

RESEARCH REGARDING THE QUANTITY AND QUALITY OF MILK OBTAINED FROM PRIMIPAROUS SAANEN GOATS REARED IN INDUSTRIAL SYSTEM

Stela Zamfirescu¹, Daniela Jitariu¹, N. Dobrin¹, Dorina Nadolu¹,
Ana Cismileanu², Il. Voicu²

¹“Ovidius” University of Constanta, Romania

²Balotesti National Institute for Animal Biology and Nutrition, Romania

Abstract

The rearing system, the mating season and the nutrition of primiparous Saanen goats have influence on the quantity and quality of milk. The natural mating of Saanen females at 7-9 months of age, with a normal weight of 35-38 kg, has influence on the quantitative production of milk. Given the administration of a feed ration that ensured 2.29 UFL at mating and 3.29 UFL at birth, the primiparous Saanen goats gained 51.50-56.65 kg 30 days after birth. The milk production generated within 240-270 days was 612.2 kg-778.2 kg, with a daily average production of 2.55-2.88 liters. The type of birth (simple or twins) has no influence on the milk production or its quality. The quality control of the milk obtained from the three lots emphasized that the biochemical parameters analyzed have normal values for fat (3.80 %-3.95%), slightly elevated for proteins (3.69%-3.80%), lactose (4.19%- 4.25%) and casein (2.57% - 2.59), and a constant pH of 6.61-6.77. The fat-protein ratio was 1.02-1.04, lower than the normal values of 1.15-1.20. The non-protein nitrogen – g/100g (NPN/CU) from the milk had values under 0.03 in all the lots. NPN/CU is an indicator for the ruminal proteins digestion. The urea nitrogen-MUN (g/100g) displayed very high values, of 16±3.06 in lot 1, and 15.86 in lot 2 and 3. MUN is an indicator that provides information about the status of the energy and protein balance in goats, which is used to monitor feeding and to evaluate the excess nitrogen in the ration. The casein (g/100g) determined in the Saanen goat milk had the following values 2.59 (lot 1), 2.54 (lot 2) and 2.57 (lot 3). In our research, of the total proteins, casein represented 179.9% in lot 1, 75% in lot 2 and 67.6 % in lot 3, being inversely proportional to the daily and total milk production of the lots.

Key words: Saanen goats, primiparous, milk quality

INTRODUCTION

The feeding habit and the rearing system of primiparous Saanen goats influence the quantity and quality of milk [5], [6], [15]. Considerable research has demonstrated the influence of the nutrition management and of the rearing system on the growth and development of young imported Saanen goats [12], [14], [22]. The industrial rearing system, namely goats kept in permanent confinement, has negative effects on them, influencing their health and especially their productive longevity. This is why the reform percentage is higher than the one for goats reared in semi-intensive or extensive systems. The nutritional,

reproductive and exploitation management must be controlled very well with the purpose of maximizing the productive potential of goats. The objective of the research was the quantitative and qualitative evaluation of milk production in primiparous Saanen goats exploited in industrial system at the Elcomex Agroindustrial S.A. complex, in Nicolae Balcescu (Constanta county).

MATERIAL AND METHOD

a) The biological material was made up of young Saanen goats (n =174), 7-9 months of age, separated into 3 groups, depending on body weight, on June 1st, 2016. Lot 1 was made up of 30 goats (5.5 months old, 30-32 kg), Lot 2 included 41 goats (6.5 months old, 32-34 kg) and Lot 3 made up of 103 goats

*Corresponding author: zamfirescustela@yahoo.com

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(7.5 months old, 35-38 kg). For Lots 1 and 2, the mating was natural between August 15 and September 30 2016, while for Lot 3, with goats weighing over 35 Kg, the mating was artificial, after a treatment of estrus induction and synchronization with Chronogest R sponges. The feed ration for the Saanen goats at birth was calculated for 3.0 kg of milk and ensured a protein and energy value of: UNL-2.39, PDIN-308, PDIE-283, Ca-21 and P-6.87. The initial protein and energy value of the ration increased monthly (from mating to birthing) by 0.2 UFL (Table 1). Also, in all the lots, the feed ration was supplemented with minerals and vitamins (DYNA HP4, Alicoop France) beginning with the third month of pregnancy. In the 4th month Enerlene (20 ml/head) was administered *per os* to prevent pregnancy toxemia.

b) Rearing conditions: The goats were kept in intensive system with permanent confinement and fully mechanized zootechnical activities. The whole grains and cereals were administered by mechanized means, while the fibrous feed was administered by hand. The animal shelters were fitted with automated drinkers, controlled ventilation and the waste was removed by mechanized means every month. Milking was accomplished by a linear milking installation (MILKPLAN, Greece) fitted with a system of measurement and individual recording of the milk (AFMILK GOAT, Israel). All the females were weighed at the beginning of the experiment (June 1st, 2016), three months after mating and a month after birthing. The control of the milk production was done at 40, 100 and 150 days after birthing.

c) Goat reproduction was induced hormonally in 103 heads (Lot 3) by means of Chronogest sponges (INTERVET HOLLAND) in June 2016, while the rest of the young females (Lots 1 and 2) were mated naturally between August 15 and September 30 2016. The birthing events were grouped in November 2016 for Lot 3, while the goats in Lots 1 and 2 gave birth in January-February 2017.

d) Biochemical analyses from milk. The biochemical parameters were determined by the milk analyzer LactoScope FTIR (Delta

Instruments). The following parameters were determined: fat (g/100g), lactose (g/100g) non-protein nitrogen / calculated urea-NPN/CU (g/100g), milk urea nitrogen MUN (g/100g), pH value, protein (g/100g), solids (g/100g) and casein (g/100g). The analyses were done when the milk was delivered to the dairy plant in March, May and July.

e) The evaluation of the results was accomplished by weighing the animals when the experimental lots were formed, in the third month of pregnancy and a month after birthing, by the analysis of the reproduction indicators for each lot and by the quantitative and qualitative analysis of the milk production accomplished at the beginning, middle and end of lactation. The duration of lactation in primiparous goats was on average 240 days for Lots 1 and 2 and 270 days for Lot 3. The data were statistically processed by the "SPSS Statistics-17" software.

RESULTS AND DISCUSSIONS

The evolution of body weight and the reproduction indices in primiparous goats, reported to the feed ration (Table 1), the reproduction performances and the milk production are presented in Tables 2, 3, 4 and 5.

All the goat lots received a unique feed ration, with a protein and energy value of 2.39 UNL, 308 PDIN and 283 PDIE, monthly supplemented with 0.2 UNL until birthing. The daily average of the weight gain between mating and the third month of pregnancy (g/day) was 100.8g in Lot 1, 86 g in Lot 2 and 122.37g in Lot 3. The weight differences at the formation of the experimental lots were due to the age differences of the goats whose weight at the moment of mating was according to their breed standard. The evolution of the body weight of females was normal, so 30 days after birthing all the lots registered a normal average weight for the Saanen breed after the first birth, namely: 51.50 kg, 54.90kg and 56.65kg. The monthly intake of 0.2 UNL supplemented the standard needs for proteins and energy to 3.39 UNL for an adult Saanen goat (Table 1).

Table 1 Structure of the feed ration in primiparous Saanen goats, calculated for a milk production of 3 liters

Feed	kg	SU	% refusal	UNL	PDIN	PDIE	Ca	P
Total intake		2.777	-	2.194	261	216.8	24.31	8.21
Total requirements		2.50		2.27	181	181	15.5	7.5
Verdipack lactation granules	1.2	1.06	0	0.95	117	106	11	3.0
ELCO* mix	0.4	0.347	0	0.364	57	34	0.4	2.18
Alfalfa hay	0.7	0.6	15	0.39	51	34.8	8.46	1.2
Mash hay	0.5	0.42	0	0.31	28	27	3.6	1.20
Straw ad libitum	0.4	0.35		0.19	8	15	0.85	0.63

*Elco mix: 100g corn, 100 g barley, 200g sunflower

Table 2 Evolution of the body weight of young Saanen goats (7-9 months old), at mating, in the third month of pregnancy and 30 days after birthing (Elcomex 2017)

lot	goats (n)	Weight (kg) on June 15 th , 2017	Weight at mating (kg)	Weight in the third month of pregnancy (kg)	Weight 30 days after birthing (kg)
Lot 1	30	31.31±0.73	35.30±1.25	44.38±2.35	51.50±2.03
Lot 2	41	33.41±0.58	38.38±2.19	46.13±1.88	54.90±1.55
Lot 3	103	36.67± 1.15	38.57±2.51	49.80±2.33	56.65± 2.78

Table 3 Evolution of the reproduction indices in the Saanen goats after full term pregnancy (Elcomex 2017)

Lot/n	Weight at mating (kg)	Females in estrus (n/%)	NR (%)*	Pregnant at 45 days **	Fertility % (n/%)***	P %	Simple births (n/%)
Lot 1/30	35.30±1.25	21/70	19/63.33	19/63.33	17/89.47	23/135.29	11/64.70
Lot 2/41	38.38±2.19	36/87.80	31/86.11	29/79.48	28/93.54	37/132.42	19/67.85
Lot 3/103****	38.57±2.51	96/93.20	91/94.79	86/94.50	81/94.18	143/176.54	24/29.62

Table 4 Average daily and total milk production in primiparous Saanen goats at the beginning, middle and end of the lactation period (Elcomex 2017)

Lot	Birthing interval	Kg 30 days after birthing	UNL	Milk kg/day X±sx	Milk kg/day* X±sx	Milk kg/day X±sx	Lactation days	Total milk lact. kg/	Average milk production /day
				Cop1	Cop 2	Cop 3			
1	11.01-25.02.2017	51.50±2.03	3.39	2.40	2.85	2.36	240	612.8	2.55
2	11.01-25.02.2017	54.90±1.55	3.39	2.45	3.03	2.26	240	690.4	2.87
3	15.11.2016-25.11.2016	56.65±2.78	3.39	2.73	3.15	2.78	270	778.2	2.88

The reproduction indices in the three lots were different among lots 1 and 2, which were mated in natural estrus in reproductive season, compared to lot 3 where the estrus was induced outside reproductive season (June 2017) by Chronogest R sponges. The pregnancy percentage in lot 1 was 63.33 % while in lot 2, it was 79.48%. The values were normal in the primiparous goats mated in normal reproductive season, lower than in

the multiparous females, as the first estrus cycles in young goats are anovulatory.

There were no significant differences between the fertility and prolificacy indices ($P < 0.05$) among the lots. These were 89-93% and 135%-132%, respectively, the values being normal for primiparous Saanen goats. The simple births were 64.70%-67.85% (table 2). The goats in lot 3, mated naturally in induced estrus, had higher reproductive

indices. The treatment included the administration of a gonadotropin (Folligon 400UI) which synchronically stimulates multiple ovulations, and which determined the grouped induction of estrus in 93% of the goats, a fertility of 94% and a prolificacy of 176.54% (Table 3) The primiparous goats in lot 3 gave birth in November 2016. They were 7 months old when they mated, and had a higher body weight which maintained after birthing. Given these conditions, the reproduction indices obtained were competitive as the high fertility and prolificacy ensured a significant surplus of kids, obtained due to the large number of twin births.

In the industrial rearing system of Saanen goats, the ultra-precocious weaning is practiced, by which the kids are taken immediately after birth and transferred to the nursery, where the colostrum from the mother is administered by feeding bottle for three

days. After this period, the colostrum milk from the mothers is mixed and administered to the kids. Five days after birth, the milked milk is stored in cooling tanks and delivered to the dairy plant. Given that all three lots received identical feeding rations, there was a difference in the average weight of females in the lots at mating, in the third month of pregnancy and 30 days after birthing. Thus, in a lactation period of 240 days (lot 1 and 2) and 270 days (lot 3), the average daily production of milk was 2.55 kg in lot 1, 2.87kg in lot 2 and 2.88kg in lot 3. Three controls of the production were accomplished, at the beginning, middle and end of the lactation period, which emphasize [1], [13], [3], [12] and the management of reproduction [17], [11], [3], [14]. The NPN/CU values found in goat milk were lower in all the lots, 0.03mg. Prosser (2008) found 4 mg/100ml in goat milk and 7 mg/100 ml in cow milk.

Table 5 Biochemical parameters in milk from primiparous Saanen goats determined on average milk samples collected from the three lots in mid lactation

Lot 1	N	Minimum	Maximum	Mean	
	Statistic	Statistic	Statistic	Statistic	sx
Fat(g/100g)	14	3.30	4.31	3.8057	.33049
Lactose(g/100g)	14	3.77	4.52	4.1943	.32436
NPN/CU(g/100g)	14	.02	.04	.0350	.00650
MUN(g/100g)	14	11.62	20.96	16.6086	3.06036
pH	14	6.61	6.77	6.7007	.05136
Protein(g/100g)	14	3.24	4.50	3.6986	.43204
Solids(g/100g)	14	11.73	13.19	12.4136	.49922
Casein(g/100g)	14	2.59	2.61	2.5971	.00611

Lot 2	N	Minimum	Maximum	Mean	
	Statistic	Statistic	Statistic	Statistic	sx
Fat(g/100g)	26	3.30	4.35	3.8246	.31609
Lactose(g/100g)	26	3.77	4.59	4.2504	.29613
NPN/CU(g/100g)	26	.02	.04	.0342	.00643
MUN(g/100g)	26	11.62	20.96	15.8681	3.06336
pH	26	6.59	6.77	6.6792	.05926
Protein(g/100g)	26	3.20	4.50	3.5704	.27333
Solids(g/100g)	26	11.73	13.68	12.6515	.60609
Casein(g/100g)	15	2.40	2.60	2.5433	.07098

Lot 3	N	Minimum	Maximum	Mean	
	Statistic	Statistic	Statistic	Statistic	sx
Fat(g/100g)	26	3.30	4.80	3.9554	.43863
Lactose(g/100g)	26	3.77	4.59	4.2504	.29613
NPN/CU(g/100g)	26	.02	.04	.0342	.00643
MUN(g/100g)	26	11.62	20.96	15.8681	3.06336
pH	26	6.59	6.77	6.6792	.05926
Protein(g/100g)	26	3.42	4.50	3.8027	.35988
Solids(g/100g)	26	11.73	13.68	12.6515	.60609
Casein(g/100g)	26	2.40	2.68	2.5715	.07270

MUN (g/100g) displayed values of 16 ± 3.06 in lot 1, and 15.86 in lots 2 and 3. MUN is an indicator that offers information about the status of the energy and protein balance in goats, and which is used to monitor feeding but also to evaluate the excess nitrogen in the ration [27]. The values found in milk are closely correlated to the urea in blood [7]. The normal values in the milk of some species mentioned in the specialized literature range between 9-16 mg/dl in cow and goat [1], [16]. Urea is an indicator of the ruminal balance so that MUN values over 18 mg/dl indicate a disturbance of the ruminal balance, a decrease of carbohydrates or a reduced microbial population in the rumen. High MUN levels decrease milk production and cause economic losses [27], [23], [24], [25].

Casein (g/100 g) was determined in goat milk with values of 2.59 in lot 1, 2.54 in lot 2 and 2.57 in lot 3. The main casein types in goat milk are β - and α -s2 casein. Total casein represents 81% of the total proteins, of which beta casein represents 47 % and α s2 casein represents 11.5 %, the rest being casein α s1 and k-casein [25]. A large amount of casein in goat milk indicates good quality milk with a high coefficient of transformation to dairy [26], [16], [17], [20]. Caseins determined the initiation of much research regarding the digestibility of goat milk but also regarding the improvement of the goat selection using casein α s2 and α s1 as selection index [19]. In our research, casein, out of total proteins, represented 79.9% in lot 1, 75% in lot 2 and 67.6 % in lot 3, being inversely proportional with the daily and total production of milk for the lots.

CONCLUSIONS

The natural mating of Saanen goats at 7-9 months of age, with a normal weight of 35-38 kg did not influence the quantitative production of milk.

The milk production of the primiparous goats reared in industrial system generated in 240-270 days was 612.2-778.2 kg, which led to an average daily production of 2.55-2.88 liters.

The quality control of the milk obtained from primiparous goats emphasized the biochemical parameters with normal values (fat 3.80%-3.95%), slightly elevated (proteins 3.69%-3.80%, lactose 4.19%- 4.25%, casein 2.57%-2.59) or with constant values over the entire lactation period (pH 6.61-6.77).

The fat-protein ratio was lower than the normal values by 10%-12%.

The urea nitrogen-MUN(g/100g) in milk had high values (15.86 ± 3.06), MUN indicating excess nitrogen in the ration.

The casein (g/100 g) determined in the Saanen goat milk had normal values of 2.54 - 2.59 and represented 67.6%-79.9% of the total proteins.

The research show that the rearing system, the mating season and the reproduction type (natural or artificial) of the primiparous Saanen goats had influence on the quantity and quality of milk.

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