

Milk yield of some goat breeds in Croatia

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Summary

In Croatia, goats are primarily bred for meat production. However, for the past twenty years the interest in goat milk production was based on imported breeds such as Alpine-French, Saanen and German Improved Fawn goat. The purpose of this paper is to establish litter size of the principal goat breeds in Croatia and the indicators related to milk yield and chemical composition. The largest average litter size has been determined on the German Improved Fawn (1.72), then with the Boer (1.54), the Saanen (1.53) and the Croatian coloured goat (1.51), while the Alpine-French goat was the smallest (1.31). The longest lactation period (259 days) has been determined on the Alpine-French goat, while the largest milk yield during lactation (724.4 kg) and the largest milk fat yield (20.16 kg) and protein yield (18.64 kg) have been determined on the Saanen goat. However, it has been established that the Alpine-French goat milk has the highest average fat content (3.55 %), while the German Improved Fawn's milk has the highest protein content (3.23 %). The Saanen goat had the longest milking period (222 days) and the shortest suckling period (32 days), while the Alpine-French and the German Improved Fawn had the longest suckling period (51 and 45 days, respectively). The lowest quantity of milk during the suckling period (102.97 kg, i.e. 14 %) was suckled by Saanen kids, while the Alpine-French (122.08 kg, i.e. 22 %) and the German Improved Fawn kids suckled the greatest quantity (116.31 kg, i.e. 22 %).

Key words: goat milk, breed, lactation period, milk composition

Introduction

Although in Croatia there is a long tradition of goat breeding, there has been no such drastic change in any branch of livestock throughout history as in goat breeding. Namely, goat breeding has been spread and was of great significance in certain historical periods in Dalmatia, Dalmatian Zagora and Istria. In breed structure two breeds were dominant: the Croatian coloured goat

(previously known as the Balkan goat) and the Croatian white goat. The largest number of goats in Croatia was registered in 1808, when only in Dalmatia they numbered about 750 000 animals. In the middle of the 19th century, they numbered about 427 000, at the beginning of the 20th century around 200 000 and in 1939 there were only 115 000 animals (Mioč and Pavić, 2002). However, immediately after the Law on prohibition of keeping goats came into force in 1954/55, there were only 101 609 breeding animals. This law had negative influence, not only on the decrease in the number of goats, but also resulted in complete extinction of the already formed types or breeds, for example the Istrian goat (Mioč and Pavić, 2002).

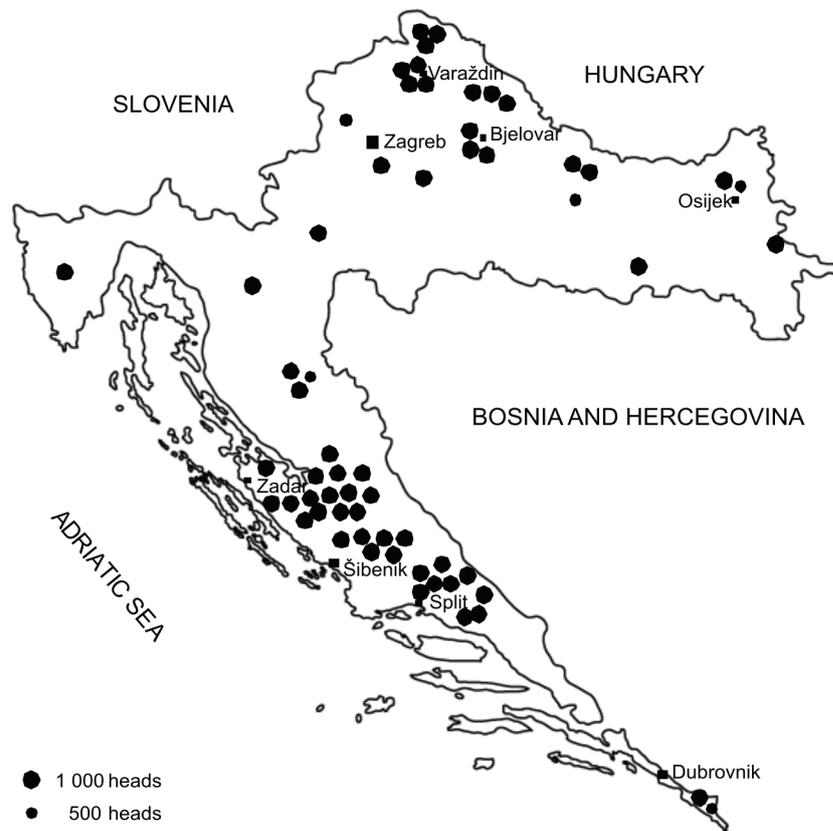


Figure 1: Geographical position and number of goats in the Republic of Croatia

Slika 1: Brojnost koza u Republici Hrvatskoj s obzirom na geografski položaj

During the eighties of the 20th century, the Law on prohibition of keeping goats was tacitly abolished, and goat breeds of high genetic potential for milk production were imported, so, based on the model of the European countries with developed goat breeding, goat milk production and manufacturing began. In recent years the traditional, extensive form of goat farming has been gradually replaced by the intensive breeding of dairy goats (Alpine and Saanen breed, German Improved Fawn) imported from France and Germany (Antunac et al., 2001). The production of goat milk is based on the Alpine-French, Saanen and the German Improved Fawn goats, and the milk is mostly processed into cheese (industrially, or on family farms). Today goats are being bred in all parts of Croatia (figure 1), although the largest number is located in the coastal area (Croatian Livestock Center, 2005).

Table 1 contains data relating to the number of breeders and breeding goats (does and bucks) for which applications were submitted for government subsidy. Taking into consideration the fact that these records do not contain breeders with less than 20 animals, female and male breeding offspring, it is logical to presume that the real total number of goats in Croatia is significantly larger ranging from 85 000 to 90 000. An average size of a herd in the coastal area is 50 animals (meat production) and in the continental area 36 animals (milk production). Out of the total number of goats in Croatia, 13 332 animals or 23 % are kept in the records of the Croatian Livestock Center as goats under selection control. Out of the total number of goats under selection control, 65 % is bred in the continental part, where the production of goat milk is most developed.

Table 1: Number of registered does and bucks per area in Croatia in 2004

Tablica 1: Broj evidentiranih rasplodnih grla (koze i jarčevi) po regijama u Hrvatskoj u 2004. godini

Area Područje	Number of breeders Broj uzgajivača	Number of animals (does + bucks) Broj koza i jarčeva	Percentage % od ukupnog broja
Continental Kontinentalno	613	22.190	38
Coastal Obalno	707	35.728	62
Total Ukupno	1.320	57.918	100,00

Source: Croatian Livestock Center, 2005

Izvor: Hrvatski stočarski centar, 2005.

Out of the total number of goats under selection control (13 332) dairy goats (Alpine-French, German Improved Fawn and the Saanen goat) represent almost 94 % (12 456 animals), and only 6 % or 876 animals belong to the breeds for meat production (Croatian coloured goat and the Boer goat). It can be concluded from the facts mentioned above that milk is the main goat product in Croatia. However, the Croatian indigenous breeds (the Croatian coloured and the Croatian white goat) that are the most significant in the total number of goats in Croatia due to their population size are mainly bred for meat production and are not represented in such a number in the herdbook herds that are kept by the Croatian Livestock Center. In the breed structure of goats under selection control, the Alpine-French goat prevails with 81.95 % or 10 926 animals, followed by the Saanen goat with 8.15 % or 1 087 animals and the German Improved Fawn with 3.32 % or 443 animals. The Boer goat and the Croatian coloured goat are bred for the purposes of meat production. The production of goat meat is mostly represented in the coastal areas with mostly rocky ground and stone, poor vegetation, thicket and underbrush, with very few possibilities of breeding other types of stock (except sheep), especially larger stock.

In Croatia, milk is becoming more and more important goat product and the number of farms that produce and, on family farms, process milk into cheese is increasing. According to the data of the Croatian Livestock Center (2005), 96 % of the purchased milk quantity is produced in the continental part of Croatia. This is logical, since these regions have greater possibilities of livestock food production and there dominates an intensive goat breeding system. Considering the growing economic importance of goats in the entire Croatian livestock, especially in the production and processing of milk, the goal of this paper is to show the most important characteristics of the goat milk production in Croatia.

Materials and methods

The data relating to the milking ability controls of the Croatian Livestock Centre (2005) for five lactations of 3 636 Alpine-French goats, 196 Saanen goats and 60 German Improved Fawns (GIF) (table 2) were used for this research.

All animals within one individual herd, regardless of the number of lactation and milking ability were kept in equal feeding and living conditions. During the research the number of kidding and the number of kids per litter and per breed was established. The milk production control was performed

using the AT method (ICAR, 1992) with a single milking by hand (morning or evening) once a month (every 28-34 days), with the measuring of the quantity of milked milk and by taking samples of milk for chemical analysis.

Table 2: Number of recorded lactations per breed in 2004

Tablica 2: Pregled zaključenih laktacija po pasminama u 2004. godini

Lactation number Redni broj laktacije	I	II	III	IV	V	Total Ukupno
Alpine-French Francuska alpina	1 020	916	558	515	627	3 636
Saanen Sanska	34	60	38	34	30	196
German Improved Fawn Srnašta	5	9	9	2	35	60
Total Ukupno	1 059	985	605	551	692	3 892

Source: Croatian Livestock Center, 2005

Izvor: Hrvatski stočarski centar, 2005.

The amount of milk (kg) is calculated by multiplying the quantity of milk shown in litres (L) with the average density of goat milk 1.030 (ICAR, 1992). During the whole lactation period, period between morning and evening milking was 12 hours. The total lactation period consisted of two parts: 1) the suckling period and 2) the milking period. Milk yield in the suckling period (from kidding to weaning or slaughtering of kids) is calculated by multiplying the amount of milk determined in the first milk production control with days of suckling. The amount of milk in the period of milking (since weaning or slaughtering of kids to dry-off) is obtained through calculations based on the data of the monthly milk production controls. By adding the amounts of milk in the two mentioned periods, one can get the total amount of milk in lactation (ICAR, 1992). The content of milk fat and proteins (FIL-IDF, 141C:2000) were obtained using the IR spectrophotometer (Milkoscan 4400). The acquired data were analyzed using SAS statistical software (SAS, 1990).

Results and discussion

Considerable differences in the values of lactation milk yield between certain goat breeds were determined (table 3). The largest average total milk yield during lactation was determined in the Saanen goat, that, during lactation of 254 days produced 724.40 kg of milk or 2.85 kg daily, as well as the highest

Table 3: Review of recorded lactations per breed in 2004

Tablica 3: Pregled zaključenih laktacija po pasminama u 2004. godini

Breed Pasmina	Lactation period (days) Dužina laktacije (dana)	Suckling period (days) Dužina razdoblja sisanja (dana)	Milking period (days) Dužina razdoblja mužnje (dana)	Total milk yield in lactation (kg) Ukupna proizvodnja mlijeka u laktaciji (kg)	Milk yield in suckling period (kg) Količina posisanog mlijeka (kg)
French-Alpine Francuska alpina	259	51	208	548.48	122.08
Saanen Sanska	254	32	222	724.40	102.97
GIF Srna	242	45	197	518.38	116.31

Source: Croatian Livestock Center, 2005

Izvor: Hrvatski stočarski centar, 2005.

Table 3: Continued

Tablica 3: Nastavak

Breed Pasmina	Milking period Razdoblje mužnje					
	Milk yield Količina mlijeka (kg)	Milk yield (kg/day) Proizvodnja mlijeka (kg/dan)	Fat Mast (%)	Fat Mast (kg)	Proteins Bjelančevine (%)	Proteins Bjelančevine (kg)
French- Alpine Francuska alpina	426.41	2.03	3.55	14.99	3.08	13.03
Saanen Sanska	621.43	2.76	3.35	20.16	3.05	18.64
GIF Srna	402.07	2.04	3.49	13.79	3.23	12.80

Source: Croatian Livestock Center, 2005

Izvor: Hrvatski stočarski centar, 2005.

total fat and protein yield (20.16 and 18.64 kg, respectively). During the same lactation period, the Saanen goats in Slovenia produced 584 kg of milk

(Kompan et al., 1998), i.e. 1.97 kg daily (Breznik et al., 1997). One of the reasons for lower milk yield of the Alpine-French (548.48 kg or 2.12 kg daily) in relation to the Saanen goats is the fact that the researched goat population mostly consisted of younger goats (55 %) in the first and second lactation. Namely, according to Crepaldi et al. (1999), the Alpine goats reach the highest milk yield in the fifth lactation, whilst according to Mourad (2001) they reach it in the third lactation. The duration of lactation in Alpine-French goats (259 days) determined through research was comparable to the one for the same breed in the intensive production system in Egypt (Mourad, 2001). However, the average lactation period of Alpine goats in Italy is 231 days (Crepaldi et al., 1999), and 209 days in Greece (Frangos, 1988). Duration of the lactation period, of the Alpine goat population involved in the research, was significantly longer than in the same breed in Brazil, but with a lower average daily milk yield (Figueiredo, 1987).

The longest average milking period and the shortest period of suckling was determined in the Saanen goats, which is in accordance with breeding technology, i.e. with the early separation of kids from the mothers and more frequent usage of milk substitutes in feeding of kids. A considerably longer suckling period and a greater quantity of suckled milk were determined in the other two monitored breeds. During the suckling period, most milk was suckled by the Alpine-French kids (122.08 kg), whilst the highest milk yield in the milking period was recorded in the Saanen goats (621.43 kg).

The content of fat and proteins in milk determines its feeding value, the possibility of processing into cheese, as well as the quality and sensory characteristics of the produced cheese. In Alpine-French and the GIF goat milk during lactation it was established that the average content of milk fat is roughly equal (3.55 vs. 3.49 %). However, the average fat content in milk of the mentioned breeds is slightly higher in relation to the established fat content in milk of the Saanen goats (3.35 %), which confirms the existence of a negative genetic correlation between the quantity of milk and the content of milk fat, since the Saanen goats had considerably higher milk yield. The highest average protein content was established in the milk of the Alpine-French goat, whilst in the other two breeds the protein content was almost identical and lower than the values of the protein content mentioned by Kompan et al. (1998.) for Alpine and Saanen goats.

Table 4: Review of purchased quantities (L) of goat milk according to classes
 Tablica 4: Pregled otkupljenih količina kozjeg mlijeka prema klasama, u litrama

Year Godina	2003		2004		2005	
Class Klasa	Quantity Količina	%	Quantity Količina	%	Quantity Količina	%
Extra Ekstra	2.663 529	81.33	2.537 287	77.12	3.473 886	90.90
I*	391 217	11.95	81 239	2.47	30 081	0.79
II	220 129	6.72	130 885	3.98	103 623	2.71
III	-	-	46 687	1.42	15 293	0.40
Not classed Nije klasirano	188	0.01	494 061	15.02	198 961	5.21
Total Ukupno	3.275 063	100.00	3.290 159	100.00	3.821 844	100.00

* I class ≤ 1 000 000 total bacteria count/mL

I. klasa ≤ 1 000 000 mikroorganizama/mL

II class 1 001 000-1 500 000 total bacteria count/mL

II. klasa 1 001 000-1 500 000 mikroorganizama/mL

III class >1 500 000 total bacteria count/mL

III. klasa >1 500 000 mikroorganizama/mL

Source: Dakić, A., 2006

Izvor: Dakić, A., 2006.

In 2005 in Croatia, there were 10 dairy plants that purchased and processed goat milk - Vindija Varaždin being the most important one. Besides this, certain quantities of goat milk are produced and directly processed on family farms and these quantities are not recorded. From the data in table 4, a rising trend in the purchased quantities of milk can be noticed in the period from 2003 - 2005. Namely, during 2005, approximately 17 % more goat milk has been purchased in comparison to 2004 or 2003. Also in the past three years the hygienic quality of milk has increased. In relation to 2004, the amount of extra quality milk increased for 37 % in 2005, which is a good indicator that producers are more educated and this guarantees a high quality of dairy products (cheese). There is a similar increasing trend relating to the hygienic quality of goat milk in Hungary (Kukovics et al., 2004) which is primarily the result of a new policy of the state subsidies for goat-breeding.

Besides greater milking ability, the Saanen goat had a greater average litter size (1.53) than the Alpine-French (1.31), while the GIF had the largest average litter size (1.72). The average litter size of the breeds for meat production was 1.54 for the Boer goats and 1.51 for the Croatian coloured goat. In several current researches, a greater average litter size of the Saanen breed was established in relation to the Alpine breed (Pavić et al., 1988) and this is in accordance with the mentioned results. On the basis of our research,

the litter size of the dairy Damascus goats on Cyprus (Güney et al., 2005) is equal to the average litter size of the Saanen goats, followed by the Boer goat and the Croatian coloured goat. The number of kids in a litter is under direct influence of the kidding number, so a great part of the first and second kidding Alpine-French goats in our research contributed to such a low average litter size for this breed. Crepaldi et al. (1999) point out the smallest litter size of the Alpine goat in the first kidding (1.2) and the highest in the fourth kidding (1.7).

Conclusions

The production of goat milk is becoming more and more significant in Croatia and is mostly based on the imported goats breeds, the Alpine-French (the largest number), the Saanen and GIF goats. There are considerable differences among the breeds in the total milk yield in lactation and the chemical composition of the milk, as well as in the average litter size. The longest lactation period, as well as the longest milking period and the highest total milk yield were determined in the Saanen goats. However, the greatest average number of kids in a litter was established in the GIF, whilst the Alpine-French goat had the smallest average litter size.

MLIJEČNOST NEKIH PASMINA KOZA U HRVATSKOJ

Sažetak

Koze se u Hrvatskoj koriste uglavnom radi proizvodnje mesa. Međutim, u posljednjih dvadeset godina raste interes za uzgojem francuske alpine, sanske i njemačke oplemenjene (srnaste) koze radi proizvodnje mlijeka. Svrha ovog rada bila je utvrditi prosječnu veličinu legla najvažnijih pasmina koza koje se uzgajaju u Hrvatskoj te njihovu mliječnost i prosječne vrijednosti kemijskog sastava mlijeka. Najveća prosječna veličina legla utvrđena je u srnaste koze (1,72), zatim burske (1,54), sanske (1,53) i hrvatske bijele koze (1,51), dok je najmanja utvrđena prosječna veličina legla u francuske alpine (1,31). Najdulju prosječnu laktaciju od 259 dana imala je francuska alpina, dok je najveća ukupna proizvodnja mlijeka u laktaciji (724,4 kg), kao i najveća količina u laktaciji proizvedene mliječne masti (20,16 kg) i bjelančevina (18,64 kg) utvrđena u sanskih koza. Međutim, u mlijeku francuske alpine utvrđen je najviši prosječni sadržaj masti (3,55 %), dok je u mlijeku srnaste koze utvrđen najviši prosječni sadržaj bjelančevina (3,23 %). Sanske koze

imale su najduže razdoblje mužnje (222 dana) i najkraće razdoblje sisanja (32 dana), dok su francuska alpina i srnasta koza imale najduže razdoblje sisanja (51, odnosno 45 dana). Najmanju količinu mlijeka tijekom razdoblja sisanja (102,97 kg, odnosno 14 %) posisala je jarad sanskih koza, dok je jarad francuske alpine (122,08 kg, odnosno 22 %) i srnaste koze (116,31 kg, odnosno 22 %) posisala najviše količine mlijeka.

Ključne riječi: kozje mlijeko, pasmina, laktacija, sastav mlijeka

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