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Effect of Nutritional Stress on Allometric Parameters of Non Descript Indian Buck(Capra Hircus) in a Controlled Thermoneutral Condition

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ABSTRACT *Goat rearing is the backbone of the economy of small and landless farmers in India. Indian goat industry is facing many constraints like non-availability of high-yielding breeding stock, low level of nutrition and lack of scientific knowledge on assessing the breeding soundness of animal at farmer's doorstep. Allometric parameters are simple and effective tool for breeding soundness evaluation in breeding buck. The major indirect effect of climate change is crunch in feed resources. Goat production is severely affected by feed scarcity and energy deficiency. So the present study was conducted to evaluate the effect of nutritional stress on the allometric parameters (Body Weight,Body Condition Score(BCS), and Heart Girth) in breeding bucks. The study consisted of eight native non descript breeding bucks weighing 23-25 kg under same age group. Total duration of trial was 20 weeks. In the initial 10 weeks, animals were considered as control group and were fed with full feeding as per ICAR requirement for breeding buck. In the next 10 weeks same animals were considered as treatment group and were provided with a 50% concentrate restricted ration.The entire trial was conducted inside the climatological chamber where temperature and relative humidity kept uniform in thermoneutral zone. Allometric parameters were studied at fortnightly interval. Body weight and HG reduced significantly ($P < 0.05$) in feed restricted group in the last 4 weeks of study whereas BCS reduced significantly ($P < 0.05$) inlast 6 weeks. It can be concluded from the present study that allometric parameters were reduced significantly in 50% concentrate restricted group and this would ultimately affect the production parameters of breeding buck. Farmers can rely upon the allometric parameters for predicting the breeding potential of animal at their door step.*

KEYWORDS : Nutritional Stress, Allometric parameters,Non descript Buck,Concentrate Restriction, Breeding Soundness Evaluation.

INTRODUCTION

India possesses the second-largest goat population in the world. In India the small and marginal farmers, mostly in non-green revolution areas where irrigation facilities are poorly developed, prominently rear goats (Rekib, 1998). Indian goat industry is facing many constraints which include non-availability of high-yielding breeding stock, low level of nutrition and managerial efficiency, lack of definition of the production objectives. Goats are exposed to wide range of stresses, these stresses redistribute the available body resources at the cost of decreased growth, body condition score, production and reproduction (Maurya et al.,2009). It becomes even more important when seen in context of climate change and crunch in feed resource.

In natural production system energy deficit makes internal adaptive changes inside the animal which ultimately affect production. More detailed knowledge about these changes helps farmers to adopt mitigation measures to augment production. The performance and genetic improvement in a herd is mainly decided by the contributions of male breeding animal (Maurya et al.,2010). Since the Indian farmers are resource poor, the importance of less sophisticated but highly efficient breeding soundness evaluation tool is the call of hour. Breeding soundness evaluation should be performed for each male animal in a herd for optimizing production. Since Chronic nutritional stress affect the production potential of animal, the breeding animal should be evaluated periodically for assessing its breeding potential. Assessmentof seminal parameters, sexual behaviour, and scrotal attributes are important and reliable tool for breeding soundness evaluation. But evaluation of these parameters require highly technical skills and sophisticated environment, which is not practical at the farmers doorstep.But assessment of allometric parameters like body weight, Heart girth, and body condition score, are easy and practical as far as resource poor Indian farmers are concerned. When animal is under nutritional stress several body parameters are altered which help in adaptation of animal to stressors (Aboelmaaty et al.,2008). It is therefore important to pay attention to the factors which may influence male physiological and reproductive efficiencies. Hence the present research is conducted to evaluate the effect of dietary energy restriction on allometric parameters of nondescript Indian buck.

MATERIALS AND METHODS

1. Site of study: The study was conducted at the Psychrometric chamber of Physiology and Climatology division, Indian Veterinary Research Institute, Izatnagar. The mean temperature and relative humidity were set at thermoneutral conditioninside the chamber during whole trial periodof 20 weeks. This ensures uniform ambient environmental condition to animals under study during entire trial period.
2. Experimental Animals: Eight healthy non-descriptnative bucks weighing 23-25 kgof uniform age (2-3 years) were selected as the experimental animal from the animal shed. The animals were maintained under well ventilated and proper hygienic conditions inside the chamber. Prophylactic measures against goat diseases were carried out as prescribed by the health calendar of the institute to ensure that the animals were in a healthy condition throughout the study.
3. Design of Experiment: Total duration of trial was 20 weeks. In the initial 10 weeks, animals were considered as control group and were fed with full feeding as per ICAR requirement for breeding buck(ICAR 1985). In the next 10 weeks same animals were considered as treatment group and were provided with a 50% concentrate restricted ration..To avoid the error due to individual variation of animals, both controland treatment animals were same during trial.The entire trial was conducted inside the climatological chamber where temperature and relative humidity kept uniform in thermoneutral zone in order to negate the seasonal effect on animal productivity.
4. Allometric parameters:Allometric parameters were studied at fortnightly interval. Weighing of bucks wasdone in empty stomach during the early morning hours. Each animal were kept in cage and weighed using electronic balance. Body weight was measured in kilograms (kg). Heart girth was measured directly behind the front leg as vertically as possible with a tailors tape rule in centimeters. Body condition scoring (BCS) is a simple, non invasive,and time savingmethodology to rank bucks according to their body reserve by visual and tactile perception. Body Condition Scoring was done as per method of Mauryaet.al(2008). BCS ranges between 1 to 5 with lower scoring being very thin (1 BCS) and highest scoring bucks (5BCS) being very fatty with half

points in the middle. Scoring is performed by using palm and fingers to feel muscling and fat cover over and around vertebrae in the loin region. During the scoring bucks were standing in level and relax position. Fingers and thumps are used in determining the sharpness of spine and transverse process behind the last rib and infront of the hip bone (loin area).

Statistical Analysis

The statistical significance of differences in means was assessed using SPSS software. Independent T test was used for assessing the effect of nutritional stress on allometric parameters.

RESULTS

Allometric Parameters: The body weight, Body Condition Score (BCS), and Heart Girth (HG) are describedin Tables 1, 2&3 respectively. Body weight and HG reduced significantly ($P < 0.05$) in feedrestricted group in the last 4 weeks of study whereas BCS reduced significantly ($P < 0.05$) inlast 6 weeks.

Table 1.Mean ± SE of body weight of animals in kg. (Values with different superscript along a row differ significantly; P < 0.05)

WEEKS	Control	Treatment
2	23.54 ± 0.24^{b}	24.31 ± 0.26^{a}
4	23.64 ± 0.24^{a}	24.16 ± 0.26^{a}
6	23.73 ± 0.25^{a}	24.04 ± 0.26^{a}
8	24.11 ± 0.24^{a}	23.33 ± 0.18^{b}
10	24.28 ± 0.22^{a}	22.73 ± 0.21^{b}

Table 2. Mean± SE of body condition score of animals (0-5). (Values with different superscript along a row differ significantly; P < 0.05)

WEEKS	Control	Treatment
2	3.51 ± 0.02^{a}	3.56 ± 0.03^{a}
4	3.53 ± 0.03^{a}	3.48 ± 0.03^{a}
6	3.56 ± 0.03^{a}	3.23 ± 0.02^{b}
8	3.56 ± 0.03^{a}	2.63 ± 0.04^{b}
10	3.60 ± 0.03^{a}	2.53 ± 0.03^{b}

Table 3. Mean± SE of heart girth of animals in cm. (Values with different superscript along a row differ significantly; P < 0.05)

WEEKS	Control	Treatment
2	65.58 ± 0.28^{a}	66.91 ± 0.41^{b}
4	66.19 ± 0.39^{a}	66.14 ± 0.43^{a}
6	66.68 ± 0.40^{a}	65.99 ± 0.29^{a}
8	67.47 ± 0.43^{a}	65.55 ± 0.31^{b}
10	67.76 ± 0.40^{a}	64.84 ± 0.23^{b}

DISCUSSION

As per the first and second law of thermodynamics, feed restriction in animals results in reduction in metabolic body weight .The decrease could be due to reduction in mass of visceral tissue during feed restriction as reported in other species (Sainz and Bentley, 1997).The visceral organs have different growth and metabolic rates compared with other organs and the feed quality and quantity affect their growth (Kamalzadeh et al., 1998). An animal which is knownto be well adapted to nutritional stress can tolerate relatively large reductions in body weight(Castellini and Rea, 1992).

Stress induced fat mobilization and insufficient fat storage results in reduced BCS infeed restricted animals as it was earlier documented in other species like ewes (Sejian et al.,2010). Earlier studies indicated that subcutaneous fat was mobilized more easily than others(-Dashtizadeh et al., 2008).The best indicator mechanisms of bodyreserves management is BCS (Croston and Pollott, 1994). It is evident from the experimentsthat low BCS clearly influenced various parameters of fertility (Maurya et al.,2010). This is incontrast to female livestock under similar conditions. The study indicates that the bucks keptunder the similar environmental condition should be maintained at efficient BCS during breedingstage to ensure maximum reproductive efficiency. This will in turn ensure economically viablereturn in goat production.

CONCLUSION

The present study was conducted to evaluate the effect of nutritional stress on the allometric parameters,in nondescript Indian bucks. In many of the previous studies on dietary energy restriction animal trial was conducted in ambient environmental condition.So the data obtained may have some seasonal influence along with nutritonal stress. Since the trial was conducted inside the chamber in a controlled thermoneutral environmental condition, in the present investigation seasonal variation could be minimized.The data obtained clearly depicts the effect of dietary restriction only.It can be concluded from the present study that allometric parameters were reduced significantly($P < 0.05$) in 50% concentrate restricted group and this would ultimately affect the production parameters of breeding buck.It is, therefore, important for farmers to know when these critical periods of nutritional stress occur which could have an impact on the reproductive activities of their animals. Farmers can rely upon the allometric parameters for predicting the breeding potential of animal at their door step.Regular assessment of variation in allometric parameters can be recommended as a simple and effective tool for breeding soundness evaluation in native indian buck.

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