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Fungal diversity in goat milk obtained by manual milking

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Abstract

The level of microbiological contamination with yeasts and moulds in samples of goat milk collected in spring, summer and autumn season was evaluated. Yeasts are present in a larger number in the analyzed goat milk with values between 1.9-3.42 log CFU/ml, contrast to molds that had a range of mean values between 1.47-3.02 log CFU/ml. Of the milk samples were isolated mould strains belonged to genera: *Cladosporium sp.*, *Fusarium sp.*, *Penicillium sp.* and yeasts genera as *Kluyveromyces sp., Rhodotorula sp., Cryptococcus sp*. The outcome of this study indicate mycotic contamination of goat milk that can pose serious health risk to consumers.

Keywords: yeasts, moulds, goat milk, grazing

1. Introduction

The specific environmental conditions (e.g. mountain pastures) can define unique features of the raw milk: its chemical composition, the presence of natural micro- and mycobiota. The description of the microbial communities inhabiting raw milk and cheeses is particularly relevant for establish product quality features and authenticity assurance.

Milk contamination with yeast and molds is inevitable especially in the case of the manual milking. These microorganisms may be responsible for modifying the sensorial properties of milk due to their action on proteins or lipids.

Raw milk provides all necessary nutrients and conditions for growth of many fungal species, their occurrence is influenced by animal physiological state, weather and breeding conditions [2,4].

Consumers are interested more often in organic and traditional food that meets the quality characteristics.

Fungal flora is also able of generating components of aroma (e.g., amino acids, fatty acids, esters) that significantly contribute to flavour [7,8,12], but on the other hand can have deleterious effects such as the case of mycotoxins produced by molds [5]. Also, the main defects caused by spoilage yeasts are fruity bitter or yeasty off-flavours, gas production and a softening of product texture [3].

The purpose of this study was to identify the frequency of fungi in the fresh dairy product obtained by manual milking from goats, during three periods of lactation: spring, summer and autumn, in order to take appropriate measures against possible contamination and illness of the consumer.

2. Materials and Method

Milk samples were collected from goats bred and maintained in the traditional system, in the herd. Grazing of the animals was conducted in two regions: the hilly and the mountainous area, depending on the season, as can be seen in Table 1, which includes the experimental design.

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Table 1. Experimental design

Flock of goats	50-60		
Grazing periods Grazing areas altitude (m.s.m.)	March-May Hill pastures 600-900	June-August Mountain pastures 1000-1300	September-November Hill pastures 600-900
Fodder	Fresh grass from pasture		
Milking system	By hand		
Milk sampling	3	3	3

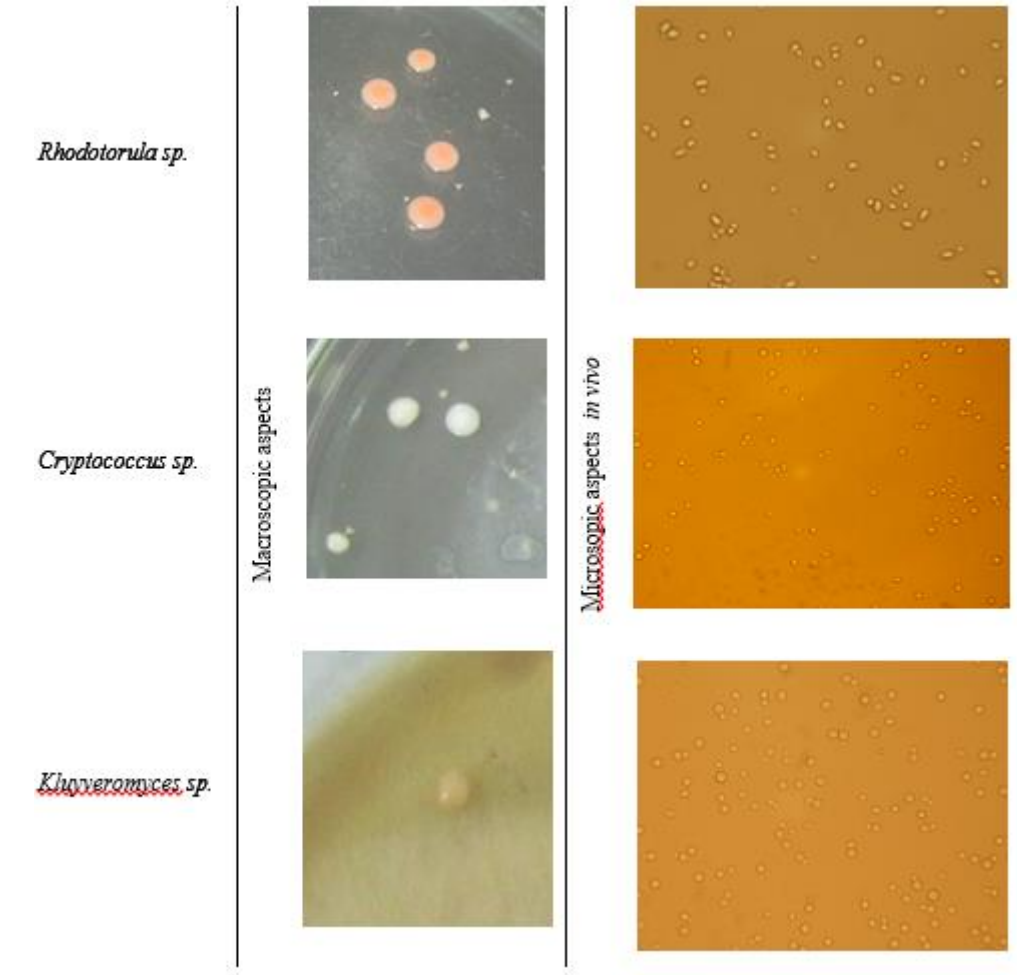

Figure 1. Macroscopic and microscopic aspects of the yeasts identified in the milk samples

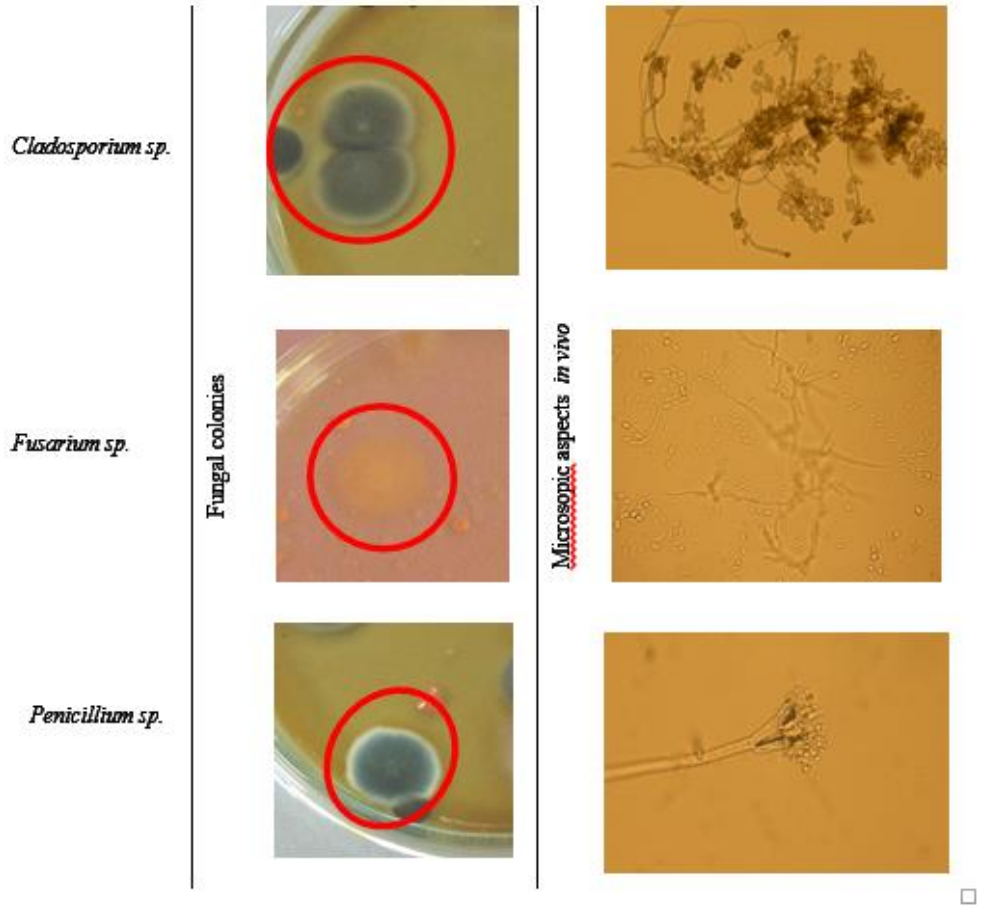

Figure 2. Macroscopic and microscopic aspects of the molds identified in the milk samples

Milk samples taken for analysis were immediately transported to the laboratory in a portable refrigerator at 4°C. Fungal diversity was assessed using cultural methods, applying the colony count technique at 25^0C, according to STAS ISO 7954-2001.

In order to identify the main types of yeasts and molds direct a direct microscopic examination was performed using a trinocular biological microscope with digital reception and microscopic imaging.

Statistical analyses were processed in CurveExpert 1.3 using the indicators: average, standard deviation (S.D.).

In the analyzed goat milk, the fungi load was higher in summer with values of 3.42 and respectively 3.02 log CFU/ml when grazing takes place in the mountains and thus the milking and storage conditions of milk are heavier

Table 2. Total number of yeasts and molds/ml goat milk depending on the season (mean values), (n=3 ± S.D.)

Milking periods	Yeasts (log CFU/ml)	Moulds (log CFU/ml)
Spring	1.90±0.0	1.47±0.0
Summer	3.42±0.0	3.02±0.0
Autumn	2.46±0.0	1.84±0.0

This is due to the difficulties of keeping the hygiene and the general grazing conditions in mountain pastures (i.e., walking, altitude) coupled with low herbage quality [6]. It can be seen that in all three cases of analysis, yeasts are more numerous in the milk obtained by manual milking, unlike the molds found in smaller numbers (Table 2). A previous research on the number of yeasts and molds, made

by Suguna on the goat milk shows that which were in the range of (mean values) 4.2- 4.6 log CFU/ml.

Fungal diversity of the fresh goat milk was evidenced by direct microscopic examination; there were identified yeast genera such as: *Kluyveromyces sp., Rhodotorula sp., Cryptococcus sp*. The appearance of colonies and microscopic aspects of the main types of yeast identified in the goat milk are shown in Figure 1.

The occurrence of yeasts such as *Debaryomyces sp., Kluyveromyces sp., Trichosporon sp., Rhodotorula sp., Candida sp., Cryptococcus sp., Pichia sp., etc*. was confirmed by other authors, [2, 4, 9], in the study of the presence and frequency of yeasts in goat milk. Pathogenicity for humans of some of these fungi was demonstrated long ago. These include also the *Cryptococcus sp.* which was identified only in summer in the goat milk analyzed in this study. According to Barzoi and Apostu, to avoid contamination of milk with these microorganisms, the main measure is to combat and prevent mastitis in animals.

Because of their ability to adapt to the different environmental conditions, molds are commonly found in foods. According to the research of Delavenne et al., using advanced identification techniques, in the goat milk there were present the genera: *Aspergillus sp., Chrysosporium sp., Cladosporium sp., Engyodontium sp., Fusarium sp., Penicillium sp.* şi *Torrubiella sp.*. Through the microscopic study of the fungi colonies detected in this study research, we could identify some of the genres most representative: *Cladosporium sp., Fusarium sp., Penicillium sp.*. Mycelia colonies grown on solid medium and microscopic aspects of fungi isolated in pure strains are shown in Figure 2.

The presence of these types of molds was highlighted in all milk samples analyzed.

4. Conclusions

The results of this study show the load and the diversity of fungi in the goat milk obtained by hand milking. During grazing at higher altitudes (1000-1300 m), contamination of milk with yeast and molds is higher, and also their incidence on food. The present study showed variations in milk fungal communities according perioada de lactatie. It is important to respect the minimum safety precautions in order to prevent spore germination and vegetative forms formation that can produce toxic metabolites endangering consumer health.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

References

1. Bărzoi, D.; Apostu, S., *Microbiologia produselor alimentare*, Editura Risoprint, Cluj Napoca, 2002, pp. 308.
2. Callon, C.; Duthoit, F.; Ferrand, M.; Le Frileux, Y.; De Crémoux, R.; Montel, M.C., Stability of microbial communities of goat milk, during a lactation: molecular approaches, *Systematic and Applied Microbiology* **2007**, *30*(7), 547-560.
3. Corbo, M.R.; Lanciotti, R.; Albenzio, M.; Sinigaglia, M., Occurence and characterization of yeasts isolated from milks and dairy products of Apulia region, *International Journal of Food Microbiology* **2001**, *69*(1-2), 147-152.
4. Delavenne, E.; Mounier, J.; Asmani, K.; Jany, J.L.; Barbier, G.; Le Blay, G., Fungal diversity in cow, goat and ewe milk, *International Journal of Food Microbiology* **2011**, *151*(2), 247-251.
5. Filtenborg, O.; Frisvad, J.C.; Thrane, U., Moulds in food spoilage, *International Journal of Food Microbiology* **1996**, *33*(1), 85-102.
6. Gorlier, A.; Lonati, M.; Renna, M.; Lussiana, C., Lombardi, G.; Battaglini, L.M., Changes in pasture and cow milk compositions during a summer transhumance in the western Italian Alps, *Journal of Applied Botany and Food Quality*, **2012**, *85*, 216 -223 .
7. Lund, F.; Filtenborg, O.; Frisvad, J.C., Associated mycobiota of cheese, *Food Microbiology* **1995**, *12*, 173–180.
8. Panelli, S.; Brambati, E.; Bonacina, C.; Feligini M., Diversity of fungal flora in raw milk from the Italian Alps in relation to pasture altitude, *SpringerPlus* **2013**, *2*, 405, doi:10.1186/2193-1801-2-405
9. Spanamgerg, A.; Ramos, J.P.; Leoncini, O.; Alves, S.H.; Levente, P., High frequency of potentially pathogenic yeast in goat's raw milk and creamed cheese in Southen Brazil, *Acta Scientiae Veterineriae* **2009**, *37*(2), 133-141.
10. Suguna, M.; Bhat, R.; Wan Nadiah, W.A., Microbiological quality evaluation of goat milk collected from small scale dairy farms in Penang Island, Malaysia, *International Food Research Journal* **2012**, *19*(3), 1241-1245.

11. Torkar, K. G.; Vengušt, A., The presence of yeasts, moulds and aflatoxin M1 in raw milk and cheese in Sloveni, *Food Control* **2008**, *19*(6), 570-577.

12. Vasdinyei, R.; Deák, T., Characterization of yeast isolates originating from Hungarian dairy products using traditional and molecular identification techniques, *International Journal of Food Microbiology* **2003**, *86*(1-2), 123–130.