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Genetic Analysis of Malkangiri Goats in its Native Tract

Surita Majumder[1], Tanay Ghosh[2], Ajit Kumar[3], Susanta Kumar Dash[1], Manas Ranjan Senapati[1], Lipismita Samal[1]

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ABSTRACT

Background: In the present study, genetic analysis of Malkangiri goat, a native goat population of southern Odisha is made.

Methods: The present study area was under south eastern ghat agro climatic zones in Odisha. These goat type is raised under semi-intensive system of management with a flock size ranging from 5 to 35. The body weight and some biometric traits were recorded from birth to 12 months at an interval of 3 months. Estimation of heritability, genetic and phenotypic correlation also were reported in this research article.

Result: Overall body weight of this goat type were found to be 16.31±0.17 kg with height of 57.44±0.50 cm at marketable weight of 12 months. The heritability estimate of body weight was recorded as 0.19±0.13 and 0.22±0.15, respectively at birth and 12 month of age. The heritability estimates of HW, BL, HG and PG at 12 month of age were 0.13, 0.32, 0.22, 0.13, respectively. The genetic correlation among the body weight and body measurement traits ranged from 0.21 to 0.91, whereas, the phenotypic correlation range from 0.18 to 0.52 at 12 month of age. This information on the genetic analysis may be helpful in developing further breed improvement strategies and conservation.

Key words: Agro-climatic zones, Body measurement traits, Heritability.

INTRODUCTION

Goats are a major source of food security and economic security for smallholder farmers in rural areas and women are essential to goat farming which promotes economic prosperity of family. Because they are flexible to climatic change and are simple to manage, non-descript goat populations are extremely valuable. The long-term use and breed development of these goats in southern Odisha, however, are still hampered by the lack of emphasis on accurate breed characterization.

Establishing a proper connection between the market and production, implementing practical regional and national agricultural policies, implementing community breeding programmes, cooperating on regional research projects and receiving continued government assistance can all help to overcome this. There are 148.88 million goats in India overall, making up 27.80% of all livestock (20th Livestock Census, 2019). Odisha has over 64 lakh goats, with the single registered breed, the Ganjam, having about 4 lakh heads as of the 20th livestock census.

MATERIALS AND METHODS

Twenty villages had taken for the study but only eleven villages of Mathili and Chitrakonda blocks in Malkangiri district were focused of the present study as these villages had single buck and half sib data were available (Fig 1). So the data, thus collected were considered for genetic studies. Animals were measured using four body metrics across a range of ages. For biometrical characteristics, data were collected by direct measurement of animals at farmer's doorstep. All the measurements were taken before grazing. The work were carried out in the Department of Animal Genetics and Breeding, College of Veterinary Sciences and Animal Husbandry, Odisha University of Agriculture and Technology in 2022. The flocks were managed under semi-extensive system (Fig 2). The data thus collected was put to standard statistical analysis (Harvey, 1996).

Heritability

The data were corrected for the effects before estimating h^2 of the characters using paternal half sib analysis.

$$h^2 = \frac{4\sigma^2 S}{\sigma^2 S + \sigma^2 w}$$

$$\text{S.E. of } h^2 = \frac{4\sqrt{2} / k^2 (MS_s / s - 1 + MS^2_w / n - s)}{\sigma^2 p}$$

[1]Department of Animal Genetics and Breeding, College of Veterinary Sciences and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar-751 003, Odisha, India.
[2]College of Veterinary Sciences, Assam Agricultural University, Khanapara, Guwahati-781 022, Assam, India.
[3]College of Veterinary Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata-700 037, West Bengal, India.

Corresponding Author: Surita Majumder, Department of Animal Genetics and Breeding, College of Veterinary Sciences and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar-751 003, Odisha, India.
Email: suritamj1994@gmail.com

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Correlations

The genetic and phenotypic correlations among the traits were computed in the following way in the corrected data.

$$rG = \frac{\sigma_{Sxy}}{\sqrt{\sigma_{Sx} \cdot \sigma_{Sy}}}$$

$$\text{S.E. of } rG = \frac{1 - rG^2}{\sqrt{2}} \sqrt{\frac{SE\,(h^2\,x).SE\,(h^2\,y)}{h^2\,x.h^2\,y}}$$

$$rP = \frac{\sigma_{Sxy} + \sigma_{Wxy}}{\sqrt{(\sigma^2_{Sx} + \sigma^2_{Wx})\,(\sigma^2_{Sy} + \sigma_{wy})}}$$

$$\text{S.E. of } rP = \sqrt{\frac{1 - r^2P}{n - 2}}$$

RESULTS AND DISCUSSION

Malkangiri

Malkangiri is the southern most district in Odisha. The temperature is often between 12 to 14°C in winter, while the summer time temperature ranges from 33 to 35°C. Mean annual rainfall is 1710 mm here. Malkangiri goats are medium-sized animals that are farmed solely for their meat. Dark brown or light brown goats made up the majority of the herd. However, white and black coloured goats were also spotted. Goats with brown coat colour had white stripes on their faces that extended from the ear's base to their nose. Its upper line was dark. Bucks used for breeding had black neck ring (Fig 3). The muzzle and hooves were predominantly black. The information pertaining to management practices was collected by observation. Natural service is carried out among these goats. Female animals reach sexual maturity at around 12 months and drop the first kid at around 18 months (Fig 4). Besides the twinning in this goats were reported to be around 45 per cent after second kidding onwards.

Morphometric traits

The average body length (BL), height at withers (HW), heart girth (HG), paunch girth (PG) at different stages of growth (0, 3, 6, 12 months) are given in Table 1. Verma *et al*. (2015) reported higher estimates for the morphometric traits with regards to present study at the age of 3 and 6 months. BL, HW, HG, PG were found to be higher at 12 months of age which is 52.82, 57.44, 58.50, 59.15 cm, respectively, which showed lower value than (Verma *et al*., 2015).

Body weight

The marketable animal weighed 16.31 kg (Table 1). The overall body weight of Malkangiri goat at different stages (0, 3, 6, 12 month) of growth were 1.39±0.06, 6.16±0.09, 11.11±0.10 and 16.31±0.17 kg, respectively. Verma *et al.* (2015) reported higher estimates of body weight than present study at the age of 3, 6 and 12 months of age.

Inheritance and association among morphometric traits and body weights

The heritability estimate of body weight was recorded as 0.19±0.13 and 0.23±0.15, respectively at birth and 12 months of age. Mia *et al*. (2013) and Ali (1983) showed higher estimates of the heritability of birth weight in Black Bengal goats. The report of Amble *et al*. (1964) corroborated the present finding. Siddiqui *et al*. (1981) reported a lower

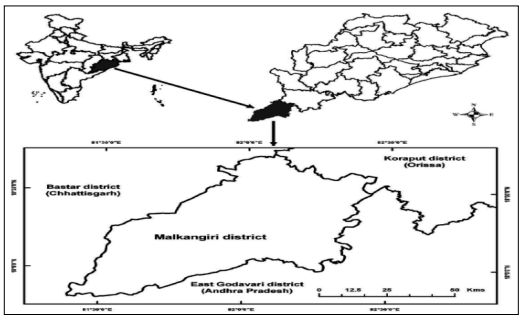


Fig 1: Malkangiri district.

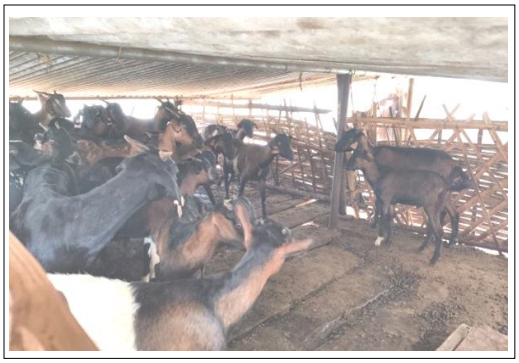


Fig 2: Goat shed.



Fig 3: Malkangiri buck.



Fig 4: Malkangiri doe with kids.

Table 1: Body weight and morphometric characteristics of Malkangiri goats during various growth stages.

Traits	Stages of growth			
	Birth	3M	6M	12M
Body wt in kg (34)	1.39±0.06	6.16±0.09	11.11±0.10	16.31±0.17
HW in cm (34)	28.46±0.32	44.99±0.56	47.75±0.30	57.44±0.50
BL in cm (34)	25.88±0.43	43.77±0.58	47.20±0.70	52.82±0.45
HG in cm (34)	25.48±0.48	43.34±0.60	47.95±0.40	58.50±0.40
PG in cm (34)	27.33±0.45	45.35±0.70	48.95±0.68	59.15±0.45

*Figures in parentheses indicate number of observations.

Table 2: Heritability, genetic correlation, phenotypic correlations between different conformation traits in Malkangiri goats at birth.

Traits	Body weight	Height at withers	Body length	Heart girth	Paunch girth
Body weight	0.19±0.13	0.22±0.13	0.27±0.25	0.48±0.25	0.51±0.38
Height at withers	0.33±0.02	0.51±0.25	0.33±0.18	0.56±0.23	0.61±0.27
Body length	0.25±0.01	0.51±0.01	0.25±0.16	0.54±0.36	0.25±0.11
Heart girth	0.12±0.06	0.49±0.02	0.56±0.06	0.16±0.121	0.19±0.06
Paunch girth	0.09±0.03	0.44±0.06	0.40±0.02	0.50±0.06	0.34±0.19

Estimates in the diagonal are heritabilities.

Estimates above diagonal are genetic correlation.

Estimates below diagonal are phenotypic correlation.

Table 3: Heritability, genetic correlatio, phenotypic correlations between different conformation traits in Malkangiri goats at 12 months of age.

Traits	Body weight	Height at withers	Body length	Heart girth	Paunch girth
Body weight	0.23±0.14	0.47±0.24	0.31±0.24	0.21±0.18	0.82±0.24
Height at withers	0.52±0.03	0.13±0.11	0.51±0.42	0.52±0.44	0.88±0.27
Body length	0.18±0.02	0.26±0.02	0.32±0.19	0.74±0.27	0.91±0.25
Heart girth	0.25±0.03	0.36±0.03	0.31±0.02	0.22±0.15	0.45±0.26
Paunch girth	0.30±0.03	0.36±0.06	0.34±0.05	0.43±0.02	0.14±0.12

Estimates in the diagonal are heritabilities.

Estimates above diagonal are genetic correlation.

Estimates below diagonal are phenotypic correlation.

value for Osmanabadi goats for heritability of birth weight. Higher estimations were recorded in Black Bengal goats by Mia *et al.* (2013) for 12 month body weight. Further the heritability estimates of HW, BL, HG and PG were 0.51, 0.25, 0.16 and 0.34, respectively at birth (Table 2). The genetic correlation among the body weight and body measurement traits ranged from 0.19 to 0.61, whereas, the phenotypic correlation ranged from 0.09 to 0.56 at birth which is low to moderate. Corresponding genetic correlation among the body weight and body measurement traits ranged from 0.21 to 0.91, whereas, the phenotypic correlation range from 0.18 to 0.52 at 12 month of age which is low to moderate (Table 3).

CONCLUSION

The moderate heritability estimates on body weight and body measurements suggested that selection for growth performance could be based on individual superiority and desired improvement may be achieved with good management care and nutrition. Due to the moderate to high and positive genetic correlations among the economic traits, simultaneous selection of more than one trait at a time may trigger favourable response with regard to overall growth performance of this goat type. Further, realising the overall performances, individual variability and genetic analysis on growth traits, it may be registered as a goat breed and suitable conservation and improvement strategies may be adapted towards livelihood enhancement of the stakeholders.

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Conflict of interest

There is no conflict of interest.

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