TECHNOLOGICAL FLOW AND PHYSICAL-CHEMICAL ANALYSIS OF HOMEMADE GOAT CHEESE OBTAINED INTO A SMALL RANGE UNIT FROM IAŞI COUNTY, ROMANIA

FLUXUL TEHNOLOGIC ŞI ANALIZA FIZICO-CHIMICĂ A BRÂNZEI DIN LAPTE DE CAPRĂ OBȚINUTĂ PRIN METODE TRADIȚIONALE ÎNTR-O UNITATE DE CAPACITATE MICĂ DIN JUDEȚUL IAŞI, ROMÂNIA

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Abstract. *The aim of the current paper is to present the traditional homemade technological flow utilised for obtaining goat cheese into a small range unit from Iaşi County, Romania and to realise an analyse upon the product's physical-chemical features. Regarding physical-chemical characteristics, the current paper aimed to study the following parameters: fat content, moisture content and acidity of goat cheese. At the end of the study we can affirm that goat cheese homemade obtained into a small range unit from Iaşi County, Romania, fulfilled all the demands required by the Romanian legislation, being a traditionally made product. The quality of the product is a very good one, being recorded superior values to those imposed by nowadays standards, for all the analysed physical-chemical indicators.*
Key words: goat cheese, homemade, traditional methods, physical-chemical analysis.

Rezumat. *Scopul lucrării de față este de a prezenta fluxul tehnologic tradițional de obținere a brânzei din lapte de capră practicat într-o unitate de mică capacitate din județul Iași, precum și de a realiza o analiză asupra caracteristicilor fizico-chimice ale produsului finit. Referitor la caracteristicile fizico-chimice, prezenta lucrare s-a axat pe determinarea următorilor parametri: conținutul de grăsime, procentul de apă și aciditatea brânzei obținute din lapte de capră. La finalul cercetărilor întreprinse se poate afirma că brânza din lapte de capră obținută prin metode tradiționale într-o unitate de mică capacitate din județul Iaşi, îndeplineşte toate cerințele impuse de legislația în vigoare, putând fi considerată un produs tradițional. Calitatea produslui astfel obținut este una foarte bună, fiind înregistrate valori superioare celor impuse de standardele naționale în vigoare pentru toți parametrii fizico-chimici luați în analiză.*
Cuvinte cheie: brânză din lapte de capră, metode tradiționale, proprietăți fizico-chimice.

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INTRODUCTION

Many researchers affirmed that "goats were among the first farm animals which were domesticated" (Zeder and Hesse, 2000; Menrad, 2003; Haenlein, 2004; Hatziminaoglou and Boyazoglu, 2004; Muehlhoff *et al.*, 2013; Monteiro *et al.*, 2019).

The founded archaeological evidences indicated that goats had been associated with humans into a symbiotic relationship for more than 10,000 years (Tilahun *et al.*, 2014).

Goat (*Capra hircus*) is one of the main sources of milk and meat products for human consumption (Lima Reis *et al.*, 2018), and is a very important component of livestock industry, having adaptability to harsh climates which make them suitable for landless and marginal farmers (Pascal, 2015).

Economically speaking, in many countries, goat farming is the most important part, especially in Mediterranean and Middle East areas (Park, 2006).

Many scientists focused on the functional properties of goat milk. It was concluded that, goat milk have not only a high nutritional value but also have a therapeutic value and dietary properties (Lie, 2012), as well as goat's milk products play a very important role in persons' diet with allergy at cow's milk casein (Janštová *et al.*, 2010).

Goat milk is a rich source for proteins, vitamins, minerals and is quite important since it has high biological value and important nutritional qualities (Costin *et al.*, 2007; Bruzantin *et al.*, 2016).

Its higher digestibility, alkalinity and dietary features make it highly recommended for infant feeding and for adults who are sensitive or allergic to cow milk or have gastrointestinal disorders; therefore, it can be used as a healthy substitute for cow milk products (Haenlein, 2004; Park *et al.*, 2007; Mituniewicz-Malek *et al.*, 2014; Monteiro *et al.*, 2019).

In the last decades demands of consumers' regarding food production know a considerably change (Avarvarei, 2013; Avarvarei *et al.*, 2014). Consumers more and more believe that foods contribute directly to their general health state and/or decrease the risk of illnesses (Simeanu, 2015).

Cheese is a nutrient-dense food made from cows, buffalo, goats, or sheep milk, by coagulation (Abdel Moneim E. Sulieman *et al.*, 2012). Cheese supplies essential nutrients for human nutrition in the form of proteins, bioactive peptides, amino acids, fat, fatty acids, vitamins, and minerals (Manuelian *et al.*, 2017).

Cheese is suitable for lactose-intolerant individuals due to the fact that almost 94% of lactose is washed out with the serum during cheese making, and the rest is fermented to lactic acid (Walther *et al.*, 2008; Muehlhoff *et al.*, 2013).

Manufacturing cheese is a way to add value to raw milk and increase the shelf life of milk. Cheese composition depends on milk's microbiological and chemical composition, the cheese-making technology, ripening time, and cheese factory conditions (De Marchi *et al.*, 2008; Formaggioni *et al.*, 2015).

Milk protein and fat contents vary greatly according to species, breed, season, health status, stage of lactation, as well as animal diet (Martini *et al.*, 2008;

Manuelian *et al.*, 2017).

The current paper aimed the study of traditional technological flow used for obtaining of goat cheese into a small rage unit from Iaşi County, Romania. Physical-chemical analysis of goat cheese targeted on the following parameters: fat content, moisture content and acidity.

MATERIAL AND METHOD

Studied material was represented by goat cheese obtained into a small rage unit from Iaşi County, Romania.

Physical-chemical analyses were realized in according with AOAC norms (2019) and were effectuated within laboratories of University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" from Iaşi, Romania.

Due to the fact that these methods are much utilized and very well know, we will mention just the method's principle and we will not describe them in details.

For realizing the analyses were gathered 10 samples of goat cheese, the samples were collected from products which belong to the same batch, were obtained in similar conditions and are delivered in the same type of packaging.

Preparation of samples for physical-chemical analyses is realized by homogenization and after that the samples are brought to temperature of +20°C.

Determination of fat content from goat cheese was realised by Van Gulik acid-butyrometric method which is based on separation of fat from cheese sample through centrifugation, after dissolving of proteins under the action of sulphuric acid (H_2SO_4) and in the presence of isoamyl alcohol ($C_5H_{12}O$).

Determination of moisture content from goat cheese was determined using a FoodScan Dairy Analyzer.

Determination of goat cheese acidity was realised by Thörner method which consist in neutralization of acids from a certain quantity of cheese through titration with a solution of NaOH (0.1 N) in the presence of phenolphthalein as indicator.

RESULTS AND DISCUSSIONS

The cheese obtained into the studied small range unit from Iaşi County, Romania, is produced only from integral goat milk and the final product (goat cheese) is very tasty and healthy, being processed through a traditional technology.

The technological flow for goat cheese obtaining through a traditional method has the following stages: milk reception (qualitative and quantitative) – pasteurization at 85°C – cooling of milk at insemination temperature (31°C-32°C) – milk insemination with *Lactobacillus lactis* spp. *lactis* and *Lactobacillus lactis* spp. *cremoris* and rennet – milk fermentation for 9-10 hours – curd processing – packing – labelling – final product. Forwards we will detail each stage of the processing flow.

1. Milk pasteurization, before being subjected to pasteurization milk must be cleaned. The removal of mechanical impurities is realised by filtration through multi-layered gauze. After that, milk is transferred into a 40 litres stainless steel pot, and it is boiled till the temperature of +85°C is reached (fig. 1).

2. Milk cooling till insemination temperature, when milk reached the pasteurization temperature it is subjected to an immediate cooling. Milk is transferred into a cooling tank, where will be cooled till the optimal temperature of 31°C-32°C. The process is very important because this temperature is favourable for lactic bacteria. After milk is cooled, it is subjected further to technological process for cheese obtaining.

3. Milk insemination, the processing flow of goat cheese continues with adding of starter cultures. For goat cheese studied by us are used bacteria which belongs to mesophile gender: *Lactobacillus lactis* spp. *lactis* and *Lactobacillus lactis* spp. *cremoris*. Starter culture is prepared by mixing those two ferments with 500 ml boiled and cooled milk (fig. 2) and after that is introduced in the total mass of milk; the dosage of ferments is the one for 40 litres of milk. After 30 minutes of resting, in milk is added also the rennet. It must be very well stirred, by up and down movements. Addition of those ferments will help at cheese coagulation, obtaining a homogenous mass, soft and creamy (fig. 3).

4. Fermentation of inseminated milk took place for 9 to 10 hours. The stainless steel pot with those 40 litres of milk is placed into a warmed space/room and it is very well covered so milk will be kept warm, fact which allows ferment to action and to coagulate the milk.

5. Curd processing, after 9-10 hours of fermentation, milk is checked if it is coagulated. After that the curd (fig. 4) is cut into vertical columns, then in cubes with the size of 2.5 cm (fig. 5). Then curd is moved into perforated forms, lined with multi-layered gauze. For 8 to 9 hours is left to drain, into a chilled room. After whey drained, curd cubes are taken from forms and are jointed together to obtain a compact block of fresh cheese. Cheese will be placed in a refrigerator at +2°C ÷ +4°C, for 12 hours and after that will be packed.

6. Packing, cheese will be cut in triangular forms (fig. 6), weighted (fig. 7) and packed in plastic casseroles of 200 grams.

7. Labelling, casseroles with cheese are labelled with individual sticks, on this are marked the following: product name, producer, address and telephone number, fabrication date, shelf life time, storage temperature and the ferments utilised for product obtaining (fig. 8). Labels are daily stamped with the date in which the product was obtained.

Fig. 1 Milk pasteurization

Fig. 2 and Fig. 3 Milk insemination

Fig. 4 and Fig. 5 Curd and curd cubes

Fig. 6 Cheese portioning

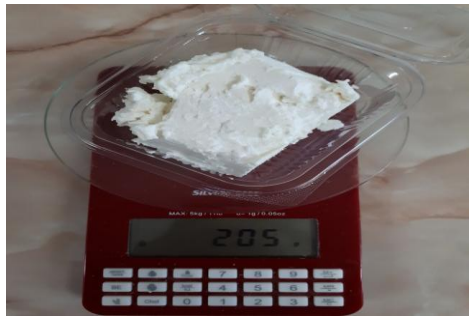

Fig. 7 Weighting

Fig. 8 Labelling

To effectuate the determinations, were subjected to analysis a number of 10 samples of goat cheese traditionally obtained. To present the product quality we aimed to determine the most important physical-chemical parameters.

The analyzed indicators were: fat content, moisture (water) content, and acidity. The limits imposed by the nowadays legislation for the above mentioned physical-chemical parameters must be respected in order to keep the quality of final product.

The obtained results (tab. 1) were compared with the firm's standard, appreciating the correspondence level between them.

Table 1

Physical-chemical parameters of studied goat cheese obtained through a traditional method

Physical-chemical characteristics	Standard	Results (n=10)			
		Minimum	Maximum	$\overline{X} \pm s_{\overline{X}}$	V (%)
Fat (%)	min. 30	30.01	32.40	31.195±0.227	2.302
Water (%)	max. 70	68.50	69.50	69.104±0.130	0.593
Acidity (°T)	max. 200	196	199	197.380±0.304	0.487

Regarding fat content we obtained a mean value of 31.195±0.227% (tab. 1), in comparison with minimum of 30% as it is stipulated in the standard. The

minimum value obtained by us was 30.01% and the maximum value was 32.40% (tab. 1). Variation coefficient recorded a value of 2.302% which indicates a good homogeneity inside the analysed lot (tab. 1).

Analysis effectuated on samples of goat cheese enlightened the fact that value of water content recorded a minimum value of 68.50% and a maximum one of 69.50%. The calculated mean value was 69.104±0.130% (tab. 1), which was in according to standard which impose a value of maximum 70% for this indicator. Value of variation coefficient was 0.593% which shown the fact that the homogeneity of the analysed lot was a very good one (tab. 1).

Acidity of goat cheese had values between 196°T (minimum) and 199°T (maximum), with an established mean value of 197.380±0.304°T (tab. 1). The acidity was below the maximum value imposed by standard (max. 200°T). Variation coefficient, in this case had the value of 0.487%, fact which highlight a very good homogeneity for the analysed product (tab. 1).

CONCLUSIONS

Based on the effectuated study we can affirm that goat cheese obtained into a small range unit from Iaşi County, Romania, fulfilled the technological demands and flow, being a traditionally made product.

Regarding fat content was obtained a mean value of 31.195±0.227% in comparison with the minimum of 30% as it is stipulated in the standard. The minimum value obtained by us was 30.01% and the maximum value was 32.40%, variation coefficient recorded a value of 2.302% which indicated a good homogeneity inside the analysed lot.

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The quality of the product is a very good one, being recorded superior values for all the analysed physical-chemical indicators which had superior values to those imposed by nowadays legislation.

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