Goats Coat Association with Heat Tolerance

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Goats are the principal activity in Northeast region of Brazil, typically a dry and tropical area. Some breeds of local goats showed a high adaptation to environment and they can help animal production, even in a warming climate change. A visible segregation in coat hair length was noticed on Marota goat breed. In cattle there is proof of a major gene (slick hair) who affects both the coat hair and the heat tolerance. This study aims to find the correlations between visual type (short and long hairs) and coat measurements - weight (W) and length (L)- as well investigate their possible association with rectal temperature (RT) and respiratory frequency (FR) in Marota breed. The results showed that visual type of coat is associated ($p<0.05$) with W and L, although W and L are not highly correlated inter-se and the measurements W and L were overlapped in the class. Additionally, the analysis of variation reveled that RT was consistently affected by coat characteristics. Thus, in the first attempt, selection to short hair type may increase heat tolerance in goats. Further study should include others physiological parameters related with heat tolerance to reinforce the existence of slick hair gene in goats.

Key Words: Goat, Coat weigth, Coat length, Semiarid, Bioclimatology, Local breeds

INTRODUCTION

Goats in Brazil are raised mainly in Northeast region which is characterized for higher temperatures through all the year and extended periods of drought (IBGE, 2009). Some exotic standardized goat breeds have shown poor performance grazing in this region, despite their high genetic potential (Dias et al., 2007). Heat stress is one of the important effects on animal production in the tropics. According to several studies, animal production systems will be affected by climate changes through both the production of grains and direct effects on animals (Nardone et al. 2010). Therefore, researches must be made to identify animals that can continue producing at higher temperatures; mainly in countries where the animal grazing system prevalence and the animals are more exposed to the environment than in industrialized systems (Nardone et al., 2010).

There is a solid evidence of a major gene in Senepol cattle controlling the heritance of very short coat hair (slick hair) and it was associated with lower rectal temperatures (Olson et al., 2003). Variation in RT and FR in goats under heat stress has been studied in Brazil (Aiura et al, 2010) and results showed variability between breeds and also among individuals.

The Marota local breed has been conserved by The *Brazilian* Agricultural Research Corporation (Embrapa) for at last two decades because its ability to survive in the hot and dry environment. It showed a smaller body size of all the local breeds of Northeast Region and this fact has contributed to its endangered condition (Araujo, 2006). Marota breed shows a visible coat variation, showing two distinct types of coat: short and long haired. Although some researches have shown that the Marota is heat tolerant (Moraes, 2010), the previous research has not focused on the coat, or more specifically, on hair length. The work intended selected a measure of coat hair that can best express the Marota visible variation on coat type and if some of them could be useful for futures works in heat tolerance in goats.

MATERIAL AND METHODOS

The data were collected in the conservation herd of Embrapa, Castelo do Piauí, PI. located a 5º 20'South and 41º 34' West. The climate classification is C1wA'4ª, subumid dry. For that, two sample groups ware formed, on the basis of visual type of coat hair: short and long hair. Each group was composed of ten individuals, two-five years old and non-pregnant females. All data refer to August 2011, dry period beginning

It was measured the length and the weight of hair as metric indicator of type, instead the subjective visual type. The hair sample of each individual was collected using a clipper in a washed area of 10 cm^2 in the side neck of animal. After collected in a numbered plastic bag, the hair was dried in environment temperature for 24 hours. The weight of hair (W) was taken in a balance, as describe for Olson et al. (2003) and the length of hair (L) was estimated through the average of ten hairs units from each sample, by scientific rule.

The rectal temperature (RT, ^0C) and respiratory frequencies (RF, $mov.min^{-1}$) were measured twice a day, at 8:00 AM and 2:00 PM in the same day. In the measurement day, goats remained shut with no restriction of food and water.Rectal temperature and respiratory frequencies (in each turn) were analyzed by PROC GLM (SAS Institute Inc., 2009), in a model including time of day as fixed effect. The RT was by taking the log of the difference between the measured rectal temperature and 37.0°C in an attempt to normalize the data (Olson et al., 2003).The presence/absence of barb and wattles was observed and the difference in segregation between type of hair analyzed by Chi-square using PROC FREQ (SAS Institute Inc., 2009).

The dairy environmental parameters was taken in a data logger CR1000 (Campbell) at a height of 2 m and recorded every 60 min. The temperature-humidity index (THI) was calculated according the equation of Revagnolo et al. (2000): THI=(1.8 X T +32) - [(0.55 - 0.0055 – RH) X (1.8 X T – 26)], where T=dry bulb temperature (^0C) and RH= relative Humidity (%).

RESULTS AND DISCUSSION

The dry-bulb temperature (^{0}C) at 8:00 h and 14:00 h were 25.59 and 34.99, respectively. The relative humidity (%) was 56 and 24, respectively at the same time. Calculated THI were 73.21 and 79.52, respectively. Therefor the environmental conditions were different before and after noon and out of comfort zone for animals in both.

The short type hair showed W values between .17 and .59 g (Mean= .32±.15 g) and L values between 1.17 and 2.31 cm (Mean= 1.65±.37 cm); the long type hair showed measures ranging .10 to .72 g (Mean=.65±.37 g) and 1.67 to 2.31 cm (Mean=1.99±1.18 cm), for W and L, respectively. The correlation between L and W was moderate (.727), even with overlapped values. The visual type is easier to data collection when it is descriptive of hair coat characteristics (W and L), how was indicated by this study.

L and W also presented straight difference ($p<0.01$) between visual type, as expected. Visual type demonstrates affect rectal temperature ($p<0.05$), in both times of the day (AM and PM). However, visual type not affects RF. RF in both visual types was above that considered normal for goats, what can indicate the activation of hyperventilation as a mechanism to lost heat. This result contrast with that found in bovines by Olson et al. (2003), where the short hair group does not show increased RF. However RF high variation nature (counting of movements), as well the small number of animals used in the present study may had made more difficult determine differences in heat tolerance between the two hair types.

The differences between RT means in short and long hair classes were as large as found in cattle (Olson et al., 2003), .5^{0}C in AM and .8^{0}C in PM. This indicates that selection for short hair might be useful to improve heat tolerance in goats.

The presence of wattles was 0.7 in both types of coat ($\chi^2<0.40$), showing no importance for futures studies in coat segregation. But the presence of beards showed different distribution between types of coat; where the presence of beards was 0.7 in the long hair type and no occurred in short hair type. More investigation needs to prove if the type of coat hair is linked with barb presence in Marota breed.

Table 1. Coat measurements (weigh, W and length, L) and physiological parameters (rectal temperature, RT and respiratory frequency, RF) at two different times (8:00 h and 14:00 h)

Hair type	W (g)	L (cm)	RT-8 (^{0}c)	RT-14 (^{0}c)	RF-8 (mov/min)	RF-14 (mov/min)
Short	0.32±0.15^a	1.65±0.37^a	38.14±0.41^a	38.26±0.25^a	35.8±7.57^a	41.2±6.54^a
Long	0.65±0.37^b	1.99±0.18^b	38.64±0.41^b	39.04±0.37^b	33.8±4.05^a	42.0±6.32^a

CONCLUSION

Both weight and length were good indicators of visual type (short/long hairs) in goats. Additionally, the visual type could be applied for selection when the goal is heat tolerance, since short hair type showed lower rectal temperature. However, despite the hair type, the respiratory frequency was elevated, indicating others parameters should be added for further studies of heat tolerance in goats.

REFERENCES

Aiura, A.L.O., Aiura, F.S.B E Silva, R.G. 2010.Respostas termorreguladoras de cabras saanen e pardo alpina em ambiente tropical. **Arch. Zootec.,** 59:1-4.

Araujo, A.M. 2006. Caprinos do Nordeste: uma visão realista. **A Lavoura,** Sociedade Nacional de Agricultura p.33.

Dias, L.T., McManus, C., Sasaki, L.C.B., Lucci,C., Garcia, J.A., Louvandini, H. 2007. Análise comparativa de características da pele e pelame relacionadas à adaptação ao calor em ovinos. In: Proceedings of the 2007 SOCIEDADE BRASILEIRA DE ZOOTECNIA, Jaboticabal. pp.287-288.

IBGE. Sistema IBGE de Recuperação Automática. SIDRA. 2008. Censo Agropecuário. http://www.sidra.ibge.gov.br/bda/acervo/acervo2.asp?ti=1&tf=99999&e=v&p=CA&z=t&o=2.

Moraes, J.B. **Termorregulação e adaptabilidade climática de caprinos no semiárido piauiense,** Dissertação (Mestrado em Ciência Animal) – Universidade Federal do Piauí – Teresina, Piauí.

Nardone, A., Ronchi, B., Lacetera, N.,Ranieri, N.S., Bernabucci, U. 2010. Effects of climate change on animal production and sustentaibility of livestock systems. **Livestock Scinece,** 130:57-69.

Olson, T. A, Lucena, C., Chase, JR. C. C., Hammond A. C. 2003. Evidence of a major gene influencing hair length and heat tolerance in Bos Taurus cattle. **J Anim Sci** , 81:80-90.

Revagnolo O., Mizstal, I. Hoogenboom, G. 2000. Genetic component of heat stress in dairy cattle: development of heat index function. **J Dairy Sci**, 83: 2120-2125.

SAS Institute Inc. 2009. SAS STAT User´s Guide, v.9. SAS Institute Inc., Carry, North Carolina.