Acta Scientiarum

http://periodicos.uem.br/ojs/acta
ISSN on-line: 1807-8672
Doi: 10.4025/actascianimsci.v40i1.42454

ANIMAL PRODUCTION

Behavior of Saanen dairy goats in an enriched environment

Karina Aurora Rodrigues Gomes[1], Jean Kaíque Valentim[2*], Sara Santana Ramos Lemke[1], Gabriel Machado Dallago[2], Ricardo Cruz Vargas[1] and André Luís da Costa Paiva[1]

*[1]Instituto Federal de Minas Gerais, Bambuí, Minas Gerais, Brazil. [2]Universidade Federal dos Vales do Jequitinhonha e Mucuri, Rodovia MGT-367, Km 583, 5000, 39100-000, Alto da Jacuba, Diamantina, Minas Gerais, Brazil. *Author for correspondence. E-mail: Kaique.tim@hotmail.com*

ABSTRACT. The objective of the present study was to evaluate the behavior of lactating Saanen dairy goats housed with or without the use of environmental enrichment technique. Twelve animals were split into two equal groups and assign to one of two treatments: stall with or without enrichment. Five objects were used to enrich the stalls: plastic PET bottles suspended and freely on the floor (both filled with corn as a visual and auditory stimuli), general cleaning brushes fixed to the wall of the stall, suspended tire, and a tree trunk for climbing. The behavior of the goats was observed during two hours for 10 consecutive days. The behaviors were recorded using focal-animal sampling method, observing each animal during 10-minute period. Descriptive statistics were calculated plotting the results in behavior frequency charts. Animals on both treatments showed similar behaviors frequencies for food intake and self-cleaning. However, a higher frequency of stereotyped behaviors was registered in the treatment without environmental enrichment. The highest frequency of interaction was observed for suspended tire, indicating animal's preference for this object. In conclusion, animals on enriched environment show more different behaviors than animals in non-enriched environment and showed greater preference for some object over others.

Keywords: animal welfare; dairy goat; environmental enrichment; ethology; stereotyping.

Comportamento de cabras leiteiras Saanen em ambiente enriquecido

RESUMO. Objetivou-se com o presente trabalho avaliar o comportamento de cabras leiteiras da raça Saanen alojadas com ou sem a utilização da técnica de enriquecimento ambiental. Doze animais foram divididos em dois grupos iguais e designados a um dos seguintes tratamentos: baia com ou sem enriquecimento ambiental. Cinco objetos foram utilizados para enriquecer as baias: garrafa PET suspensa, garrafa PET solta no chão (ambas contendo milho como atrativo visual e auditivo), escova de limpeza fixada na parede, pneu suspenso e tronco de árvore para escalada. O comportamento das cabras foi avaliado por duas horas durante dez dias consecutivos e registrado por meio da amostragem focal instantânea durante intervalos de 10 minutos. Estatística descritiva foi calculada para os dados obtidos e criados gráficos de frequências. Animais em ambos os tratamentos tiveram frequências similares para os comportamentos relacionados ao consumo alimentar e autolimpeza. Entretanto, foi registrada maior frequência de estereotipias no tratamento sem enriquecimento ambiental. Foi observada maior interação com o objeto pneu suspenso, indicando a preferência dos animais pelo mesmo. Conclui-se que animais mantidos em ambiente enriquecido tiveram maior acervo comportamental e demonstraram maior preferência por determinados objetos.

Palavras-chave: bem-estar animal; caprinocultura leiteira; enriquecimento ambiental; etologia; estereotipagem.

Introduction

Goat farming was a marginal or subsistence activity, characterized by low productivity. Small producers with low income and no technological resources usually carried it out. However, this is changing due to increase in national and international consumption of products coming from this activity. In addition, methodological and technological advances are contributing to consolidate the activity (Resende et al., 2010). Goat breeding is one of the most competitive and growing activities of the Brazilian economy. It has increased the supply of meat, milk, and derivative products to the population as well as ensuring profitability for small producers (Martins Júnior et al., 2007).

The market has become more demanding about the quality of the products from this sector. It is, therefore, important that Brazilian producers understand and adapt to the international market demands and dynamics for goat meat, milk, and derivative products. Environmental enrichment can improve animal welfare and production.

The stress is related to animals' physiology and the environment in which they are housed. When animals are stressed, they develop atypical behaviors, which negatively affect their welfare, and consequently, their productive and reproductive performance (Marai, El-Darawany, Fadiel, & Abdel-Hafez, 2007). Environmental enrichment consists in introducing objects that stimulate the animals, reducing the monotony of feedlot to which they are commonly housed during the productive process.

Animals in feedlot are restricted to express behaviors compatible with those that the environment allows them to perform, consequently, they fail to perform behaviors characteristic of the species and begin to develop abnormal behavior, such as stereotypies.

A stereotypy is a behavioral disorder characterized by continuous repetition of certain behaviors. Campos, Tinôco, Silva, Pupa, & Silva (2010) describe agonistic behaviors between animals such as fighting, biting, or scratching each other. Frustration leads to repetitive and non-functional behaviors (stereotypy).

Therefore, environmental enrichment is based on the introduction of environmental improvements to fulfill the animals' behavioral needs (Foppa et al., 2014). In addition, environmental enrichment seeks to allow the expression of the natural pattern of behaviors of the species, avoiding anomalies that could harm the physical and psychic welfare of farming animals, as well as their productivity.

This type of management consists of placing objects, such as balls, tires, and others that can break the monotony of the physical environment. For goats, it is also important to provide vertical structures that serve as climbing objects, since these animals usually go to elevated places to feed and hide from predators (Ribeiro et al., 2009).

The objective of this study was to evaluate the effect of environmental enrichment on animal welfare of Saanen goats during lactation through behavioral analyses.

Material and methods

This study was carried out in the goat-breeding sector of the Federal Institute of Minas Gerais (IFMG) – Bambuí Campus, from May 11th to May 20th of 2015. The Institute is located in the city of Bambuí, Minas Gerais, Brazil at 20° 02' South latitude, 46° 00' West longitude, and altitude of 725.9 meters. The weather of the region, according to Köppen classification (1931), is Cwa (temperate hot with rainy summer and dry winter). Animals were housed in an over-ground slatted floor facility. Twelve Saanen dairy goats yielding 1.4 liters of milk per day on average at 45 days after calving, corporal condition score of three, and age ranging from 2 to 5 years old, were randomly allocated into four stalls (2.60 x 3.10 m) with three animals in each. Each stall was randomly assigned to a treatment. Stalls were equipped with nipple drinkers and feeding bunk with safety feed fence.

They had *ad libitum* access to water, roughage (corn silage), and concentrate during the experimental period. The animals were evaluated for 10 days in two different treatments. Animals on stall number 1 and 2 were submitted to an enriched environment, while animals on stall number 3 and 4 were not submitted to any environmental enrichment. The animals were already acclimated to the stalls and their stall roommates, and there was no redistribution or selection of animals, avoiding new territorial disputes by the dominant goats and possible stress source.

The objects used to enrich the environment were evenly placed in the stalls, allowing animals to have free access to them. We used the following objects: plastic PET bottles filled with ground corn as visual and audial attractive (they were suspended up to animals' back height and freely placed on stall floor); cleaning brushes fixed to the stall wall at 70 cm height, so animals could use it to clean or "scratch" their backs; suspended tire; and a tree trunk with 20 cm height and 60 cm long for climbing.

Previously, we observed that animals had the habit of scrubbing their backs on the stall walls as an attempt to clean their hair. We then had the idea to fix brushes to the wall.

Behavioral evaluations of the animals were performed a week after enriching the environment, this first week was the pre-experimental period. During the pre-experimental period, most common behaviors of animals placed in all stalls (enriched or not) was observed in order to create an ethogram (Table 1).

During the pre-experimental period, the activities performed by the animals were recorded for one hour. Trained personnel recorded the behavior of each animal. All people responsible for recording animal behaviors were trained in order to increase the observations accuracy. Goat behaviors were observed for two hours during 10 days from 10:00 to 11:00 and from 16:00 to 17:00, using 10-minute intervals. This timing was chosen because the animals had already consumed their feeding and rumination rate had already decreased. The behaviors were recorded using focal-animal sampling method. Each animal was observed during 10-minute period, resulting in 6 observations per

hour, 12 observations per day, and 120 observations per animal during the experimental period.

Animals in both groups were evaluated regarding the following behaviors: standing, lying, bipedal, self-cleaning, food intake, water intake, interaction with the nipple drinker, interaction with the feeding bunk, interaction with the bay, social interaction, stereotyped behaviors, fights, and competitions (Table 1).

Table 1. Ethogram applied to Saanen dairy goats during the 10-day experimental period.

Behavior	Description
Standing	The goat is standing and showing no activity
Lying	The animal is lying in the stall for resting or rumination
Bipedal	The animal is standing only with its hind legs
Self-cleaning	The animal is removing ectoparasites using its teeth, horns, and other body parts to scratch
Voluntary intake	The animal is on the feed bunk ingesting its feeding
Water intake and interaction with the nipple drinker	The goat pushes the nipple drinker and ingests (or does not) water;
Interaction with the feeding bunk	The animal visits the feeding bunk, but does not eat its feeding
Interaction with the stall	The animal is leaning on the stall wall;
Social interaction	An animal establishes some kind of relationship with other animal such as play, sniff, or lie down on each other
Stereotyped behavior	The animal is showing repetitive behaviors without a useful purpose, such as biting, licking, or repetitive movements
Fight and competition	The animal is having an aggressive behavior towards other animals.

For animals on enriched environment, we also recorded the interactions with the tire, suspended PET, tree trunk, brushes, and free PET on the floor. Data analyses were performed using spreadsheets from Microsoft Office Excel® 2007. Data from behavioral analysis were summarized through descriptive statistics and used to build frequency charts, which aimed at facilitating the interpretation of the obtained results.

Results and discussion

Figure 1 depicts the frequency (percentage) of each behavior during the 10-day experimental period.

Self-cleaning and voluntary intake were the most frequent behavior observed on both treatments. Self-cleaning behaviors, which are commonly observed in animals in their natural habitat are highly frequent and aim at preventing and eliminating ectoparasites. The behavior of biting stall parts alternated with food intake was considered abnormal and recorded as stereotyped behavior, as well as licking several times the same spot or standing without moving in front of the wall in the same place for a long time. Oliveira et al. (2015) stated that goats in feed-lot in environmentally not appropriate places tend to show abnormal behaviors, such as stereotypy, self-destruction, and depraved appetite among others.

Fight and competition behaviors were lower in the stalls without enrichment (2.8%) than in the stalls with enrichment pens (5.2%). Dispute for enrichment objects among dominant goats explain this result. Morais, Balbinotti, and Schmidt (2010) point out the necessity to regroup animals according to their physiological and production needs, in order to reduce aggressions among young and old animals that are generally subordinated and dominant ones, respectively. Subordinated animals suffer from stress due to aggressions and decrease their daily feed intake and performance. Animals under stress most certainly reduce their feed intake. Thus, it is reasonable to assume that animals in stalls with enrichment had greater feed intake than animals on stalls without enrichment due to the improvement of their animal welfare level.

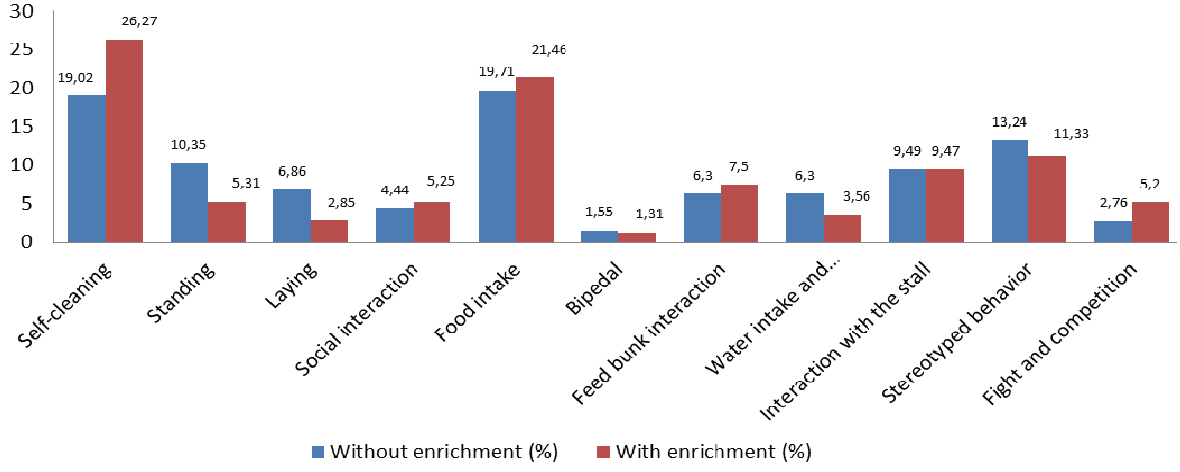

Figure 1. Frequency (percentage) of the different behaviors of lactating Saanen dairy goats housed in environments with or without enrichment.

In general, goats on the enriched environment preferred the suspended tire to other possible objects, with an interaction frequency of 38.2%, followed by suspended PET (21.4%), and brushes (21.0%)(Figure2).

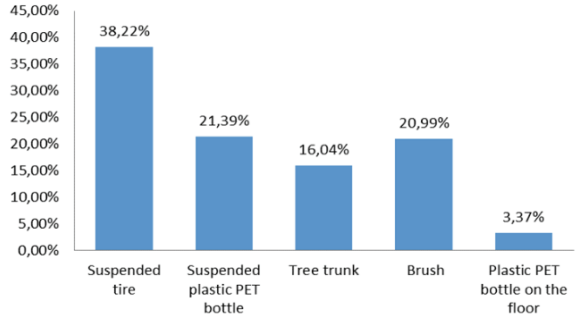

Figure 2. Frequency of interaction between Saanen dairy goats and environmental enrichment objects.

The bipedal position, in which goats stand using only their hind legs, is used under natural conditions to catch leaves from trees and bushes. This is one of the few non evolutionary-lost behaviors. According to Malechek and Leinweber (1972) as well as Malechek and Provenza (1983), goats prefer wide and high located leaves even when good quality pasture is available, which justifies their bipedal behavior.

Animals extensively used the tree trunk placed in the stalls to assume the bipedal standing position. However, we did not measure the length of time the animals remained in this position. Animals constantly assume this position in feed-lots systems and the trunk inside the stall aimed at promoting in feed-lot animal an approximation to natural environments.

The results of our study were similar to those reported by Oliveira et al., (2015) and Almeida, Margarido and Monteiro Filho (2008). They observed behavioral changes in feed-lot animals with the enrichment of their ambient because this practice makes the environment more comfortable and reduces the apathy in feed-lot animals. Animals' physiological, physical, and psychological condition changes if their welfare is affected due to environmental changes, injury, illness, tension, or other reason, consequently resulting in behavioral changes.

Ribeiro et al., (2006) and Silva et al., (2014) stated that behavioral analyses build knowledge about normal animal behaviors that can be transferred to producers, which in turn may use it to identify abnormal behaviors and seek for palliative measures to solve the problem. The mainly purpose of providing environmental enrichment is to allow animals to express their natural behavior, propitiating their welfare as far as possible (Ribeiro et al., 2006). Thus, making animals more productive by fulfilling their behavioral needs. According to Oliveira et al., (2015), the long-term effect of environmental enrichment is more effective for animal production, which justifies its use to improve animals' life quality at a relatively low implementation cost.

Conclusion

Animals submitted to environmental enrichments were more active than animals not submitted to environmental enrichments. In conclusion, different forms of environmental enrichment influence on the improvement of abnormal behavior of dairy goats in intensive housing.

Acknowledgements

The authors thank the Federal Institute of Minas Gerais – Bambuí Campus for aiding the execution of this experiment.

References

Almeida, A. M. R., Margarido, T. C. C., & Monteiro Filho, E. L. (2008). Influência do enriquecimento ambiental no comportamento de primatas do gênero *Ateles* em cativeiro. *Arquivos de Ciências Veterinárias e Zoologia da UNIPAR, 11*(2), 97-102. doi: 10.25110/arqvet.v11i2.2008.2564

Campos, J. A., Tinôco, I. F. F., Silva, F. F., Pupa, J. M. R., & Silva, I. J. O. (2010). Enriquecimento ambiental para leitões na fase de creche advindos de desmame aos 21 e 28 dias. *Revista Brasileira de Ciências Agrárias,5*(2), 272-278. doi: 10.5039/agraria.v5i2a660

Foppa, L., Caldara, F. R., Machado, S. P., Moura, R., Santos, R. K. S., Nääs, I. A., & Garcia, R. G. (2014). Enriquecimento ambiental e comportamento de suínos: revisão/ environmental enrichment and behaviour of pigs. *Revista Brasileira de Engenharia de Biossistemas, 8*(1), 1-7. doi: 10.18011/bioeng2014v8n1p1-7

Köppen, W. P. (1931). *Climatologia*. México: Fundo de Cultura Econômica.

Malechek, J., & Provenza, F. (1983). Comportamiento alimentario y nutrición del ganado caprino en pastizales. *Revista Mundial de Zootecnia, 47*, 38-48.

Malechek, J. C., & Leinweber, C. (1972). Chemical composition and *In vitro* digestibility of forage consumed by goats on lightly and heavily stocked ranges. *Journal of Animal Science, 35*(5), 1014-1019. doi: 10.2527/jas1972.3551014x

Marai, I., El-Darawany, A., Fadiel, A., & Abdel-Hafez, M. (2007). Physiological traits as affected by heat stress in

sheep—a review. *Small Ruminant Research, 71*(1), 1-12. doi: 10.1016/j.smallrumres.2006.10.003

Martins Júnior, L. M., Costa, A. P. R., Azevêdo, D. M. M. R., Turco, S. H. N., Campelo, J. E. G., & Muratori, M. C. S. (2007). Adaptabilidade de caprinos Boer e Anglo-Nubiana às condições climáticas do meio-norte do Brasil. *Archivos de Zootecnia, 56*(214), 103-113.

Morais, C. C., Balbinotti, Z. M., & Schmidt, V. (2010). Comportamento social de cabras em lactação após reagrupamento. *Acta Scientiae Veterinariae, 38*(4), 425-428.

Oliveira, A. P. G., Costa, W. M., Costa, W. M., Nunes, R. A., Dias, N. C. S., & Madella-Oliveira, A. F. (2015). Influência do enriquecimento ambiental nos padrões de comportamentos sociais e anormais de cabras em confinamento. *Archives of Veterinary Science, 20*(2), 1-7. doi: 10.5380/avs.v20i2.36390

Resende, K. T., Teixeira, I. A. M. A., Biagioli, B., Lima, L. D., Boaventura Neto, O., Junior, P., & Deus, J. (2010). Progresso científico em pequenos ruminantes na primeira década do século XXI. *Revista Brasileira de Zootecnia, 39*(sup.), 369-375. doi: 10.1590/S1516-35982010001300040

Ribeiro, V. L., Batista, Â., Carvalho, F. F. R., Silva, M. J. M. S., Mattos, C. W., & Alves, K. S. (2009). Seletividade e composição da dieta ingerida por caprinos recebendo alimentação à vontade e restrita. *Revista Brasileira de Ciências Agrárias, 4*(1), 91-94. doi: 10.5039/agraria.v4i1a15

Ribeiro, V. L., M., V. B. A., Carvalho, F. F. R., Azevedo, M., Mattos, C. W., & K., S. A. (2006). Comportamento ingestivo de caprinos Moxotó e Canindé submetidos à alimentação à vontade e restrita. *Acta Scientiarum. Animal Sciences, 28*(2), 331-337. doi: 10.4025/actascianimsci.v28i3.50

Silva, C. M., Furtado, D. A., Medeiros, A. N., Saraiva, E. P., Pereira, W. E., & Guimarães, M. C. C. (2014). Image monitoring on the behavior study of three genetic groups of confined goats. *Revista Brasileira de Zootecnia, 43*(6), 327-335. doi: 10.1590/S1516-35982014000600007

Received on April 19, 2018.
Accepted on June 11, 2018.