pouring of curd in cylindrical moulds (Ɵ6 and high 18 cm). After 24 h of whey drainage, cheese were taken of, salted with dry salt and then sprayed with *P. geotricunm* mould spores and ripened for one month. It was characterized by very low level of casein hydrolysis (5%) and high level of lipolysis (up to 6%). Seven compounds are characterized in Saint Mareá cheese as have a specific goat cheese aroma. They are hexonoic, octanoic, nonenoic, decanoic, 3-methylbutanoic, 4-methyl octanoic and 4-ethyl octanoic acids; some were already present at levels higher than their threshold value in 2 day-old cheese, whereas some others only reached this value after 31 days (Le-Queré *et al.,* 1998).

2) Blue-Viend Cheese: Curd of this cheese is prepared with lactic acid culture and rennet. It has inside a greenish or bluish marbled appearance which originates from the mycelial filmants of mould such as *P. roqueforti* or *P. glancum*. After 1 to 2 hours of curdling. The curd is cut in cubes, put in moulds and inoculated with penicilum. After salting and piercing, the cheese is ripened for 1-4 months at 9-10°C and 90-95% RH. For example Savoy (France), Roqufort (France), Cabrale (Spain) and Gemondo (Portugal) (Ali *et al.,* 1993).

3) Semi-hard cheese: It contained 40-50% moisture and prepared by using mesophilic started and rennet. After curdling, cutting the curd, scalting, moulding, pressing and salting, the curd was waxed and ripened for 1-5 months at 8-10°C and 90-95% R.H. Edam is a good example of semi-hard cheese.

4) Hard Cheese: It contained 30-40% moisture and produced in warm countries or in mountainous area. For example Chevrotin which produced in French Alps, Kefalotili (Greece), Ras (Egypt) and Manchege (Spain).

Regarding to Chevrotin cheese, it prepared by culture and rennet curdling. After rapid curding, the curd is stirred until grains begin to form about size of a rice corn, then moulded pressed, salted and reipened for 5 days in a fresh and well-ventilated palce the cheese is preserved for 1 to 3 months submersed in olive oil.

Attulla *et al.* (2014) fortified goat cheese with caramel, cocoa and cocoa with walnuts are corresponamg high quality protein ingredient for sweet spreadable cheese. The ω-6/ ω -3 ratios was at level 6.00, 7.7 and 4.7 contribute to caramel sweet cheese, cocoa sweet cheese, and cocoa & walnut cheese, respectively. Methionine + cysteine and follows by tryptophan were the most limiting essential amino acids, in these ingredients. Different formulas' goat cheese could be improved their amino acids scores. The highest cohesiveness value was recorded for of cocoa and walnut sweet cheese treatment followed by caramel spreadable sweet cheese and cocoa spreadable sweet cheese appreciable differences between them. Revealing to microbiologic assays, sweet cheese samples is stable during storage against poising bacteria and other microorganisms. Conclusion, a fortified sweet goat cheese with cocoa and walnut could be regards as Egyptian economic products and nourished for human consumption especially for children feeding.

Nireo *et al.* (2014) compared the physicochemical, microbiological, and sensorial characteristics of Caciocavallo cheeses, made from cow milk and a mixture of cow with ewe or goat milk, during ripening. Different cheese-making trials were carried out on an industrial scale following the standard procedure of pasta filata cheeses, with some modifications. The percentage of the different added milk to cow milk influenced compositional and nutritional characteristics of the innovative products, leading to a satisfactory microbiological and sensorial quality.

Castillo *et al.* (2000) showed that a diffuse reflectance sensor, which used optical fibers and near-infrared radiation (NIR) at 880 nm, was used to monitor goat's milk coagulation. A randomised block design replicated three times was utilized to test the effects of pH, temperature and enzyme concentration on diffuse reflectance parameters. Milk pH was adjusted to three levels (5.5, 6.0 and 6.5) and coagulated at three different temperatures (28, 32 and 36°C), using three enzyme concentrations (0.020, 0.035 and 0.050 mL kg_{-1} of milk). A linear cutting time prediction equation, $T_{cut}= \beta T_{max}$, was found to predict visual cutting time with a standard error of prediction of 84.5 s and an R^2 of 0.9785. β was affected by pH, temperature and enzyme concentration. The diffuse reflectance parameter (T_{max}) was strongly correlated to the Berridge clotting time (R^2 = 0.9913). Parameters generated from the diffuse reflectance profiles, with the exception of response-based parameters, were found to be a function of coagulation rate.

Goats Butter

It is not very common to produce butter from goats milk except in some developing countries or with both nomadic and sedentary population; sometimes it is artificially coloured in order to be like cows butter (Le-Jaouen, 1981).

It is unlikely that a significant industrial and commercial butter production can be expected because the difficulty in cream separation, soft texture and susceptibility to hydrolytic rancidity. Few works concerning with goat butter was done. Bindal and Wadhwa (1993) demonstrated that goats ghee has a higher liquid fraction (69%) compared with cows ghee (30.5%) or buffaloes ghee (36%). Levels of glycerides were also higher in goats ghee 64.5 vs. 54.5 and 56% for cows and buffaloes ghee respectively. Consequently melting point and softening point of goats ghee (30.2° and 29.4°C) were lower than in cows ghee (35.8° and 33.7°C).

Idoui *et al.* (2013) made first report describing microbiological physiochemical properties and fatty acid composition of a traditional butter produced form goat's milk in East of Algeria. The results show the presence of lactic acid bacteria (3.51 x 10^5 + 2.44 cfu/g), psychotrophic bacteria (1.11 x 10^5 + 1.31 cfu/g), moulds and yeasts (39.08 x 10^2 cfu/g), lipolytic bacteria (4.41 x 10^3 + 5.91 cfu/g) and the absence of total coliforms except in one sample. The presence of Staphylococcus and Salmonella was not detected in the analyzed butter samples. Variations in values of the physicochemical parameters were recorded. Thus, the average values of moisture and impurity did not exceed 35.73% and 12.25% respectively. Values of iodine index and saponification index extended between 37.17 - 85.95 mg/ 1/g and 84.15 – 254.87 m g KOH/g respectively. Recorded value for peroxide index and acid index are on average equal to 1.41 + 1.12 mg KOH/g and 67.86 + 19.13 eq O_2/kg respectively. The determination of fatty acids composition by GC-MS showed the prevalence of the saturated fatty acids dominated by palmitic acid with a low rate of unsaturated fatty acids dominated by oleic acid.

Goats liquid milk and beverages

El-Senaity *et al.*(1989) produced goats milk beverages flavoured with fruit juices with acceptable properties different. Ahmed et al (1992) manufactured three types of fruit preparations (Guava, Orange and Fig) for fortifying skim goat milk in order to prepare low fat beverages. The obtained beverages were analysed for some physical, microbiological and organoleptic properties during 10 days storage at 5 + 10. The acceptance of the resultant beverages depended upon the type of fruit syrup and its concentration Guava (10%) beverage was the most acceptable one, followed by 15% Orange beverage and then the beverage containing 10% Fig. Control and flavoured beverages were free from coliform spores, moulds and yeast during 10 days of storage.

Chemical characteristics of pasteurized goats milk and goat milk kefir prepared using different amount of Indonesian Kefir grains and incubation times had been studied. Kefir samples were prepared using amount of Kefir grains 3,5 and 7% (V/V) with incubation time of 8,21 and 24 hours, respectively, and controls were made without kefir grains and before incubation. The resulted showed that pasteurized goat milk samples contain: Fat 3.43%, protein 4.72%, lactose 4.30%, titratable acidity number as lactic acid content 0.19% and pH value of 6.66 while the best chemical characteristics (pH 4.37, ethanol content 0.917, titratable acidity number 0.76%; and lactose content: 4.23%) was obtained from goat milk kefir prepared with 7% (W/V) kefir grains and incubation time of 24 hours (Purnomo and Musilmin 2012).

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