ISSN 1313 - 8820
Volume 6, Number 4
December 2014

AGRICULTURAL SCIENCE AND TECHNOLOGY

2014

An International Journal Published by Faculty of Agriculture,
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The journal is accepted to be indexed with the support of a project № BG051PO001-3.3.05-0001 “Science and business” financed by Operational Programme “Human Resources Development” of EU. The title has been suggested to be included in SCOPUS (Elsevier) and Electronic Journals Submission Form (Thomson Reuters).

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ISSN 1313 - 8820

Volume 6, Number 4
December 2014

AGRICULTURAL SCIENCE AND TECHNOLOGY

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An International Journal Published by Faculty of Agriculture,
Trakia University, Stara Zagora, Bulgaria

AGRICULTURAL SCIENCE AND TECHNOLOGY, VOL. 6, No 4, pp 491 - 493, 2014

Variability of individual coagulation ability and qualitative composition of milk from Kalofer Longhaired goats

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Abstract. *The growing scientific interest in the coagulation ability of milk in leading countries in Europe and in the world, is the premise for the research carried out by us in this direction. In this study 49 individual milk samples of goats from* the *autochthonous breed Kalofer Longhaired were examined for coagulation ability and qualitative composition of the milk. Analysis of individual coagulation ability was made in the dairy lab of Agricultural Institute, Stara Zagora through Computerized Renneting Metter – Polo Trade, Italy. The studied phenotypic parameters defining the dynamics of the qualitative composition of milk are with average values, respectively: fat – 4.15%, protein – 3.34%, dry non-fat substitutes (DNS) – 8.84%, lactose – 4.84% and pH – 6.62. The average values of exponents are rennet clotting time (RCT) – 11.47min, curd firming time (CR) – 0.86min, and curd firmness – 27.16 mm. Coagulation ability of the milk of Kalofer Longhaired goat have good technological properties for the production of traditionally identical milk products.*

Keywords: Kalofer longhaired goats, coagulation ability, qualitative composition, curd firmness, coagulum, milk

Introduction

Kalofer Longhaired goat is an autochthonous breed, whose productive qualities are poorly studied. In previous studies it was found that the main income of the farmers growing this breed are skins; they produce from them traditional Kuker costumes. In a large number of farms with Kalofer Longhaired goat traditional white brined cheese is made from the milk produced. That's what provoked the establishment of the coagulation ability and some quality parameters of milk directly related to the production of traditional dairy products from Kalofer Longhaired goats. Coagulation ability of milk is in connection with the quality and yield of cheese (Clark et al., 2000; Storry and Ford, 1982a; Okigbo et al., 1985b; Oster-sen et al., 1997). The conditions for the production of cheese, such as type and concentration of the enzyme, temperature of incubation and individual components in the composition of milk influence the coagulation ability of milk (Storry and Ford,1982b; Okigbo et al., 1985b). Thus, any factor which influences the quality of the milk composition also has an impact on the coagulation ability (Storry et al., 1983; Politis and Ng-Kwai-Hang, 1988; Aleandri et al., 1989). The composition of milk from ruminants is influenced by breed, age, period and the next lactation, month of taking the sample, feeding, and not less by the external environmental and genetic factors (Storry et al., 1983; Politis and Ng-Kwai-Hang, 1988; Aleandri et al., 1990; Clark, 1993).

While not all of the factors can be explored or controlled by breeders, conducting appropriate selection of dairy goats in the direction of improving the coagulation ability and qualitative composition of milk should improve the cheese making qualities of goat milk (Walstra et al., 1984). When the k-casein is hydrolyzed casein micelle becomes unstable and prone to precipitation by the calcium. Gathering or contraction of the casein micelles occurs during the non-enzymatic phase (Garnot and Olson,1982; Storry and Ford, 1982a; Walstra et al., 1984). Rennet clotting time (RCT) is the point where the casein micelles formed coagulum enough to be seen. The curd firming time (CR) is a measure of how fast the coagulum lace once coagulation has begun. Ideally, for the processors of milk RCT is to be reduced and CR increased since both parameters affect the processing time for the production of cheese. Most important for the manufacturers of cheese from goat milk is increasing curd firmness (CF) as it is a basic coagulation parameter that influences the quality of cheese and the yield and economic efficiency. CF improves the yield of cheese from goat milk by keeping the composition of milk components (Bynum and Olson, 1982; Okigbo et al., 1985a,b; Marziali and Ng-Kwai-Hang, 1986; Politis and Ng-Kwai-Hang,1988; Aleandri et al., 1990; Martin and Addeo, 1996).

The aim of this study was to determine the variability of individual coagulation ability and its association with the qualitative composition of goat milk from Kalofer longhaired goats.

Material and methods

To establish the individual coagulation ability of milk from Kalofer Longhaired goats 49 individual milk samples from the same breed were analyzed reared in the region of Blagoevgrad. Sample taking and analysis was carried out in June 2012. Goats that were taken individual milk samples from were in the fourth month of the milking period (mid-lactation). The animals were in excellent health and physical condition. They were reared on pasture conditions without supplementary feeding.

Individual milk samples were taken during the morning milking, without preservatives added, the amount of each sample was 50 ml. The samples were stored in freezer storage bags at 4°C at which they were transported to the laboratory within three hours to be

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analyzed. Milk samples were examined in terms of features characterizing the qualitative composition of milk: fat, protein, dry non-fat substitutes (DNS), pH and lactose through Ekomilk Total ultrasonic milk analyzer ISO 9001:2000. Analysis of individual coagulation ability (Figure 1) was made in the dairy lab of Agricultural Institute, Stara Zagora through Computerized Renneting Metter – Polo Trade, Italy, batched 10 ml of milk in each of the sockets of the former. The milk was heated to temperature of 35°C batched 0.2 ml enzyme (rennet chymosin) (NATUREN Plus 215/0.8 l). When the temperature reached 35°C, we add enzyme homogenize in milk, 15 –20 times. The duration of the analysis was 30 min.

The data processing is performed by software product SYSTAT13.

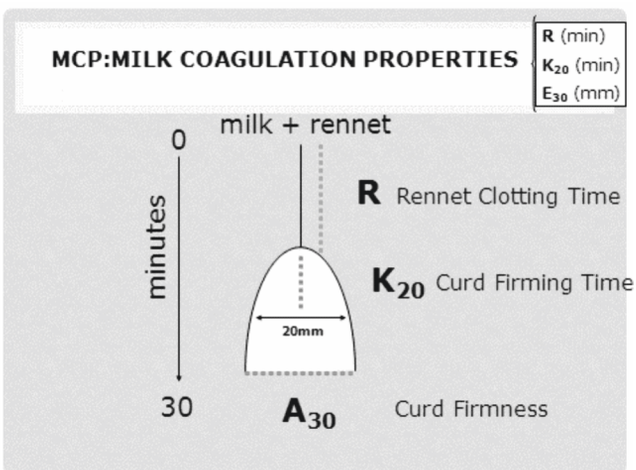

Figure 1. Methodology for determining the sign coagulation ability of milk

Results and discussion

Coagulation ability of milk can generally be divided into three characteristics that shape it: RCT, curd firming time (K20) and curd firmness (A30). The qualitative composition of milk is one of the main factors that determine coagulation ability. Five phenotypic indicators whose percentage affects mostly the coagulation capability are: fat, protein, DNS, lactose and pH. Table 1 presents the main statistical parameters describing the coagulation ability of goat milk and its qualitative composition in the Kalofer Longhaired goat studied by us. In the minimum values of the parameters very low minimum value of the percentage of fatty substances is observed – 2.11%, but at the maximum values it is observed that there are representatives of the breed with much higher values than the mean of the parameters. There was an increased level in the maximum value of pH of goat milk – 7.26, this higher level is due to one individual included in our study. The standard deviation of the five indicators determining the qualitative composition of milk was in ranges from 0.14 to 0.86. The coefficient of variation in the protein, DNS, lactose and PH was low with values of 0.01 to 0.02, except a bit more high-fat ratio at 0.16. We note the very low minimum and high maximum values of the traits characterizing the coagulation ability of milk, which we believe is the reason for the slightly higher standard deviation and coefficient of variation. The highest value of 12.04 standard deviation has trait (A30) – curd firmness and the highest coefficient of variation 0.89 belongs to (K20) – curd firming time.

Table 1. Statistical parameters describing the coagulation ability of milk and its qualitative composition

Variables	Min.	Max.	Mean	SD	CV
Fat, %	2.11	5.67	4.15	0.65	0.16
Protein, %	3.00	5.25	3.34	0.32	0.01
DNS, %	7.94	13.90	8.84	0.86	0.01
Lactose, %	4.35	7.57	4.84	0.47	0.01
pH	6.46	7.26	6.62	0.14	0.02
RCT, min	6.27	29.50	11.47	4.91	0.43
K_{20}, min	0.30	3.34	0.86	0.77	0.89
A_{30}, mm	7.00	46.00	27.16	12.04	0.44

The mean values of five traits describing the qualitative composition of goat milk are within the optimal range (Figure 1). Only slightly higher mean value of the percentage of lactose – 4.84% was noted, the accepted mean content in goat milk being 4.1% to 4.3%. Goat milk is characterized by slightly acidic nature, the acceptable limits being 6.4 to 6.7 pH, as found in our study 6.62 pH mean value of this indicator is close to the upper limit. The other three variables: fat, protein and DNS have optimal mean values 4.15%, 3.34% and 8.84%, respectively, and it can only be noted that the mean value for the percentage of protein is close to the lower limit for the mean for goat milk, which is 2.9%. Todaro et al. (2005) studied 1485 milk samples from goats of Girgentata breed. The authors found a lower value for fatty substances – 3.93%, while for protein substances it is higher than the value established by us – 3.48%. For the traits pH and lactose the differences are minimal.

In Figure 2 are presented the mean values of the traits (rennet clotting time RCT, curd firming time K20 and curd firmness A30), forming the process of coagulation of goat milk. The values are as follows: rennet clotting time 11.47 min., curd firming time 0.84 min., and curd firmness 27.16 mm. These values determine an

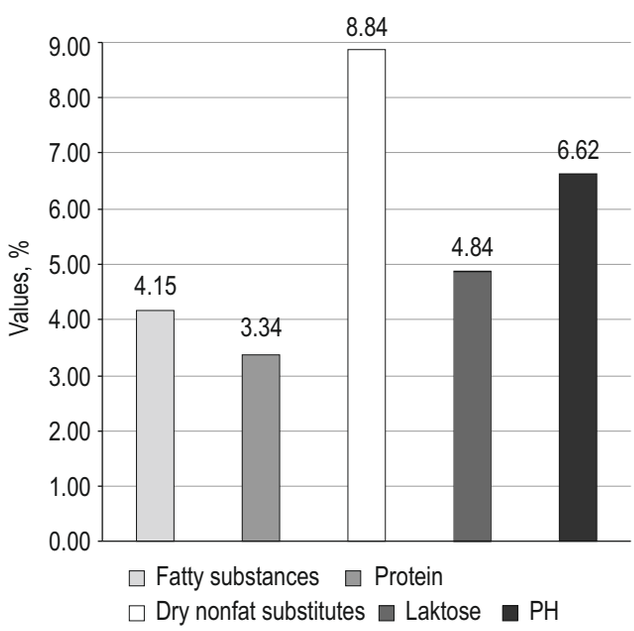

Figure 2. Mean values of parameters that characterize the qualitative composition of milk

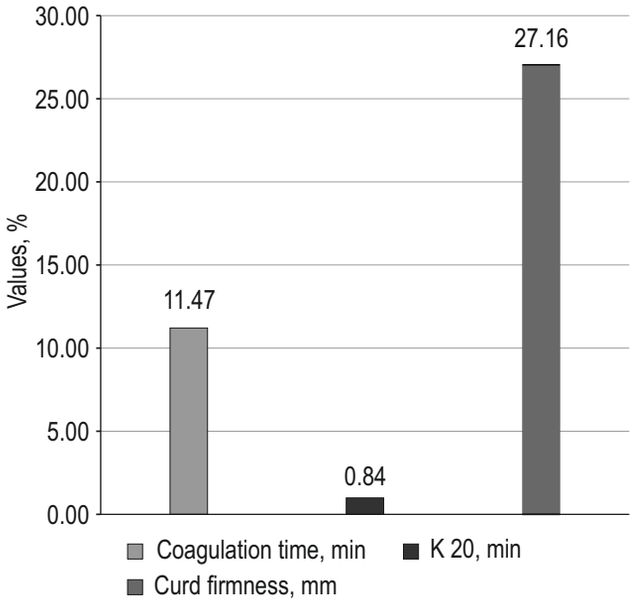

Figure 3. Mean values of parameters that characterize the coagulation ability of milk

exceptionally good coagulation ability that milk from Kalofer longhaired goats has. Our results for coagulation ability of milk correspond to these indicated by Clark and Sherbon (2000). The authors point out that milk from goats of the Alpine breed are characterized by a rennet clotting time of 12.1 min., while the milk of goats from Togenburg breed has a slower time of coagulation – 13.8 min. Todaro et al. (2005) point out rennet clotting time relatively higher than we received – 16.96 min. They also reported similar higher values for the trait curd firming time, while the curd firmness has similar values – 25.08 mm.

Conclusion

Significant variations in the qualitative composition of milk from Kalofer Longhaired goat affect individual coagulation ability and the mean values of the traits rennet clotting time, time for tightening the coagulum and curd firmness are as follows: 11.47 min., 0.86 min., 27.16 mm. Coagulation ability determined to a large extent by the qualitative composition of milk of the native breed of goats object of our study has good technological properties for the production of traditionally identical milk products.

To achieve positive results in the management and conservation of the genetic diversity of the endangered populations, we believe it is related to the knowledge of the genetic variance important for cheese making traits and specific peculiarities of milk from different breeds and quality in the production of various dairy products. In this regard, we believe that research in this direction should be continued.

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Volume 6, Number 4
December 2014

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