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Thakare PD

Department of Animal Genetics and Breeding Nagpur Veterinary College, MAFSU, Nagpur, Maharashtra, India

Sawarkar AR

Department of Animal Genetics and Breeding Nagpur Veterinary College, MAFSU, Nagpur, Maharashtra, India

Pawshe MD

Department of Animal Genetics and Breeding Nagpur Veterinary College, MAFSU, Nagpur, Maharashtra, India

Heat tolerance ability and its variability in different breeds of goats with respect to respiratory rate

Thakare PD, Sawarkar AR and Pawshe MD

Abstract

Respiratory rate were recorded 34.063 ± 1.80 , 30.68 ± 1.123 , 28.21 ± 0.526 , 28.21 ± 1.60 , 22.62 ± 0.906 breaths/minute respectively. The local breed exhibited lower rate of respiration (22.62 ± 0.906) and less BCA Coefficient and high rate of respiration observed in Barbari breeds of goat (34.063 ± 1.80). Negative correlation observed in respiration rate and pulse rate in Osmanabadi and local goat breeds. However, significant positive correlation between respiration rate and pulse rate was observed in Jamnapari (0.670) but it was positive and non-significant in Barbari and Sirohi. The relationship between relative humidity and pulse rate was found to be non-significant except local where it was recorded to be highly significant. Significantly positively high correlation was observed between respiration rate and BCA for all breeds while significantly high and negative correlation with IHTC except Sirohi breed. The correlation Coefficient between pulse rate and environmental temperature positively non-significant in Sirohi, Osmanabadi and local and positively significant in Barbari and Jamnapari breeds of goat. The local goat breed was found to be readily adaptable in Nagpur climate and environment as shown by their lower respiration pulse rate and benezera coefficient of adaptability which was followed by Osmanabadi and sirohi. The Barbari breed from physiological view point seems to be less adaptable than other breeds with respect to Iberia heat tolerance Indices. Thus selection of goat with high tolerance to thermal stress is of primary importance as basis for the future development of goat industry in Vidarbha.

Keywords: Heat tolerance ability, breed of goat, respiratory rate

Introduction

Breeds differ in their capacity to tolerate ambient heat stress. Evaluation of thermo adaptability of different goat breed and their cross under different geo-climatic conditions, among other things, is therefore an essential pre-requisite in formulating suitable breeding plan. It is well established that heat tolerant is hereditary nature in goats. Adequate genetic variability exists for heat tolerance in various goat breeds (Kumar *et al.* 1990; Singh and Saxena 1995) [6, 9]. Factors like rectal temperature, respiration rate and pulse rate also contribute significantly to the maintenance of goat rearing. Comparative heat tolerances of various breeds of goats have not been investigated to larger extent, which should from a subject to future research programs. This aspect will help in cross- breeding programs of goats in order to develop a breed most suitable to arid and semiarid climate of Vidarbha and at the same time endowed with high production potential.

Material and Methods

One hundred and twenty five healthy goats, 25 each of Barbari, Jamnapari, Osmanabadi, Sirohi and local (of both the sexes) were utilized for the present investigation. These animals (aged 1 1/2 to 3 years) were maintained at Shivaji Estate Livestock farm (self) (Pvt) Ltd. Chargaon, Nagpur. The duration of the study was for 9 weeks. This period was selected because it constituted normally hot dry period of the year in this region the animals were housed in conventional shed, constructed in East west direction. Physiological response i.e. respirations were recorded for all goats under study. Weekly observations of the above physiological traits were made on each animal twice a day at 7.00 and 15.00 hrs. These observations were averaged to get mean values for the day. Respiration rate was recorded by using flank movements over a period of 1 minute of uninterrupted and pulse rate measured as beats per minutes by feeling femoral artery. Daily weather components comprising maximum and minimum temperature ($^{\circ}\text{C}$) and morning and evening relative humidity (%) were recorded from meteorological laboratory, office of the Extra Asst Director farm, College of Agriculture, Nagpur for the Experimental period.

Correspondence

Thakare PD

Department of Animal Genetics and Breeding Nagpur Veterinary College, MAFSU, Nagpur, Maharashtra, India

The original formulae basically developed for cattle by these workers were slightly modified for goats by putting the values of normal rectal temperature and pulse rate of Indian goats under most favourable conditions, as 39.44 °C (103.0 °F) and 24 breaths/ minutes (Jindal, 1984)

1. Iberia Heat Tolerance Coefficient (IHCT) Rhoad 1944) [8]
 HTC = 100-10 (BT-103)

2. Benezera Coefficient of adaptability (BCA) (Benezera 1954) [1]

$$BCA = \frac{B.T}{39.44} + \frac{N.R}{24}$$

Data obtained for all the physiological responses and heat tolerance indices were subjected to statistical analysis (Snedecor and Cochran, 1967) [10]

Results and Discussion

The mean values with their S.E. of RR/minute between different goat breeds are shown in table 2. The range mean values varied from 22.62±0.906 to 34.063±1.80 respectively. Local goat breeds showed lowest breath/minutes (22.62±0.906), which was followed by Osmanabadi and Sirohi (28.21±0.526 and Variance revealed significant differences between the breeds

(Table 2). The respiration rate, although a less stable attribute, appeared to indicate more accurately a differential level of adaptability among the various breed, the local breed exhibited lower rates of respiration and less BCA coefficient. The high rate of respiration rate observed for Barbari goats, in this study probably indicate of this breed to maintain its normal body temperature under high ambient temperature by increasing its heat dissipation.

Vihan and Sahini (1981a) [11] again supported the fact that, of all the physiology reaction, the respiration rate is the most sensitive index for determining the heat tolerance capacity of goats. They further discussed that Jamnapari goats appear to stand the variation in climatic elements by making adjustment in vital physiological reactions during different seasons of the year. There was negative correlation between respiratory count and pulse rate in Osmanabadi and local goat breeds. However, significant positive correlation between respiratory count and pulse rate was observed in Jamnapari, but it was positive and non-significant with respect to Barbari and Sirohi. Highly significant positive correlation (P< 0.01) between pulse rate and environmental temperature were observed between different breeds except for Osmanabadi in the present study, thereby showing that respiration increase in air temperature. Rao and Mullick (1965) [7] clearly demonstrated that non-sweating species like goat

Table 1: Correlation co-efficient between climatological parameter Heat Tolerance and indices.

Parameter / Breed	PR	IHTC	BCA	Environmental Temperature	Humidity
Barbari	0.401	-0764**	0.999**	0.747**	0.300
Jamnapari	0.670**	0.908**	1.000**	0.777**	0.242
Sirohi	0.454	0.2170	0.998**	0.750**	-0.144
Osmanabadi	-0.036	-0.655**	1.000**	0.329	0.441
Local	0.171	0.935**	1.000**	0.569*	0.734**

(P<0.05)**(P<0.01)

Table 2: Breed wise average values of physiological variables and heat tolerance indices in Barbari, Jamnapari, Sirohi, Osmanabadi and Local breeds of goat

Parameter/ Breed	Breed	Mean	S.E.	S.D.	C.V.	N
RR	Barbari	34.063	1.80057	9.003	26.44	25
	Jamrapari	30.68	1.123	5.615	18.31	25
	Sirohi	28.21	0.526	2.63	9.33	25
	Osmanabadi	28.21	1.60	8.00	28.36	25
	Local	22.62	0.906	4.53	20.027	25

Table 3: Analysis of variance for respiration rates between breeds.

Source of variation	D.F	S.S	M.S.S	VR	CD
Breed	4	666.56	166.64**	15.81	4.20
Weeks	8	319.49	39.94**	3.79	5.63
Error	32	337.46	10.55		

** Indicates (P<0.01)

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