Papers on Life Science, Marine & Environmental Research
Volume 1, issue 1, 2022
ISSN: 2800-101X
Pages : 14-17

PoLSMER

Research Article

Evaluation of the physico-chemical and microbiological parameters of a yogurt prepared from goat and sheep milk during storage

BOUCHIBANE Malika[1,♠], YABRIR Ben Alia[2], CHERIGUENEAbderrahim[3], CHOUGRANI Fadela[3], AIT SAADA Djamel[1]

[1]Laboratory of Food Technology and Nutrition, Abdelhamid Ibn Badis University, Mostaganem, Algeria
[2] Laboratory of Microbiology, University Ziane Achour, DJELFA, Algeria
[3]Laboratory of Bioeconomy, Food and Global Health, University Abdelhamid Ibn Badis, Mostaganem, Algeria
♠Contact: malika.bouchibane.etu@univ-mosta.dz/ malika.bio22@gmail.com

Received: 8 May 2022/ Accepted: 25 May 2022/ Published: 30 June 2022

Abstract

This study consists in characterizing the production of yogurt-based on small ruminants' milk. First, the microbiological and the physicochemical quality of the raw material was studied. The finished product was tested for quality and stability. The latter was evaluated during refrigerated storage. On the physico-chemical level, the analyses concerned the pH, acidity, density, total dry extract, and fat content. On the microbiological level, the analyses concerned the enumeration of the following germs "total germs, total and fecal coliforms, yeasts and moulds, lactic acid bacteria" and the search for *Staphylococcus aureus* and Salmonella. The tested kinds of milks as well as the finished product present a very good microbiological quality and are very satisfactory on the hygienic and sanitary levels. The physicochemical parameters are in conformity with the standards and are in accord with the literature. The viable lactic flora is present in the number defined by the regulation, streptococci are dominant compared to lactobacilli. From an organoleptic point of view, very good quality and stability of the organoleptic properties were noted during the storage period at 6°C.

Keywords : milk, small ruminants, yogurt, quality, stability

Introduction

Milk and dairy products are very popular in Algeria. The nutritional interest of milk resides in its richness in basic nutrients (proteins, lipids and carbohydrates), it is one of the few foods that is suitable for different age groups where it can be consumed as is in a fresh state or in the form of processed product, including yogurt. In our country, we consume mainly dairy products from cow's milk. This is mainly due to the availability of cow's milk and the massive importation of bovine milk powder. Milk from small ruminants is consumed as is by nomadic populations or rarely transformed into dairy products such as D'han (butter) or fermented milk.

Yogurt, one of the dairy products whose technology is easy to implement, is very appreciated by the consumer. However, it is a fragile and perishable product, as it constitutes a favorable environment for the development of microorganisms, which requires rigorous hygienic conditions during its manufacture, its conservation and a good quality of raw material. Cold is considered the best way to ensure the safety and stability of yogurt (Gret 2002). It is in this context and in order to satisfy the needs of the consumer, diversify production and improve the development of the production of dairy products based on milk of small ruminants in our country, we conducted our study which is interested in first characterizing the production of a yogurt based on sheep and goat milk, then to evaluate the stability of products obtained during refrigerated storage.

Material and Methods

Our study was conducted at the laboratory of quality control "Research and Development" and Microbiological Analysis, Physico-chemical in the dairy Trèfle (Blida province) and at the laboratory of hygiene of the same province. The milk samples come from two species of small ruminants (goat and sheep). The sampling was conducted during the spring among farmers located in the wilaya of Medea. The milk samples were taken from healthy goats and sheep, they are transported in a freezing box to the laboratory where they are immediately analyzed.

The tests involved physico-chemical and microbiological analyses on the one hand, and on the other hand the stability of the product during refrigerated storage (+4°C to +6°C). Each sample was divided into three aliquots. One for physico-chemical analysis, one for microbiological analysis and one for yogurt production. The pH values were measured using a previously calibrated pH meter. The density was carried out using the thermolactodensimeter. The acidity

was determined using an alkaline solution (NaOH) in the presence of the phenolphthalein color indicator (AOAC Standard 2000). Total dry extract was determined according to the thermobalance and desiccator methods by heating at 103°C for 3hours using the following formula (NA 679, NA1130 (ISO 5534).

$$EST\ (\%) = (M0 - M1) / P \times 100$$

Fat was determined according to Gerber method using butyrometers (NA15019, 2008 : *ISO11870*). The methods of enumeration and research of microorganisms in milk and finished products were carried out according to the internal practices of the Trèfle unit and the official journal. The microbiological germs studied with the media used are represented in Table I. The ingredients of the yogurt prepared from the two types of milk are shown in Table II. The control of the organoleptic quality of the experimental yogurts is carried out each morning in front of a tasting team on a scale of notation from (1 to 4 points) in order to appreciate the following organoleptic characteristics : odor, color, texture, and taste.

Results and Discussion

Physicochemical analysis of small ruminant milk

Sheep milk has a lower pH than goat's milk. For goat milk, the pH value recorded is comparable to that reported by Gaddour et *al,* (2013) with a pH equal to 6.77 noted on the milk of local goats in Tunisia. For sheep milk, the pH value found is close to that mentioned by Pirisi et *al.* (2001) for milk produced in Italy and is slightly higher than that produced in Bulgaria and Greece (Baltadjieva et *al.*, 1982). The titratable acidity of sheep's milk slightly exceeds the range established by FAO (1998). The results obtained show the richness of sheep milk in dry extract and fat compared to goat milk, The milk fat content recorded for goat milk is slightly higher than those found by El Otmani et *al*, (2013) (3.36%). For sheep milk, it corresponds to that recorded by Abd Allah (2011) (5.62%) but lower than that found by Mierlita et *al*, (2011) (6.84%).

Physicochemical analysis of yogurt during storage

We observed a remarkable decrease in the pH values for yogurt made from sheep's milk. According to Beal and Sodini (2003), the decrease in pH value is favored by the activity of lactic ferments which results in the mass production of lactic acid. A slight increase in pH was noted on day D+10 for the yogurt based on goat's milk, which reached a value of 5,0. The values recorded indicate that the pH of our yogurts is moderately acidic. A decrease in acidity is observed for both types of yogurt on day D+10, and an increase on day D+20 for the yogurt based on goat's milk. The acidity reaches 110°D. This variation is due to a too short incubation or a too low temperature (Gret, 2002).

It is observed that the fat content, independently of the type of yogurt, remains constant during the first ten days of storage and then slowly decreases at the end of storage. This is probably due to low lipolytic activity of the lactic ferments, which justifies a slight variation of the fat content for the two yogurts (Leyral and Vierling, 2001). We noticed a slight difference in the TSE for the two types of yogurt. According to Alais et *al.* (2008), a high total dry extract conditions a good consistency of the yogurt. We noticed that there is a decrease at D +20 for yogurt based on sheep's milk which reaches a value of 27.85%. According to Lorient and Philippe, (1998), proteolysis by protease enzymes that hydrolyze milk caseins into smaller constituents (polypeptides, peptides, and amino acids) implies a decrease in total dry matter.

Microbiological analysis

The lactic flora evolves and increases in number to reach its maximum at the end of ten days of conservation in the two manufactured products. Beyond that, we notice a decrease in the number of lactic ferments at the end of conservation. According to Beal and Sodini (2001), this progressive decrease can be explained by the self-inhibition of the ferments by the pH. The number of streptococci is higher than that of lactobacilli, however, the number of *Lactobacillus bulgaricus* is reversed at day D+20 for yogurt made from goat's milk. According to Vierling (2008), Streptococci grow faster and are non-acidifying than lactobacilli.

The results of the microbiological analysis of the fermented milk products show the total absence of all pathogenic or spoilage germs sought during the entire shelf life, indicating that the product has a good microbiological quality.

Very good quality and stability of the organoleptic properties were noted during the first ten days of storage at 6°C. However, a small change in taste and a slight serum in the texture were perceived at the end of the experiment. The change in taste is due to the increase in acidity and microbial activity that is not completely inhibited (Apfelbaum *et al.*, 2004). The tasting panels judged that the experimental yogurt prepared with sheep's milk was better than the yogurt prepared with goat's milk.

Table I. Microbiological germs tested

Tested germs	Media used	Incubation
Total germs	Plat Count Agar (PCA)	30°C for 72h
Total coliforms	Violet Red Bile Lactose Agar (VRBL).	30°C for 24/48h
Fecal coliforms	Violet Red Bile Lactose Agar (VRBL).	44°C for 24/48h
Staphylococcus aureus	Giolitti Cantoni, Tellurite de potassium, Chapman.	37°C for 24/48h
Salmonelles	Eau Peptonée Tamponnée (EPT), Hektoen.	37°C for 24h
Yeasts and fungi	Sabouraud.	25°C for 5j
Lactobacillus bulgaricus	Gélose de Man –Rogosa-Sharpe (MRS).	37°C for 72h
Streptococcus thermophilus	Agar (M17).	37°C for48h

Table 2. Ingredients involved in the manufacture of yogurt made from the milk of small ruminants "goat-sheep".
(**Source**: Head of the "Research and Development" laboratory, Trèfle).

Ingredients	
Recipe for goat's milk	Recipe for sheep's milk
Water 595.2 ml	Eau 2075.2 ml
milk powder(PDL) 0% 200 g	milk powder(PDL)320 g
Sugar 400 g	Sugar 400 g
Ferment 0.8 g	Ferment 0.8 g
Goat's milk 2800 ml	Sheep milk 1200 ml

Table 3. Physicochemical parameters of yogurt during storage.

	pH	Acidity (°D)	Dry extract (%)	Fat content (%)	Density
Sheep milk	6,72	26	16,82	5,5	1,038
Goat's milk	6,76	17	11,5	3,9	1,03
The standards*	Sheep : 6,5-6,85 Goat's : 6.45-6,60	Sheep: 22-25 Goat's: 14-18	Sheep : 17-19% Goat's: 11-12.2%	Sheep :7.2% Goat's :3.5%	Sheep : 1,034-1,039 Goat's : 1,027-1,035

* FAO (1995)

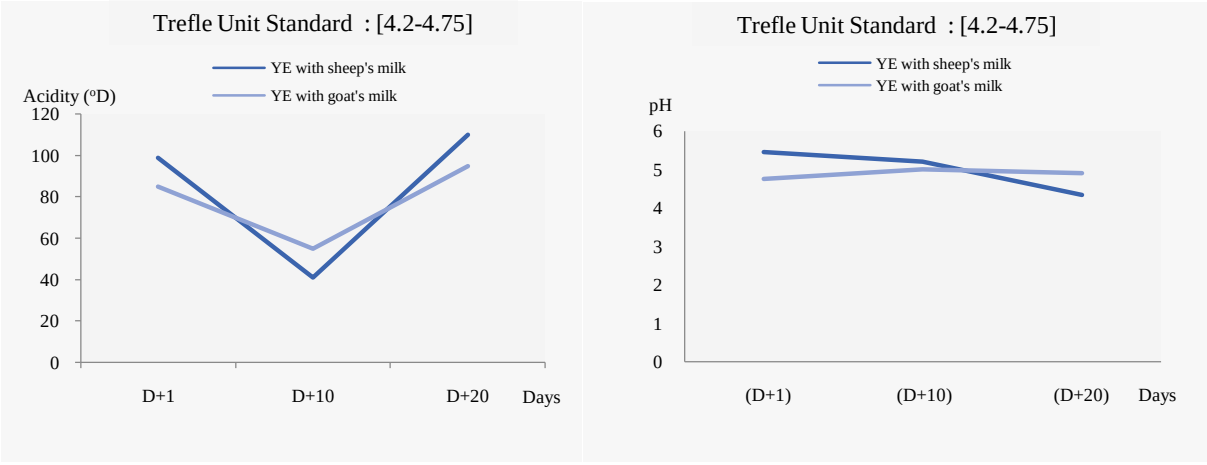

Figure 1. Variation of the pH and the titratable acidity

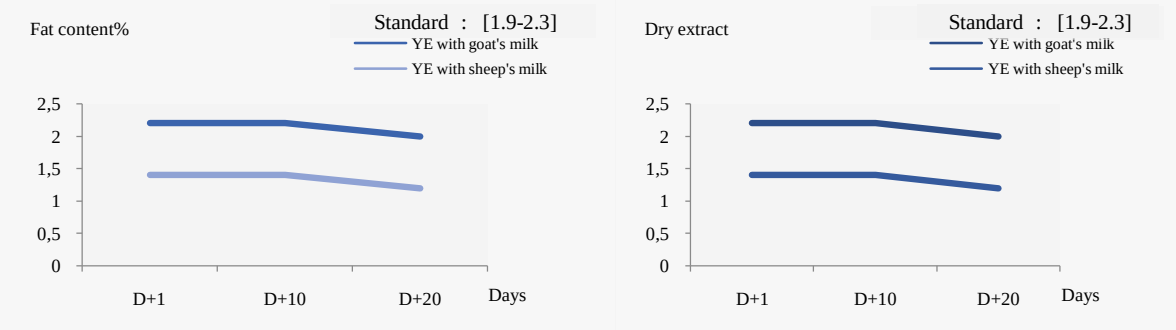

Figure 2. Variation in fat content and dry extract content.

Table 4. Evolution of the lactic flora during refrigerated storage.

	YMS			YMG			Standards JRO
	D+1	D+10	D+20	D+1	D+10	D+20	
Lactobacillus bulgaricus	1,6 10^7	2,6 10^7	1,2 10^7	2.1 10^7	3,2 10^7	2,8 10^7	More than 10^7 germs/ml
Streptococcus thermophilus	3,6 10^7	4,8 10^7	2,2 10^7	4 10^7	5 10^7	1,4 10^7	
Total number of ferments	5,2 10^7	7,4 10^7	3,4 10^7	6.1 10^7	8,2 10^7	4,2 10^7	

Table 5. Variation of the organoleptic quality of yogurts.

Type of product	Day of test	Texture	Color	Taste	Odor	Observation
YMS	D+1	4	4	4	4	Very Good and stable
YMG		4	4	4	4	
YMS	D+10	4	4	4	4	Very Good and stable
YMG		4	4	4	4	
YMS	D+20	3	4	2	4	Light serum, Good
YMG		3	4	3	4	

Conclusion

It was possible to confirm the possibility of making a yogurt-based on raw milk from species of small ruminants "goat-ewe" with the following characteristics: An acceptability on the physicochemical and organoleptic level; Compliance with microbiological standards (good microbiological quality proven by the total absence of all the germs sought; very rich by lactic ferments.

What is desirable in further studies is to carry out a similar study for the confirmation of our results obtained as well as to make a more thorough study, so we propose to determine the nutritional value of the finished product by dosing vitamins and mineral elements, and to better characterize the manufactured product by finer dosing (proteins, lactose), to be able to quantify the true energy value. Add texture agents to improve the organoleptic quality of the product. To make other tests of yogurt manufacture by cutting the kinds of milk between them or with cow's milk. To follow the microbiological and physicochemical stability of the finished products and to predict the deadline of consumption of the said products. To determine the factors that influence the composition of raw milk from small ruminants.

References

1. Abd Allah M., Abbas S. F. and Allam F.M. 2011.Factors affecting the milk yield and composition of Rahmani and Chios sheep. *International Journal of Live stock Production* , 2(3), 24-30.
2. Alais C., Linden G., Miclo L., 2008. Biochimie alimentaire. Edition Dunod, Paris, 187p.
3. Apfelbaum M., Romon M. et Dudus M., (2004). Diététique et nutrition, 6ème édition Masson, Paris : p516.
4. AOAC., 2000. Official methods of analysis. Arlington, VA : Association of Analytical Chemists, Washington, D.C., U.S.A.
5. Baltadjieva M., Veinoglou b., Kandarakis J., Edgaryan M.et Stamenova V. 1982. La composition du lait de brebis de la région de la Plovdiv en Bulgarie et d'Ioamine en Grèce. *Le lait*, 62,191-201p.
6. Beal C. et Sodini I., 2001. Fabrication des yaourts et des laits fermentés. In technique d'ingénieur, traitement agroalimentaire .Tome 2, Lavoisier, Paris, 330-764p.
7. Beal C. et Sodini I. 2003. Fabrication des yaourts et des laits fermentés. Techniques d'ingénieur. Paris. 330p.
8. El Otmani S., Hillal S., Chentouf M., 2013. Milk production and composition of « Beni Arouss » North Moroccan local goat. In: Chentouf M. (Ed), Lopez-Francos (Ed), n. 108, pp. 457 – 460.
9. FAO., 1998. Le lait et les produits laitiers dans la nutrition humaine. Collection FAO : Alimentation et nutrition no 28.Rome.
10. Gaddour A., Najari S. and Ouni M. 2013. Dairy performance of the goat genetic groups in the southern Tunisian. *Agricultural Journal*. 2 (2), 248-253.
11. Gret (2002) .Transformer les produits laitiers à la ferme édition Educagri, 237p.
12. Leyral G., Vierling E., 2001. *Microbiologie et toxicologie des aliments* : hygiène et sécurité alimentaire ; Edition CNDP d'aquitaine 3ème édition, 572 p.
13. Lorient Denis et Philippe Cayot. 1998. Structures et techno fonctions des protéines dulait, 883-892p.
14. Mierlita D., Padeanu I., Maerescu Cristina, Chereji I, Halma Elena and Lup F., 2011. Comparative study regarding the fatty acids profile in sheep milk related to the breed and parity. *Analele Universitatii din Ordea, Fascicula: Ecotoxicologie, Zootechnie Technologii de Industrie Alimentara*, 221-232.
15. NA 679, NA1130 (ISO 5534) : Laits et produits laitiers-Détermination du pH et de l'extrait sec.
16. NA15019 :2008 (ISO11870 :2000) : Laits et produits laitiers-Détermination de la teneur en matière grasse. Directives pour l'utilisation des méthodes butyrométriques.
17. Pirisi A., Piredda G., Scintu M. F. and Fois N.2001. Effect of feeding diets on quality characteristics of milk and cheese produced from Sarda ewes. *CIHEAM-Option Méditerranéennes, Série A*, 46, 115-119.
18. Vierling E., 2008. Aliments et boissons, 3ème édition, Edition DOIN Editeurs centre régional de documentation pédagogique d'Aquitaine, 38p.