



Original Research Article

Local goat milk valorization and dairy products characterization in the southern Tunisia arid zone

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ABSTRACT

Keywords

Milk;
Goat;
Cow;
Yogurt;
physico-chemical.

The objective of this study is to determine the physicochemical composition quality of goat milk for its turn in flavored yogurt. Indeed, goat's milk is a food interesting nutritional and dietary values. This work shows that the pH of goat milk is similar to that of cow's milk, they are average respectively 6.70 and 6.75, therefore, they have different acidity 19.05 ° D to goat milk and 17 ° D to cow's milk. The latter is less dense 1,031 than goat milk 1.029 Cp. For the viscosity, 3.1 for the cow and 3.63 for the goat. On the ash content, there is a higher average in the cow (8.27 g / l) than in goats (7.8 g / l). For the yogurt, manufacture of four types of yogurt (goat yogurt, goat yogurt flavored with strawberry yogurt and cow with the aroma and flavor without (Control)), then the assessment of the physical characteristics and sensory, shows that the aromatization yogurt by the strawberry retain the physical status. On the other hand, monitoring of yoghurt analyzed after a few days of its manufacture and storage at 4 ° C, shows that there is an increase in contaminant flora, which can be concluded that the expiry date not more than seven days. In addition, the study shows that sensory-flavored is most appreciated by the consumer.

Introduction

The milk of small ruminants such as goats is of particular economic interest in the developing countries. The production of this type of milk has to be a useful strategy to tackle the problems of under nutrition (Haenlein, 2004). Although the world production of goat milk has been relatively minor compared to that of bovine milk

heads with 55% increase during the last 20 years, and goat milk production has reached 12.2 million tones with 58% increase during the same period (Haenlein and Abdellatif, 2004). Goats' milk has special nutritional properties that make it attractive to some consumers. It is easier to digest than cows' milk and may have

certain therapeutic value (Park 1994a; Haenlein 2004). The use of goat becomes an opportunity to diversify the dairy market since it allows us to develop added value to the fermented products with particular characteristics compared to cow's milk. The major differences between goat's and cow's milk are related to the different proportions of the different kinds of casein, and also to the different structure and size of fat globules and protein micelles (Tziboula-Clarke, 2003). All these differences could lead to the milk behaving differently during processing that could affect the final quality of goat's milk dairy products (Vargas *et al.*, 2008).

The special characteristics concerning the composition of goat milk mean that its nutritional utilization is markedly higher than is the case with cow's milk. Thus, the protein of goat milk is more digestible (Park 1994b; López-Aliaga *et al.*, 2003; Haenlein, 2004), and less allergenic (Lara-Villoslada *et al.*, 2004). Similarly, the fat of goat milk is more digestible (Alfárez *et al.*, 2001; Haenlein, 1996), and it may be considered an excellent source of energy for use in various metabolic processes and even for combating metabolic diseases (Sanz -Sampelayo *et al.*, 2007). However, studies on yogurt from milk of the local breed goats were scanty. Therefore, in this study we would like to evaluate the nutritional and sensory quality before and after storage of goat milk yogurt with reference to cow milk yogurt.

Materials and Methods

Materials

Goat and cow milk were obtained from Arid Land Institute Medenine in Tunisia. Milk was collected from number of lactating animals. Then samples stored in a

refrigerator for subsequent processing. All chemicals and media used in this study were of reagent grade.

Yogurt making

The step of preparation yogurt is:

Standardization: In manufacture of yogurt, milk powder is mixed with 40g of milk for cow yogurt and 60 g for goat yogurt and sugar;

Seeding close: The close is used because natural yogurt contains lactic acid bacteria. During their growth the bacteria degrade both the lactose into lactic acid, causing a lowering of pH and gelling of the medium with an irreversible structural change;

Packaging: The mixture ferments milk-is packaged in jars;

Aromatization: Adding flavor, purified strawberry at the bottom of each pot.

Incubation: This is the storage of yogurt in the oven at temperatures 43 ° C for 4 hours;

Cooling: When the acidity reaches a certain threshold (70-80 ° D), it is necessary to block acidification by inhibiting the growth of lactic acid bacteria, which is why it will significantly lower the temperature.

Gross composition

Total nitrogen was measured by micro-Kjeldahl method (AOAC 1990). Protein was calculated as N x 5.38. Fat was determined by the Gerber method (Bradly *et al* 1992). Ash content was determined by dry ashing of the samples for 24 h at 550°C. Moisture content was determined by drying samples overnight at 105°C

(AOAC 1990). Total solids content was determined by gravimetric method by drying the samples in an oven at 105°C for 24 h (AOAC 1990).

Total titratable acidity was determined by AOAC (1990) method. The pH was measured using a pH-meter (HANNA-pH 210, Germany) and the viscosity was measured by a viscometer (Brookfield DV-E).

Sensory analysis

Sensory profiling of the yogurt samples was conducted, using conventional profiling, by a trained panel. Ten judges were selected among the faculty, staff, and students of Livestock and wildlife laboratory (IRA Medenine) and High Institute of Biology (ISBAM) who had successfully passed standardized tests for olfactory and taste sensitivities as well as verbal abilities and creativity. The panellists were given a hedonic questionnaire to test taste, texture, color, flavor and overall acceptability of coded samples of cow milk yogurt as a control and goat milk yogurt. Both fresh samples and those stored for different period of time (5, 10 and 15 days) of both yogurt types were tested. They were scored on a scale of 1–5 (1 = poor, 2 = fair, 3 = good, 4 = very good and 5 = excellent). Each attribute was evaluated in triplicate and the values were then averaged.

Results and Discussion

Gross composition of fresh milk

The table 1 shows changes in pH, total acidity, density, viscosity, protein, fat and Ash of two types of mil (milk goat and milk cow).

Compared to the composition of fresh cow milk, goat milk had higher pH, total acidity, density, viscosity, protein, fat and ash. Moreover, the total protein content was found higher than values reported for goats' milk of different worldwide breeds (Guo et al 2001; Hadjipanayiotou 2004; Stelios and Emmanuel 2004; Güler 2007; Pirisi et al 2007) while, fat was comparable to goat milk from Turkish breed (Güler 2007). In general, Goat's milk reported to provide higher proportion of total solids, protein and fat than cow milk (Haenlein 1996). The nutrient compositions of goat milk can be greatly influenced by several factors such as season, stages of lactation, breed, diet, individual animal and environmental management conditions (Haenlein 2004). Preparation of yogurt slightly changed the level of protein, fat, ash, total solids and moisture for both goat and cow milk products, suggesting the effect of the indigenous micro flora on such constituents. The pH, density and ash of milk goat was remarkably decreased relative by milk of cow but the acidity, viscosity, fat and the protein of milk goat increased relative by milk of cow.

Gross composition of yogurt

The table 2 shows changes in pH, total acidity and the viscosity of four types of yogurt (yogurt goat, yogurt of goat with aroma, yogurt of cow and yogurt of cow with aroma).

The pH, total acidity and viscosity of four yogurt types (yogurt goat, yogurt goat with aroma, yogurt cow and yogurt cow with aroma) were (4.78, 4.75, 4.7 and 4.64) for pH, (73.8, 76.5, 65.7 and 67.7) for total acidity, (1160, 1496, 1260 and 1544) for viscosity, respectively.

Table.1 Gross composition of goat and cow milk

Gross composition	Milk goat	Milk cow
pH	6.7	6.75
Acidity (°D)	19.05	17
Density	1.029	1.031
Viscosity (Cp)	3.63	3.1
Fat (g/l)	39.63	19
Ash (g/l)	7.8	8.27
Protein (g/l)	31.3	27.9

Table.2 The pH, acidity and viscosity of goat and cow yogurt

Parameters	Yogurt goat	Yogurt goat with aroma	Yogurt cow	Yogurt cow with aroma
pH	4.78	4.75	4.7	4.64
Acidity (°D)	73.8	76.5	65.7	67.7
Viscosity (Cp)	1160	1496	1260	1544

Table.3 Colour, flavour, texture and taste of yogurt samples during storage

Parameters	Yagurt goat					Yagurt cow				
	Preferences					Preferences				
	1	2	3	4	5	1	2	3	4	5
Colour	0	0	3	12	25	0	0	2	7	27
Flavour	0	2	8	12	18	3	0	2	15	30
Taste	0	4	5	14	16	0	3	4	12	25
Texture	0	2	8	14	21	0	4	3	13	23

A faster acidification and lower pH values in goat milk yogurt was reported by Bozanic et al (1998). Different behaviour goats' milk (Tamime and Robinson 1999). Moreover, the activity and growth rate of the starter cultures are strain dependent. Hence, the acidification rate of lactic acid bacteria varied with the type of milk (Vargas et al 2008).

Sensory evaluation

Colour, flavour, texture and taste of yogurt samples during storage are shown in Table 3. The scores of all sensory attributes of

could be explained by the enhancement of the microbial growth, acidity progress and peptidase activity of Lactic acid bacteria in goat milk yogurt are significantly lower ($P \leq 0.05$) than those of cow milk yogurt. Goat milk yogurt was evaluated as less consistent and more acid, with a non-typical yogurt taste and flavor. Similar sensory characteristics were reported by many researchers (Abrahamsen and Rysstad 1991; Alichanidis and Polychroniadou 1996; Duboc and Mollet 2001; Vargas et al 2008) of yoghurt manufactured from goat milk.

This study, undertaken in order to contribute to a better understanding of goat milk collected in the Institute of Arid this type of milk, and to a better use of it in yogurt industry. In terms of physicochemical analyzes, it marks a difference between goat milk and cow's milk. The latter being taken as reference milk, there is a significant difference in fat.

Simple technology has been implemented for the manufacture of yoghurt and the creation of a new product that is the goat yogurt flavored strawberry. Physical analysis showed that the yogurt composition is not significantly modified by the addition of flavor to the above pH parameter. Thus this analysis shows that the viscosity of our product is about 1160 for natural yoghurt Cp 1496 Cp for flavored yogurt that is consistent with the Tunisian standard. After all, we notice an improvement in the bacterial quality and organoleptic quality.

References

- Abrahamsen R K and Rysstad G 1991. Fermentation of goat's milk with yogurt starter bacteria: a review. *Cultured Dairy Product. J.* 26: 20–26.
- Alferez M J M, Barrionuevo M, Lopez-Aliaga I, Sanz Sampelayo M R, Lisbona F, Robles J C and Campos M S 2001. Digestive utilization of goat and cow milk fat in malabsorption syndrome. *J.Dairy Res.* 68: 451–461.
- Alichanidis E and Polychroniadou A 1996. Special features of dairy products from and carbon dioxide in yogurt starter grown in cow's milk and goat's milk. *J. Dairy Res.* 54: 257–266.
- AOAC 1990. Official methods of analysis, 15th edition., Association of Official Analytical Chemists, Washington, D.C, USA.
- Regions Medenine, focuses on the physicochemical characteristics of
- Bozanic R, Tratnik L and Maric O 1998. The influence of goat milk on the viscosity and microbiological quality of yogurt during storage. *Mljekarstvo* 48: 63–74.
- Bradly Jr R L, Arnold Jr E, Barbano D M, Semerad R G, Smith D E and Vines B K 1992. Chemical and physical methods. In: Marshall, T.R. Standard methods for the microbiological Examination of Dairy products, 16th edition., American Public Health Association, Washington D.C., USA.
- Duboc P and Mollet B 2001. Applications of exopolysaccharides in the dairy industry. *Inter. Dairy J.* 11: 759–768.
- Güler Z 2007. Levels of 24 minerals in local goat milk, its strained yogurt and salted yogurt (tuzlu yoğurt). *Small Ruminant Res.* 71: 130–137.
- Guo M R, Dixon P H, Park Y W, Gilmore J A and Kindstedt P S 2001. Seasonal changes in the chemical composition of commingled goat milk. *J. Dairy Sci. Suppl.* E79–E83.
- Hadjipanayiotou M 2004. Replacement of barley grain for corn in concentrate diets fed to dairy Damascus goats at different frequencies. *Small Ruminant Res.* 51: 229–233.
- Haenlein G F W 1996. Nutritional value of dairy products of ewe and goat milk. In *Production and utilization of ewe and goat milk – Proceedings on the IDF/Greek national committee of IDF/CIRVAL seminar.* Brussels, Belgium: International Dairy Federation, pp. 159–177.
- Haenlein G F W 2004. Goat milk in human nutrition. *Small Ruminant Research* 51: 155–163.
- Haenlein G F W and Abdellatif M A 2004. Trends in small ruminant husbandry

- and nutrition and specific reference to Egypt. *Small Ruminant Res.* 51: 185–200.
- Lara-Villoslada F, Olivares M, Jiménez J, Boza J and Xaus J 2004. Goat milk is less immunogenic than cow milk in a murine model of atopy. *J. Pediatric Gastroenterol. Nutrit.* 39: 354-360.
- López-Aliaga I, Alférez M J M, Barrionuevo M, Nestares T and Sanz Sampelayo M R 2003. malabsorption syndrome. *J. Dairy Res.* 68: 451–461.
- Park Y W 1994a. Hypo-allergenic and therapeutic significance of goat milk. *Small Ruminant Res.* 14: 151-159.
- Park Y W 1994b. Nutrient and mineral composition of commercial US goat milk yogurts. *Small Ruminant Res.* 13: 63–70.
- Pirisi A, Lauret A and Dubeuf JP 2007. Basic and incentive payments for goat and sheep milk in relation to quality. *Small Ruminant Res.* 68: 167–178.
- Sanz Sampelayo M R, Chilliard Y, Schmidely P and Boza J 2007. Influence of type of diet on the fat constituents of goat and sheep milk. *Small Ruminant Res.* 68: 42–63.
- SAS 1997 SAS/STAT User's Guide, Statistics Release 6.3 edn. SAS Institute Inc., ED. Cary, NC.
- Stelios K and Emmanuel A 2004. Characteristics of set type yogurt made from caprine or ovine milk and mixtures of the two. *Inter. J. Food Sci. Technol.* 39: 319–324.
- Tamime A Y and Robinson R K 1999. *Yogurt science and technology.* Cambridge, UK: Woodhead Publishing Ltd.
- Tziboula-Clarke A 2003. Goat milk. In H Roginnski, J W Fuquay, P F Fox (Editors), *Encyclopedia of dairy sciences, Volume 2* (pp. 1270–1279). London, UK: Academic UK: Woodhead Publishing Ltd.
- Vargas M, Chafer M, Albors A, Chiralt A and Gonzalez-Martinez C 2008. Physicochemical and sensory characteristics of yogurt produced from mixtures of cows' and goats' milk. *Inter. Dairy J.* 18: 1146–1152.