

BEHAVIOR, SEXUAL ACTIVITY AND MILK PRODUCTION OF CONFINED SAANEN GOATS

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ABSTRACT

We evaluated a new criterion for behavior or reactivity estimation for Saanen dairy goats, based on a ranking of attitude of goats submitted to social isolation from their herd mates. We also evaluated the influence of their behavior on milk production and composition during the whole lactation period and on reproductive characteristics. Twenty-three dairy Saanen goats, aged from 2 to 9 years, fourteen primiparous and nine multiparous, were divided into two groups according to their reactivity. Non-reactive and reactive animals were allocated in groups one and two, respectively. Milk samples were collected at an interval of 15 days and a teaser was used to identify the

first post-calving estrus. Approximation time showed a mean of 21.42±32.70 seconds, which was significantly related to the attitude of the animals. Daily mean of individual milk production was 1.30±0.26 kg, varying from 0.25 to 3.50 kg. Milk yield and composition, besides reproductive attributes, were not significantly affected by reactivity. Reactivity was not affected by parturition. Attitude allowed classification of dairy goats according to their reactivity; however, reactivity did not affect physiological, productive and reproductive attributes of dairy goats.

KEYWORDS: behavior; milk production; reproduction; Saanen goats.

TEMPERAMENTO, ATIVIDADE SEXUAL E PRODUÇÃO LEITEIRA EM CABRAS SAANEN CONFINADAS

RESUMO

A realização deste trabalho teve como objetivo avaliar um novo critério de temperamento de cabras leiteiras da raça Saanen, a partir do agrupamento de classes de atitudes durante o isolamento e avaliar a interferência da reatividade das cabras na produção e composição do leite durante a curva de lactação e nas características reprodutivas. Foram utilizadas 23 cabras Saanen, com idade variando de 2 a 9 anos, sendo 14 primíparas e 9 pluríparas, divididas em dois grupos de acordo com a reatividade medida através de escores. No grupo I foram alocados os animais reativos e no grupo II os animais não reativos. Foram realizadas coletas de leite quinzenais e rufiação para identificação do primeiro cio pós-parto. O

tempo de aproximação apresentou média de 21,42 ± 32,70 segundos e foi significativamente relacionado com a atitude dos animais. A produção média diária de leite foi de 1,30 ± 0,26 kg de leite/cabra, variando de 0,25 a 3,50 kg. A produção e a composição química do leite e as variáveis reprodutivas não foram afetadas significativamente pela reatividade. Não houve diferença entre primíparas e pluríparas quanto à sua reatividade. O critério de atitude permitiu classificar as cabras conforme a sua reatividade. A reatividade não influenciou as variáveis fisiológicas, produtivas e reprodutivas das cabras leiteiras.

PALAVRAS-CHAVE: temperamento; cabras Saanen; produção leiteira; reprodução.

INTRODUCTION

In recent years, goat production in Brazil has become an important livestock alternative, especially for the small producer who employs family labor. Amongst the factors that have contributed to this consolidation, the milk particular characteristics are noteworthy (GONÇALVES et al., 2001).

The increasingly intensive management of animal species, especially dairy goats, has revealed the importance of understanding the behavior of these animals, more specifically their temperament, that is, the way they react to stress caused by management practices and daily human contact. In this type of system, animals might not express all innate behavior when provided with basic needs such as food, shade and protection from predators. However, when the provision of these needs is inadequate, there may be a wide range of behavioral patterns. These events may have a direct influence on productivity and welfare of animals reared in confinement.

The individuals' reaction to the events is determined by their temperament, which in turn is defined as the reactivity of the nervous system and produced by genetic and environmental factors (GRANDIN, 1998). Reactivity refers to the characteristics of the individual's reaction to changes in the environment, reflected on the internal regulation by somatic, endocrine and autonomic systems for modulating responses, resulting in behavioral patterns.

The main component of temperament is fear, which predisposes the individual to perceive and react similarly to a wide range of potentially threatening events (GRANDIN, 1998). The selection of animals temperament better suited to certain conditions of handling, along with changes in aversive management techniques, may minimize problems and negative consequences for both animals and handlers (LE NEINDRE et al., 1996).

In milk-producing herds under confinement conditions, animals are reared according to age, nutritional requirements, body condition, lactation period and level of milk production, in order to increase productivity. While forming these groups, unfamiliar animals establish a social hierarchy, which usually results in aggression and submission behaviors that may temporarily disturb the animals and lead to decreased milk production (BOE & FAEVERIK, 2003) and reproductive aspects. Goats are very hierarchical animals, with an almost linear social hierarchy, and social relations within the group are important for the animals' adaptation to the environment, influencing individual responses to external events (VAN et al., 2007).

Applying tests is extremely important to determine the temperament of the animals, since highly reactive animals may be calm in a familiar environment, masking their true temperament. The design of the test, its duration and the behaviors evaluated vary amongst different experimental approaches. In general, these tests aim at providing a stimulus to the individual, collecting and analyzing their reactions. The stimulus presented varies in degrees of intensity, complexity and novelty (GRANDIN, 1998).

Little is known about the performance of the major goat breeds, and estimates of behavioral characteristics, production and reproduction of these animals are especially scarce, although they have been in the country for several decades (GONÇALES et al., 2001).

This work aimed to evaluate a new temperament criterion for Saanen dairy goats, from the combination of classes of attitudes toward seclusion, and evaluate the interference of goats' reactivity, measured by these criteria, on production and milk composition during the lactation curve and on reproductive characteristics.

MATERIAL AND METHODS

The experiment was conducted in a goat farm in the municipality of Cariacica - ES, located at latitude 20° 15 '50" South and longitude 40° 25' 12" West. We used 23 Saanen goats, aged 2-9 years, being 14 primiparous and nine pluriparous, chosen within the herd for being pregnant. Animals were housed and maintained in four bays, receiving the same kind of food and sanitary management. The feed consisted of chopped Cameroon grass (*Pennisetum purpureum* Schum. cv. Cameroon), provided at will, and approximately 250 g/ animal of commercial feed for lactating or pregnant goats, with 20% protein, offered twice a day, plus mineral salt for goats. Water was supplied *ad libitum*.

At the beginning of the experiment, the goats were examined by ultrasound for diagnosis of pregnancy, when data regarding the period of pregnancy and number of births were recorded.

When the first group of goats was on average at 15 days postpartum, milk sampling for qualitative and quantitative assessment of production was carried out every two weeks. Regarding the amount of milk produced, milk was analyzed on 10 occasions, by individual weighings of the samples from the morning and afternoon milking. As for quality checking, samples (n = 226) were taken and sent to the Milk Clinic (ESALQ-USP) in bottles

containing preservative (Azidiol), for assessment of the percentage composition of crude fat, total protein, lactose and total solids by the method of infrared spectrophotometry with the equipment Bentley 2000® (BENTLEY INSTRUMENTS, 1995a; FONSECA & SANTOS, 2000). The number of somatic cells (SCC) was analyzed by electronic counting by flow cytometry (Somacount 300 ®) (BENTLEY INSTRUMENTS, 1995b).

At 30 days postpartum, behavioral measures were performed on each female: heart rate, respiratory rate and body temperature. The temperature was measured three times along with the other measurements, as follows: first, 15 minutes before the behavioral evaluation (HR1, RF1, T1); second, soon after this evaluation (HR2, RF2, T2); and third, 15 minutes after the goats returned to the bays (HR3, RF3, T3) (RUSHEN et al., 2001).

The respiratory frequency (RF) and heart rate (HR) were checked visually (FR) and with the aid of a stethoscope (HR), and body temperature (T) was measured transrectally by a clinical thermometer.

To perform the behavioral measures, each animal was placed in a cage measuring 3.50 m wide x 2.50 m long, where each one remained alone for one minute. Soon after this period, approach time, escape distance and attitude toward isolation were observed.

Approach time (LYONS, 1989; BOIVIN et al., 2001) was evaluated after an observer, who kept distance from the animal, entered the room. The observer remained still in front of the animal for two minutes, and recorded the time it took the animal to move (approach to or escape from the person), i.e. to perform a movement of the forelimbs.

To check space distance (HEMSWORTH et al., 2002), the observer approached the animal at a constant speed. The scape distance was determined as the first distance between person and animal, when the animal moved due to the approach stimulus. If the animal did not move because of the approach, scape distance was considered 0 (zero) meter.

After approach time and scape distance evaluation, the animal remained alone in the bay, when their attitude towards isolation was assessed.

Attitude toward isolation was classified into seven classes (Table 1), and from these classes, the criterion was formulated to identify reactive and non-reactive animals. This criterion consisted of grouping the classes into two categories of reactivity. The animals were divided into two groups: reactive animals (group I) and non-reactive animals (group II).

The animals were considered reactive when they presented the following attitudes: excited, tense, apprehensive and fearful. Non-reactive animals showed friendly and curious attitudes.

The classification of animals as regards their reactivity from its attitude towards the isolation was used as a classification variable in the subsequent analysis of variance. The other behavioral and physiological variables related to temperament were considered as dependent variables.

Table 1: Definitions of classes of attitude towards the isolation of Saanen dairy goats in confinement

Item	Behavior definition
Excitable	Reacts strongly toward changes in the environment
Tense	Presents alert attitude in the new environment
Curious	Looks around, exploring the environment
Apprehensive	Shows anxiety and fear
Confident	Acts positively showing security
Friendly	Initiates approach and/or contact with people
Fearful	Shows agitation, alertness and vocalizes

SOURCE: Adapted from LYONS, 1989

Statistical analysis was performed according to a completely randomized design. The dependent variables related to the behavior and reproduction were studied according to analysis of variance, considering the effect of reactivity classes ($n = 2$) and parturition (primiparous and pluriparous). The variables relative to milk production and composition were analyzed as split plots in time, where classes of reactivity were assigned to main plots and time periods to the subplots. The frequency of reactive animals according to their parturition was analyzed by nonparametric statistical analysis χ^2 test. A 0.10 level was adopted as the maximum probability of type I error.

RESULTS AND DISCUSSION

Behavioral and physiological measures and their values are shown in Table 2. Although 50% and 69.2% of pluriparous and primiparous goats, respectively, were classified as reactive, the frequency of reactive animals in each parturition group was not statistically different ($P > 0.10$). The values were then grouped by class of reactivity.

Table 2: Mean values of variables related to temperament and the probability of rejecting the null hypothesis of the reactivity effect of Saanen lactating goats

Variables	Non-reactive	Reactive	Average	CV	R ²	P>F
Temperature (T1 – °C)	38.90	38.83	38.85	1.16	0.004	0.7720
Temperature (T2 – °C)	38.82	38.86	38.85	0.91	0.002	0.8439
Temperature (T3 – °C)	39.00	38.95	38.96	0.92	0.004	0.7856
Heart rate (FC1 – bpm)	104.00	98.89	100.00	16.41	0.018	0.5445
Heart rate (FC2 – bpm)	96.00	100.89	99.83	18.69	0.013	0.6097
Heart rate (FC3 – bpm)	94.40	89.56	90.61	39.01	0.003	0.7889
Respiratory frequency (FR1 – mpm)	60.80	50.89	53.04	54.93	0.021	0.5084
Respiratory frequency (FR2 – mpm)	66.40	49.11	52.87	58.06	0.056	0.2778
Respiratory frequency (FR3 – mpm)	76.00	58.44	62.26	69.62	0.297	0.4320
Approach time (s)	35.05	8.92	21.42	152.67	0.149	0.0692
Escape distance (cm)	135.80	108.86	114.72	81.27	0.015	0.5737

CV = coefficient of variation

R² = coefficient of correlation

Regarding the variables related to temperament, it was observed that approach time was different ($P = 0.07$) according to the attitude of the animals. Approach time presented an average of 21.42 ± 32.70 seconds, coefficient of variation of 70.37 and $r^2 = 0.0086$. Approach time of non-reactive goats was 26.13 seconds higher than the time of reactive goats. This large difference indicates that reactive goats showed more resistance to the observer. Approach time was significantly correlated with the attitude variable, subjective measurement that was performed by observing the behavior of the animal in seclusion. This significant correlation ($r = -0.39$, $P = 0.0692$) indicates that goats considered reactive in their attitude toward the isolation from their mates had also the need to escape from what they may have considered aversive situations.

The physiological measures (heart and respiratory rates and body temperature) showed no significant differences between reactive and non-reactive animals, i.e., they were not affected by the reactivity of the animals, remaining within the physiological range (Table 2) at the three measurement moments – 15 minutes before, immediately after and 15 minutes after the behavioral tests. In goats, the physiological body temperature varies from 38.5 to 39.5, the heart rate from 70 to 110 beats per minute and the respiratory rate from 50 to 70 movements per minute (BLOOD & RADOSTITS, 1991).

This occurrence may be explained by the fact that the animals are used to a certain degree of manipulation and contact with humans. It is likely

that the situations the animals were submitted to were not aversive enough to change their physiological parameters.

Changes in such measures would be expected because social isolation in an unfamiliar environment can increase cortisol concentrations and heart rate values (RUSHEN et al., 1999). The difference may be in the fact that the animals in this experiment were only in social isolation, but the environment was familiar.

Animals in isolation were able to distinguish between observers who treated them in non-aversive and aversive ways (MUNKSGAARD et al., 1997). Possibly, the isolation used in this experiment, without the practice of an aversive treatment, has not been strong enough as a stressor capable of altering the physiological parameters. Moreover, according to RUSHEN et al. (2001), the presence of people can reduce the animal's response to stress, which occurred at the time of the behavioral measures.

A slight decrease in the mean heart rate was observed during the evaluation and at 15 minutes after the behavioral measures, although it was not significant ($P > 0.05$). This fact may be compared to the one found by RUSHEN et al. (2001), justifying the possibility that human contact reduces the heart rate at least during the tests.

It is surprising that the scape distance measure was not affected by the reactivity, as it is one of the most used measurement in the verification of reactivity in different animal species. It is possible that the type of farming - intensive management and constant daily contact with people - has made the

goats used to human presence and approach. The ability to adapt to the presence of people and frequent contact is determined by learning during the animal's life, becoming an important feature that facilitates the handling minimizing the negative effects on their well-being (PRICE, 2002)

BROOM & FRASER (2007) claim that animals have the ability to prepare themselves for predictable events, by feedback mechanisms that control physiological and behavioral responses in advance. If the aversive event is predictable, the animal can prepare itself behaviorally or by changes in the brain, and it can also prepare itself for non-aversive events.

The behavioral variable scape distance was significantly correlated with body temperature measured at the three evaluation moments (T1, T2 and T3). The coefficients of linear correlation between escape distance and the temperature values measured 15 minutes before the behavioral evaluation (T1), right after the evaluation (T2), and 15 minutes after the goats returned to the stalls (T3) were, respectively, $r = 0.41$ and $P = 0.0491$, $r = 0.39$ and $P = 0.0641$, $r = 0.48$ and $P = 0.0204$. Such positive correlations indicate that the higher the escape distance was the higher the body temperature of the animals, showing a certain inability to prepare themselves for unpredictable events making body regulation more difficult. However, both behavioral and physiological evaluations were not affected by the animal's reactivity (Table 2). According to BROOM & FRASER (2007), a certain behavior will only be shown if the stimulus is strong enough to determine it, however, in the absence of a key stimulus or in the presence of some social or physical barrier, the behavior may not occur.

Milk production did not differ statistically between reactive and non-reactive goats (Table 3). Although the reactivity was positively correlated with milk production ($r = 0.15$, $P = 0.0221$), the correlation coefficient was low. It was observed that reactive goats produced numerically more milk than non-reactive goats, contrary to other studies conducted with dairy cattle, in which non-reactive cows produced more milk than those considered reactive (RUSHEN et al., 1999; HEMSWORTH et al. 2000), especially when the animals were handled in an aversive way. The goats are considered to be better adapted to adverse conditions than other domestic animals and it can also be reflected in lessened responses to stressful conditions (SILANIKOVÉ, 2000), especially when management is not considered aversive. FÉRNANDEZ et al. (2007) reported that intermediate social ranking goats produced more milk than those of low and high position in the social ranking, indicating that the former suffered less social pressure and the latter spent less energy to maintain the position of dominant animals. According to KENNEDY et al. (1982), other factors may influence milk production, such as, race, diet, age of the mother, number of births, number of litters, number of daily milkings and weather conditions.

Milk composition was not affected by the reactivity of the animals and there was no interaction between reactivity and moments of measurements. The average data of milk production and composition according to classes of reactivity are presented in Table 3.

Table 3. Mean values of milk production (kg / goat / day), chemical composition of milk constituents (%) and the corrected number of somatic cells (log n°CCS / mL of milk) and the probability of rejecting the null hypothesis of the reactivity effect of Saanen lactating goats

Milk	Non-reactive	Reactive	Mean \pm SD	CV	R ²	P>F R ¹	P>F R \times P ²
Milk production	1.21	1.41	1.3 \pm 0.26	20.02	0.87	0.3794	0.9886
Fat	3.97	3.84	3.89 \pm 0.69	17.76	0.54	0.6549	0.8997
Protein	2.89	2.85	2.86 \pm 0.19	6.57	0.74	0.6797	0.9940
Lactose	4.30	4.38	4.34 \pm 0.26	5.99	0.39	0.2172	0.3609
Total solids	12.65	12.13	12.35 \pm 2.64	21.35	0.34	0.3659	0.5014
CCS ³	6.22	6.30	6.26 \pm 0.72	11.5	0.74	0.8656	0.1028

¹effect of the reactivity

² effect of the interaction between period and reactivity

³ Number of somatic cells corrected by logarithmic transformation

The criterion for grouping the animals according to the reactivity was not sufficient to demonstrate the existence of an effect of temperament on the reproductive variables considered in this study, and no significant

differences were found between reactive and non-reactive goats.

The reproductive rates observed in reactive and non-reactive animals can be seen in Table 4.

Table 4: Mean values of reproductive indices of the probability of rejecting the null hypothesis of the reactivity effect of Saanen lactating goats

Reproduction	Non-reactive	Reactive	Mean ± SD	CV (%)	R ²	P>F
Number of previous parturition	2.36	1.50	1.91±1.50		0.5	
Number of born goats	1.67	1.82	1.75±0.55		0.4	
Interval between estrus 1 (days)	40.00	10.00	32.50	59.34	48	0.31
Interval between estrus 2 (days)	29.00	-	-	-	-	-
Interval between estrus (days)	34.50	-	-	-	-	-
Interval parturition/conception (days)	188.63±17.61	192.70±21.34	190.89±19.32	10.37	1.2	0.67
Interval between parturition (days)	331.57±19.27	338.50±21.83	335.65±20.48	6.21	2.9	0.51

SD = standard deviation

Several authors indicate that productivity and reproductive variables are affected by the animals' behavior, being lower yields and reduced fertility observed in more excitable animals than in calmer animals (CONWAY et al., 1996; HEMSWORTH et al. 2000; CHUA et al., 2002; HEMSWORTH et al., 2002). However, non-aversive intensive treatment and management may provide a better environment and management adaptation to confined animals.

CONCLUSION

Reactivity did not affect production, milk composition and reproductive traits of Saanen goats reared in confinement, according to the way of evaluation of such variables employed in this study.

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Submitted on: August, 23, 2008. Accepted on: May, 17, 2011.