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Research Paper

Identify the Phenotypic Indicators for Prognostic of Hypothetical Litter Size of Black Bengal Goat

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ABSTRACT

The present investigation recorded that the average litter size was 2.03 per doe and the prolificacy rate being 202.92%. The result indicates that the litter size proportion for single, twin and triplet were 28.3%, 40.4% and 31.3% respectively. The present study revealed substantial phenotypic variations among the goats bearing single, twin and triplet foetus. Based on stepwise discriminant function to find out month wise phenotypic descriptors, some important linear traits namely Punch girth (PG), Body Weight (BW), Rump Length (RL), Croup Height (CrH), Clearance of Sternum (CS), Distance between Tuber coxae (DTC), Distance between Trochanter major (DTM), Head-Rump Length (HRL), Body Length (BL), Curved Head-Rump Length (HRCL), Heart girth (HG, Pelvic Triangle (PLVT) and Wither Height (WH); were identified to be significant in discriminating the foetal numbers between groups. Out of these, HRL measurement might be considered as one of the best indicator for higher Litter Size (LZ) during the second, third, fourth, fifth parity. Other best suitable phenotypic descriptors like BL, CS, PG, PLVT and BW could be used to predict probable kidding size.

Keywords: Black Bengal Goat, Prolificacy, Morphometric Traits, Litter size

Goat farming in India is a well-established and very old form of farming especially in regions where dry land farming system is practiced. It is basically practiced by farmers who have small piece of land for farming. Landless labourers also do goat farming as the initial investments and risk involved in it is very low as compared to other forms of farming. Goat farming is the backbone of economy of small and landless farmers in India. It will be best suitable option among the livestock farming for upliftment of the weaker section specially the landless and marginal farmers of economically backward region of India. Moreover, due to continuous urbanization, the goat will be the livestock species of choice in the future as it occupies less space and less feed and fodder. Black Bengal goat, for to its high prolificacy and superior chevon quality is considered as a world famous meat producing goat. The level of goat meat production to meet domestic and global demand can be possible by producing faster growing goats or by improving their reproductive efficiency. It is essential to find out the prolific does from the population for exploiting kids production potential by assessing suitable body linear traits for predicting probable kidding size. The term "Morphometric" refers to the quantitative analysis of form, a concept that encompasses size and shape. Morphometric analyses are commonly useful in phenotypic analysis of farm animals. The morphometric traits can be categorized into three main groups viz. traits associated with length, height and girth (cross sectional area). Morphological measurements are

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very important method used to evaluate and assess the characteristics of various breeds of animals. These measurements can help to provide the basic information on the suitability of the animals towards their selection. Measurements of phenotypic traits can be used as selection tool for growth. It also enables the breeder to recognize early maturing and late maturing animals of different size. Animal morphology shows considerable variation with respect to breed, age, sex, nutritional condition and environmental factors among others. Thus, measurements are important tools for comparison. In order to achieve a more objective assessment, numerous metrical measurements need to be carried out.

MATERIALS AND METHODS

Three districts of West Bengal viz. Nadia, Hooghly and Purba-Bardhaman were selected for the present investigation. Two blocks under each district and two villages under each block were randomly selected. Twenty to twenty-five pregnant Black Bengal goats, preferably at the 1st month of pregnancy but not later than 2nd month, from each village were randomly selected; a total of 240 female pregnant animals of different age groups and parity were included in the present study. A group of animals were offered concentrate supplement while the other group thrived only on grazing. Some general information, qualitative traits and reproductive parameters were collected one time, while different morphometric traits including body weight were recorded at monthly interval during five months of pregnancy period and one set of observation after kidding. A complete time-series data on 240 pregnant goats were analysed using stepwise discriminant function analysis using SPSS.

RESULTS AND DISCUSSION

The percent of Black Bengal does having different birth type based on kidding size is presented in Table 1. It indicates that the litter size proportion for single, twin and triplet recorded were 28.3%, 40.4% and 31.3% respectively (Table 1). The present investigation recorded the birth of 487 kids from 240 kidding does, with an average of 2.03 kids per doe, the prolificacy rate being 202.92%. The average litter size was reported1.93±0.05 for Black Bengal goat.

Parity-Wise Phenotypic Descriptor at 1st Month of Pregnancy: The stepwise discriminant function as presented in Table 2 indicated that ten linear traits (PG, RL, CS, DTM, BW, CrH, HRCL, BL, PLVT-A and PLVT-B) were significant in discriminating the fetal numbers between groups. The standardized canonical discriminant function coefficients showed the multivariate discriminating power of the phenotypic traits. PG measurement might be considered as one of the best indicator for higher LZ during the second and fifth parity. RL emerged as another best indicator for higher LZ during 3rd and 5th parity. CS measurement was found to be the third best indicator for higher LZ from 3rd and 4th parity. DTM at first parity might be considered as indicators for higher LZ. BW at second parity might be considered as indicators for higher LZ. Moreover, CrH at fourth parity and HRCL, BL, PLVT-A and PLVT-B at fifth parity might be considered as indicators for higher LZ. Discriminant analysis allowed identifying important and informative variables from a lot of traits. The pregnant does could be divided in to classes carrying multiple fetuses and single fetus on the basis of PG, RL, CS, DTM, BW, CrH, HRCL, BL PLVT-A and PLVT-B. The results are in agreement with the previous finding of using phenotypic discriminate variables for classifying different goat breeds and Black Bengal goat.

Based on the functions at group centroids it was noted that in the first month of pregnancy supreme level of eigenvalue 958.31 was presents in fifth parity, which denotes that the linear traits HRLC, RL, BL, PG, PLVT-A and PLVT-B were the most

Table 1: Black Bengal goats with different Litter Size groups and Prolificacy

	Litter size class of does			Total Kids Born	Average Kids Born / Doe	Prolificacy (%)
	Single	Twin	Triplet			
No of Animals (n=240)	68	97	75	487	2.03	202.92%
% of animal	28.3	40.4	31.3			

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Table 2: Stepwise Discriminant Function Results for month-wise discrimination of variables during pregnancy. {Phenotypic Descriptor 1st Month Parity-wise}

Prediction from	First Parity		Second Parity			Third Parity			Fourth Parity			Fifth Parity	
	Variable	Function	Var.	Function		Var.	Function		Var.	Function		Variable	Function
		1		1	2		1	2		1	2		1
Canonical Discriminant Function Coefficients	DTM	1.11	PG	0.54	-0.14	RL	-1.05	0.54	CrH	0.60	-0.68	HRCL	-0.91
			BW	-0.47	0.53	CS	1.67	0.18	CS	-0.64	0.69	RL	-28.16
												BL	2.81
												PG	7.51
												PLVT-A	-3.73
												PLVT-B	-0.45
Unstandardized Coefficients	Const.	-7.31	Const.	-27.61	0.99	Const.	-23.06	-10.97	Const.		-12.11	Const.	-62.48
Functions at Group Centroids													
Litter Size		1		1	2		1	2		1	2		1
1		-0.16	1	-0.39	-0.94	1	0.01	0.21	1	-2.60	1.37	**1**	—
2		1.56	2	-0.49	1.15	2	-2.42	-0.05	2	-1.21	-0.34	2	21.17
3		-	**3**	3.88	0.11	3	3.02	-0.05	3	1.64	0.11	3	-37.04
Eigen value		0.28		2.40	1.38		8.20	0.01		3.17	0.26		958.31
% of Variance		100		63.46	36.54		99.84	0.16		92.32	7.69		100
% of Original grouped cases correctly classified		91.3		80.0			90.9			84.6			91.7

Table 3: Stepwise Discriminant Function Results for month-wise discrimination of variables during pregnancy. {Phenotypic Descriptor 2nd Month Parity-wise}

Prediction from	First Parity		Second Parity		Third Parity		Fourth Parity			Fifth Parity	
	Variable	Function	Variable	Function	Variable	Function	Variable	Function		Variable	Function
		1		1		1		1	2		1
Canonical Discriminant Function Coefficients	HRL	0.14	HG	0.35	BW	0.29	HRL	0.19	0.03	RL	0.74
	DTM	0.70					WH	-0.01	0.26		
							CrH	-0.32	-0.07		
Unstandardized Coefficients	Const.	-11.86	Const.	-19.16	Const.	-4.62	Const.	4.85	-10.26	Const.	-11.35
Functions at Group Centroids											
Litter Size		1		1		1		1	2		1
1		-0.27	1	-1.10	1	-0.78	1	-1.62	-1.06	**1**	—
2		2.41	2	0.78	2	-0.15	2	1.17	-0.52	2	-0.79
3		-	**3**	2.07	3	1.14	3	-0.24	0.70	3	0.59
Eigen value		0.69		1.24		0.60		1.02	0.58		0.52
% of Variance		100		100		100		63.99	36.00		100
% of Original grouped cases correctly classified		96.9		66.7		57.1		80			77.3

promising indicators that motivating the fetal size. The second largest eigenvalue was 8.20 was presents in third parity, where the linear traits RL and CS provoke the fetal size, in the direction that has the next largest spread, and so on.

Parity-Wise Phenotypic Descriptor at 2nd Month of Pregnancy: The stepwise discriminant function done parity wise for 2nd month and presented in Table 3 indicated that seven linear traits (HRL, DTM, HG, BW, WH, CrH and RL) were identified to be significant in discriminating the fetal numbers between groups. The standardized canonical discriminant function coefficients showed the multivariate discriminating power of the phenotypic traits. HRL measurement might be considered as one of the best indicator for higher LZ during the first and fourth parity. DTM at first parity might be considered as indicators for higher LZ. HG at second parity might be considered as indicators for higher LZ. BW at third parity might be considered as indicators for higher LZ. Over and above, WH and CrH at fourth parity and RL at fifth parity might be considered as predictor for higher LZ. Discriminant analysis allowed identifying important and informative variables from a lot of traits. The pregnant does could be divided in to classes carrying multiple fetuses and single fetus on the basis of HRL, DTM, HG, BW, WH, CrH and RL. Thus a parsimonious discrimination between the goat groups may be achieved by using a few discriminant traits. The results of the present finding are in agreement with the previous finding of using phenotypic discriminate variables for classifying different goat breeds and Black Bengal goat.

Correspondingly we inkling, the functions at group centroids console that in the second month of pregnancy, the absolute eigenvalue was 1.24 observed in second parity which presumes that the linear trait HG was leading the benefits that motivating the fetal size. Followed by, the linear traits HRL, WH and CrH (1.02) in fourth parity provoke the fetal number, in the direction that has the next largest spread.

Parity-Wise Phenotypic Descriptor at 3rd Month of Pregnancy: Six linear traits, viz. HRL, DTC, PG, WH, CrH and BW were identified to be significant in discriminating the foetal number between groups, as per the stepwise discriminant function analysis (Table 4). The standardized canonical discriminant function coefficients showed the multivariate discriminating power of the phenotypic traits. HRL measurement might be considered as one of the best indicator for higher LZ during the first, third and fourth parity. DTC at first parity might be considered as indicators for higher LZ. PG at second parity might be considered as indicators for higher LZ. Besides, WH, CrH and BW at fourth parity might be considered as indicators for higher LZ. Discriminant analysis helped to identify important and informative variables from a lot of traits. The pregnant does could be divided in to classes carrying multiple fetuses and single fetus on the basis of HRL, DTC, PG, WH, CrH and BW and thus prolific goats could be identified by using a few discriminant traits. The results are in agreement with the previous finding of using phenotypic discriminate variables for classifying different goat breeds and Black Bengal goat.

Table 4: Stepwise Discriminant Function Results for month-wise discrimination of variables during pregnancy. {Phenotypic Descriptor 3rd Month Parity-wise}

Prediction from	**First Parity**		**Second Parity**		**Third Parity**		**Fourth Parity**			**Fifth Parity**
	Variable	**Function**	**Variable**	**Function**	**Variable**	**Function**	**Variable**	**Function**		
Canonical Discriminant Function Coefficients		**1**		**1**		**1**		**1**	**2**	No Variables are qualified for the analysis at Fifth Parity
	HRL	0.20	PG	0.22	HRL	0.18	HRL	-0.25	0.02	
	DTC	0.36					WH	-0.01	0.25	
							CrH	0.29	-0.13	
							BW	0.18	0.08	
Unstandardized Coefficients	Const.	-13.18	Const.	-14.87	Const.	-10.23	Const.	-2.38	-8.12	
Functions at Group Centroids										
Litter Size		**1**		**1**		**1**		**1**	**2**	No Variables are qualified for the analysis at Fifth Parity
1		-0.38	1	-0.54	1	-0.87	1	1.84	-1.45	
2		2.68	2	0.32	2	-0.19	2	-0.88	-0.57	
3		—	**3**	1.44	3	0.80	3	0.25	0.65	
Eigen value		1.08		0.25		0.36		0.69	0.59	
% of Variance		100		100		100		54.27	45.73	
% of Original grouped cases correctly classified		95.2	45.9		49.2		76			

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Table 5: Stepwise Discriminant Function Results for month-wise discrimination of variables during pregnancy. {Phenotypic Descriptor 4th Month Parity-wise}

Prediction from	First Parity		Second Parity		Third Parity			Fourth Parity			Fifth Parity
	Variable	Function	Variable	Function	Variable	Function		Variable	Function		
Canonical Discriminant Function Coefficients		1		1		1	2		1	2	No Variables are qualified for the analysis at Fifth Parity
	HRL	0.19	PG	0.22	HRL	0.14	-0.13	HRL	-0.01	0.22	
	DTC	0.42			PLVT-B	0.17	0.34	WH	0.23	-0.16	
Unstandardized Coefficients	Const.	-13.13	Const.	-15.13	Const.	-11.45	0.01	Const.	-9.96	-5.91	
Functions at Group Centroids											
Litter Size		1		1		1	2		1	2	
1		-0.38	1	-0.55	1	-0.67	0.57	1	-0.87	-1.37	No Variables are qualified for the analysis at Fifth Parity
2		2.65	2	0.33	2	-0.33	-0.23	2	-0.71	0.43	
3			3	1.26	3	0.93	0.09	3	0.64	-0.03	
Eigen value		1.06		0.25		0.42	0.09		0.51	0.27	
% of Variance		100		100		82.31	17.69		65.37	34.63	
% of Original grouped cases correctly classified		95.2		45.9		47.7			60		

Parity-Wise Phenotypic Descriptor at 4th Month of Pregnancy: Like other months 4th month of pregnancy also identified few important discriminating linear traits like HRL, DTC, PG, PLVT-B and WH as shown by stepwise discriminant function analysis (Table 5). The standardized canonical discriminant function coefficients showed the multivariate discriminating power of few phenotypic traits. HRL measurement might be considered as one of the best indicator for higher LZ during the first, third and fourth parity. DTC at first parity, PG at second parity, PLVT-B at third parity and WH at fourth parity might also be considered as indicators for higher LZ. The results are in agreement with the previous finding of using phenotypic discriminate variables for classifying different goat breeds and Black Bengal goat.

In fourth month of pregnancy the maximal eigenvalue of 1.06 in first parity revealed that HRL and DTC rife a prominent rhythm with prolificacy. Subsequently, the second highest eigenvalue was 0.51 in fourth parity, where the linear traits HRL and WH influenced the predictor of foetal number.

Parity-Wise Phenotypic Descriptor at 5th Month of Pregnancy: The 5th month of pregnancy also emerged with six phenotypes descriptors to significantly discriminate the foetal numbers between groups as shown by stepwise discriminant function (parity wise) (Table 6). The standardized canonical discriminant function coefficients showed the multivariate discriminating power of the phenotypic traits. HRL measurement might be considered as one of the best indicator for higher LZ during the first and fourth parity. BW emerged as another best indicator for higher LZ during 3rd and 4th parity. DTC at first parity, HG at second parity, WH at third parity and CrH at fourth parity might also be considered as indicators for higher LZ. Discriminant analysis assisted to identify important and informative variables from a lot of traits. The pregnant does could be divided in to classes carrying multiple fetuses and single fetus on the basis of HRL, BW, DTC, HG, WH and CrH. The results are in agreement with the previous finding of using phenotypic discriminate variables for classifying different goat breeds [3]and Black Bengal goat.

Eventually, with the eigenvalue in fifth month of pregnancy, the maximum eigenvalue was 1.14 in first parity, where the linear traits HRL and DTC rife a positive influence in prolificacy. Followed by the second highest eigenvalue was 0.73 in fourth parity where the linear traits HRL, WH, CrH and BW provoke the LZ, in the direction that has the next largest spread.

Table 6: Stepwise Discriminant Function Results for month-wise discrimination of variables during pregnancy. {Phenotypic Descriptor 5th Month Parity-wise}

Prediction from	First Parity		Second Parity		Third Parity		Fourth Parity			Fifth Parity
	Variable	**Function**	**Variable**	**Function**	**Variable**	**Function**	**Variable**	**Function**		
		1		**1**		**1**		**1**	**2**	
Canonical Discriminant Function Coefficients	HRL	0.19	HG	0.22	BW	0.33	HRL	0.25	-0.07	No Variables are qualified for the analysis at Fifth Parity
	DTC	0.42					WH	0.11	0.22	
							CrH	-0.33	0.01	
							BW	-0.14	0.14	
Unstandardized Coefficients	Const.	-13.50	Const.	-12.11	Const.	-6.49	Const.	-1.15	-9.30	
Functions at Group Centroids										
Litter Size		1		1		1		**1**	**2**	
1		-0.39	1	-0.52	1	-0.85	1	-2.41	-0.57	
2		2.75	2	0.30	2	-0.31	2	0.55	-0.84	No Variables are qualified for the analysis at Fifth Parity
3			3	1.34	3	1.00	3	0.08	0.67	
Eigen value		1.14		0.23		0.51		0.73	0.56	
% of Variance		100		100		100		56.55	43.45	
% of Original grouped cases correctly classified		95.2		54.1		50.8		74		

SUMMARY

While analyzing through stepwise discriminant function to detect parity wise phenotypic descriptors ten linear traits (PG, RL, CS, DTM, BW, CrH, HRCL, BL, PLVT-A and PLVT-B) were significant in discriminating the foetal numbers between groups in 1st month of pregnancy. PG measurement might be considered as one of the best indicator for higher LZ during the second and fifth parity. Similarly, HRL among seven significant linear traits (HRL, DTM, HG, BW, WH, CrH and RL) during 1st and 4th parity in 2nd month, HRL among six-significant linear traits (HRL, DTC, PG, WH, CrH and BW) during 1st, 3rd and 4th parity in 3rd month, HRL among fivesignificant linear traits (HRL, DTC, PG, PLVT-B and WH) during 1st, 3rd and 4th parity in 4th month and HRL among six-significant linear traits (HRL, BW, DTC, HG, WH and CrH) during 1st and 4th parity in 5th month were found to be best indicators for higher LZ during gestation.

CONCLUSION

With the help of body linear traits, suitable phenotypic descriptors like Punch Girth, Body Length, Head-Rump Length, Pelvic Triangle Area, Body Weight could be used to predict probable kidding size during gestation which in turn can draw appropriate management and nutritional measures for survival of more healthy kids. The present finding may be need in the field level to find out the prolific goat to have better kid production potential.

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