Aggregation of Estimated Breeding Values for Different Traits of Goat

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Aggregation of Estimated Breeding Values for Different Traits of Goat

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List of abbreviation

Abbreviation and Symbol	Elaboration
BVs	Breeding Values
et al.	And his associate
UVH	Upazila Veterinay Hoapital
SAS	Statistical Analytical Software
GLM	General Liner Model
REML	Restricted Maximum Likelihood
BLUP	Best Linear Unbiased Prediction
SPC	Service Per Conception
KN	Kid Number
MY	Milk Yield
LWT	Live weight
Fig.	Figure

Abstract

The present study was conducted with a view to know the productive and reproductive performances and to estimate the heritability and breeding value of the traits for individual goat in backyard goat flock from three villages in Pirojpur district. Data were collected on regular basis from January to March, 2015 and analyzed by PROC GLM of SAS and Animal Model to know the phenotypic performance and BLUP breeding values of different traits, respectively. The result showed that service per conception and kid number was significantly affected by parity of dam and use of proper breeding system and feeding management. Daily milk production was significantly affected by the type of breeds, body weight and parity of dam. The heritability value of service per conception, number of kid, milk yield, and live weight of goat was 0.204±0.364, 0.017±0.623, 0.340±0.381, and 0.269±0.402, respectively. The estimated breeding values of service per conception, number of kid, milk yield and live weight of dam were ranged from -0.38 to 0.47, -0.14 to 0.60, -0.30 to 0.78, and 0.73 to 0.34, respectively. Estimated breeding values of individual were aggregated and ranking was performed. If the proper breeding and scientific management could be ensured to the village goat flock it will be profitable.

Keywords: Traits, Heritability, Breeding value, Animal Model, Phenotypes.

Chapter 1: Introduction

Goat is the most popular and abundant species among the livestock. The poor people of Bangladesh easily can rear the goat as the primary capital is less for their management. The productive and reproductive performances of goat are higher compare to other livestock. But the present system of their rearing causes reduced growth and reproductive performances of the goat (Islam *et al.,* 2009).

High reproductive performance is necessary for efficient milk production and has an important influence on flock's profitability *(*Pryce *et al.,* 2004). Black Bengal goat has high reproductive lower productive performance compared to other breeds in Bangladesh. It becomes famous for its adaptability, early sexual maturity, larger litter size and superior skin quality (Paul *et al.,* 2014). It produces less amount of milk which is not enough for kid rearing and slower growth rate (Chowdhury *et al.,* 2002). But the milk contains more nutrient and different types of antibody which is more important for human health and it is also easily digestible for all classes of people.

The reproductive and productive traits may vary with breed, season, age, nutritional status, health, breeding management and farm to farm (Drazen *et al.,* 2012). So those trait values can be increased by improving genetic, management, nutrition and health care. Among these options genetics is permanent and stable. The genetic make-up of an individual can be estimated from the estimation breeding values of the different traits. Heritability is the strength of inheritance of a character that is whether it is likely to be passed on the next generation or not. From the value of heritability, the genetic merit or breeding value may be predicted and the animal may be selected based on those values for rearing purposes.

In order to cope with the increasing demand of goat production potential, a lot of research work has been done on estimation of productive and reproductive traits in Bangladesh on goat (Faruque *et al.,* 2010; Amin *et al.,* 2001). But unfortunately, the systemic information on production and reproduction on goat especially for the black Bengal goat are very limited and not properly reached to the village people. The

productivity of Black Bengal goat is not increasing due to unsystematic breeding programme. To boost up the productivity of this genotype a systematic genetic improvement programme is essential. For set up a systematic genetic improvement programme the information on heritability, repeatability and breeding value for different traits is important.

Here the study was planned and executed to evaluate the productive and reproductive performance of the Black Bengal and their crosses and estimates the breeding values of different traits. Therefore the study was design with the following objectives:

Objectives:

1. To know the management of goat rearing.
2. To evaluate the reproductive and productive performance of the goat.
3. To estimation the heritability and genetic and phenotypic correlation of different traits.
4. To estimation the breeding value of the different traits of goat and ranking them based on the aggregate BVs.

Chapter 2: Materials and Methods

2.1. Study area and duration:

The study was conducted at the backyard goat flocks of K.nagar, Porgola and Dupasha villages under Pirojpur district during internship placement at UVH from the period of 13th January to 12th March, 2015. The ecology of those three villages is almost same.

2.2. Data collection:

In this study, data were collected from 8 backyard goat flocks under the three villages at Pirojpur district. The total goat populations were 56 in number. The eight backyard goat flocks of this village were randomly selected. The flocks' owner used to rear the Black Bengal and the crossbred of the goat. Data were collected through the flocks randomly by interviewing method using pre-structured questionnaire. Data for reproductive and productive traits on individual animal were recorded.

The total management procedures of goat flock including housing, feeding and rearing were observed and data was recorded. All the data obtained from the three villages covering all the eight backyard goat flocks are arranged in group according to flock, parity, service per conception, litter size, body weight.

2.3. Data analysis:

The data were analyzed by using the PROC GLM (General Liner Model) procedure of SAS (SAS, 2012). BLUP Estimated breeding value (EBVs) of different traits was estimated by using AIREML based on Restrictd Maximum Likelihood (REML) and using the average information (AI) matrix (Johnson, 1993). The model of analysis for individual animal was presented as

$$Y_{ijkl} = F_i + B_j + S_k + P_l + a + e_{ijkl}$$

Where, Y_{ijkl} is the traits yield, F_i , B_j, S_k ,P_l are the vector of fixed effect due to flocks of goat, breed, sex and parity of the goat,

a is a matrix relating to breeding value of an animal, distributed with mean 0 and variance σ^2a, the genetic variance for the observed traits, and
e is the vector of error terms, assumed N(0, σ^2e).

In matrix notation the above equation of animal model becomes:

$$Y = Xb + Zu + e$$

Where, Y is the vector of all observation,
b is the vector of fixed effects,
u is the vector of breeding value of the animal, and
e is the vector of residual effect.

X and Z are designed matrices connecting to the fixed and random effect respectively.
The aggregation of breeding value was derived by summing the Breeding values of all traits.

Pictures

Fig 1: Data collection

Fig 2: Housing for goat

Fig 3: Crossbred of goat

Fig 4: Black Bengal goat

Fig 5: Feeding management of goat (Stall feeding and browsing)

Chapter 3: Results

3.1. Management of flocks:

The management procedure of goat flocks in those three villages at Pirojpur was satisfactory. Most of the farmer (flock no.1, 3, 4 and 7) provides the separate house (steelted house) for their goat in the village of K.nagar, Porgola and Dupasha under Pirojpur district. Some farmer (flocks no.2, 6, and 8) did not have the economic ability to house their goat separately and this is why they kept their goat in open place during the day time and at night time they keep their goat in their own living room. The house of the goat used to clean regularly and take more care for bedding for their goat.

Goats are allowed to graze on pasture land for 8 hours (from 9 am to 5 pm) with 1 hour rest (1pm to 2 pm). In most of the flocks (flock no.4 and 7) the owner provides green grass, green tree leaves, concentrate mixture such as rich polish, wheat bran, common salt and drinking water twice daily. They also supply their kitchen waste such as rice gruel, by product of vegetables etc to their goat. Few farmers (flock no. 3 and 7) used improved pastures and concentrates to enhance the nutrition of their goats. In most of the flocks the goat are look after by the women or children.

Some flocks (flock no1, 3, 4 and 7) they follow the selective breeding programme and some flock have their own buck to breed. They used to rear mainly tow breed, Black Bengal and cross breed of the goat.

Most of the owner of the flock used to vaccinate his goat against PPR and use to administer the anthelmintic. The sick animal and kids, stunted growth, unthrifty condition, repeat breeding, sever skin diseases were usually culled from the flock.

3.2 Productive and reproductive performance:

The productive and reproductive performances of goat in the different flocks of three villages under Pirojpur district give in table 1

Table 1: Phenotypic performances of goat in the different flocks of three villages

Flocks	Breed	Sex	Parity	SPC	NK	MY	LWT
1	Black Bengal	Male	Parity 1	-	1	-	8
			Parity 2	-	2	-	10
			Parity 3	-	3	-	10
		Average in male		-	2	-	9.33
		Female	Parity 2	2	2	1.5	10
			Parity 3	1	3	1.4	10
		Average in female		1.5	2.5	1.45	10
	Average in Black Bengal breed			1.415	2.25	2.41	9.66
	Crossbred	Male	Parity 1	-	2	-	11
			Parity 2	-	1	-	10
			Parity 3	-	2	-	11
		Average in male		-	1.66	-	10.67
		Female	Parity 1	1.33±0.58	2	1.66±.29	10.3±.58
			Parity 3	2	2	1.2	10
		Average in female		1.66±.58	2	1.43±.29	10.15±.5
	Average in crossbred			1.83±.58	1.83	1.45	10.41±.5
Average in flock no 1				1.53±.51	2.07	1.4±.26	10±.70
2	Crossbred		Parity 3	-	2	-	12
		Average in male		-	2	-	2
		Female	Parity 1	1	1	1.5	8
		Average in female		1	1	1.5	8
	Average in flock no 2			1	1.5	1.5	10

Flocks	Breed	Sex	Parity	SPC	NK	MY	LWT
3	Black Bengal	Male	Parity 1	-	2	-	10
			Parity 2	-	3	-	10
			Parity 3	-	2	-	10
		Average in male		-	2.33	-	10
		Female	Parity 1	1	2	1.8	10
			Parity 2	2	3	2	10
		Average in female		1.5	2.5	1.9	10
	Average in Black Bengal breed			1.41	2.414	1.92	10
		Male	Parity 2	-	2	-	13
			Parity 3	-	1	-	13
		Average in male		-	1.5	-	13
		Female	Parity 1	1	1	1.35±.21	11.5±2.1
			Parity 2	2	2	1.5	13
		Average in female		1.5	1.5	1.42±.2	12.2±2
	Average in crossbred			1.5	1.5	1.38±.2	12.6±2
Average in flock no 3				1.46	1.96	1.65±.2	11.3±2
4	Black Bengal	Male	Parity 1	-	2	-	11
			Parity 2	-	3	-	11
			Parity 3	-	2	-	11
		Average in male		-	2.33	-	11
		Female	Parity 1	1.5±.71	1.5±.71	1.5±.07	10.5±.70
			Parity 2	2	3	1.2	11
			Parity 3	1	2	1.6	11
		Average in female		1.5±.7	2.1±.7	1.43±.07	10.83±.7
	Average in flock no 4			1.41±.7	2.2±.7	1.38±.07	10.9±.7

Flocks	Breed	Sex	Parity	SPC	NK	MY	LWT
5	Crossbred	Male	Parity 1	-	1	-	11
			Parity 3	-	2	-	12
		Average in male		-	1.5	-	11.5
			Parity 3	2	2	1.3	12
		Average in female		2	2	1.3	12
	Average in crossbred			2	1.75	1.3	11.75
Average in flock no 5				2	1.75	1.3	11.75
6	Black Bengal	Male	Parity 1	-	2	-	12
			Parity 3	-	3	-	12
		Average in male		-	2.5	-	12
		Female	Parity 3	2	3	1.5	12
		Average in female		2	3	1.5	12
	Average in crossbred			2	2.75	1.5	12
Average in flock no 6				1.62	2.62	1.68	12
7	Black Bengal	Male	Parity 1	-	2	-	11
			Parity 2	-	1	-	10
			Parity 3	-	3	-	10
		Average in male		-	2	-	10.33
		Female	Parity 1	1	2	1.7±.52	10.3±.58
			Parity 3	1	3	1.8	10
		Average in female		1	2.5	1.75±.5	10.1±.58
	Average in flock no 7			1	2.25	1.75±.5	10.2±.58

Flocks	Breed	Sex	Parity	SPC	NK	MY	LWT
8	Crossbred	Male	Parity 1	-	1	-	10
			Parity 3	-	2	-	12
		Average in male		-	1.5	-	11
			Parity 2	2	1	1.3	12
			Parity 3	2	2	1.6	12
		Average in female		2	1.5	1.45	12
	Average in crossbred			1.75	1.5	1.37	11.5
Average in flock no 8				1.75	1.5	1.37	11.5

Legend: SPC = Service per conception, KN = Kid number, MY = Milk yield, LWT = Live weight.

The service per conception (SPC) in the flocks was ranging from 1 to 2 (Table 1). The highest SPC was observed in flock 5 (2) and lowest in flock 2 and 7 (1) and all other flock had intermediate. In case of crossbred, the service per conception rate is higher and ranging from 1.5 to 2 than the Black Bengal breed that ranges from 1 to 1.5. So Black Bengal have good conception rate. In case of 2nd parity the conception rate was higher (2) than 1st parity.

The kid number (KN) in the flock was ranging from 1.5 to 2.62 (Table 1). The highest number of kid was observed in flock 6 (2.62) and lowest in the flock 3 (1.5) and all other are intermediate. In case of black Bengal breed, the numbers of kid were higher (2.62) than the crossbred 1.5. In 3rd parity the numbers of kids were more in number and ranging from 2 to 3 than 1st parity. In case of crossbred, the average number male of kid is 1.35 and the average number of female kid is 1.45±0.2 and in case of Black Bengal breed, the average number of male kid is 2 and and the average number of female is 2.25±0.5.

Milk yield (MY) in the flock was ranging from 1.3 to 1.75 (Table 1). The highest amount of milk production was observed in flock 7 (1.75±0.5) and lowest in the flock 5 (1.3).The Black Bengal breed produces higher amount (1.6±o.33) than the crossbred (1.39±0.29) in this area and in the 3nd parity the production of milk were higher (1.55±0.34) than other parity.

The live weight (LWT) of the goat at kidding time were higher at the farm number of 5 (11.75±0.58) than other flocks goat. In crossbred, the live weights of the goat were measured higher (11.23±1.34) than the black Bengal breed (10.50±0.86). In first parity the live weight (11.04±1.04) of the goat remain higher than the third parity (10.48±1.17).

3.3. Estimation of heritability, genetic and phenotypic correlation of traits:

The estimation of heritability (h^2) and genetic correlation (r_g) and phenotypic correlation (r_p) of service per conception, litter size, milk yield and body weight is showed in Table 2.

Table 2: The estimation of heritability (h^2) and genetic correlation (r_g) and phenotypic correlation (r_p) of service per conception, litter size, milk yield and body weight

Traits	SPC	NK	MY	LWT
SPC	**0.20±0.364**	0.15±0.227	0.11±0.193	0.19±0.193
NK	0.38±9.032	**0.01±0.623**	0.16±0.191	0.16±0.188
MY	0.05±1.166	0.91±16.816	**0.34±0.381**	-0.05±0.194
LWT	-0.19±1.220	-0.39±11.265	-0.32±0.928	**0.26±0.402**

Legend: SPC = Service per conception, KN = Kid number, MY = Milk yield, LWT = Live weight.

The heritability of service per conception, number of kid, milk yield, and live weight of goat are 0.204±0.364, 0.017±0.623, 0.340±0.381, and 0.269±0.402, respectively.

Result showed that, the larger genetic correlation value is 0.91±16.816 (Table 2); it means when the number of kids is larger than the milk production will be increased and smaller value is -0.39±11.265 that means, when the number of kids is more than the live weight will be decreased. The others value of genetic correlation are intermediate.

Result showed that, the larger phenotypic correlation value is 0.19±0.193 (Table 2); it means when the number of service per conception rate is higher than the value of

live weight will be higher and smaller value is -0.05±0.194 that means, when the live weight is lower than the milk yield will decreased. The others value of genetic correlation are intermediate.

3.4. Breeding value estimation and ranking based on aggregated BVs:

Table 3: Aggregation of breeding value (BVs) for different traits of goat and their ranking

	Animals	Traits of breeding Value				Aggregation of BVs	Ranking
		SPC	KN	MY	LWT		
Sire	2010	-	0.593	-	-0.289	0.241	3
	2050	-	0.723	-	-0.178	0.545	2
	2070	-	-0.238	-	-0.101	0.137	4
	2080	-	0.136	-	-0.262	-0.126	5
	2140	-	0.785	-	0.125	0.660	1
Dam	503	0.467	0.603	0.128	-0.304	0.894	2
	506	0.334	0.136	0.221	-0.262	0.429	3
	507	0.810	-0.143	-0.731	-0.102	-0.163	5
	508	-0.389	0.609	0.158	-0.252	0.126	4
	509	0.536	0.125	0.344	0.785	1.79	1
Animal	10010	0.843	0.194	0.792	-0.365	1.46	5
	10012	0.112	0.996	0.205	-0.195	1.118	10
	10016	0.877	0.775	0.150	-0.395	1.757	2
	10018	0.812	0.740	0.145	-0.373	1.324	6
	10021	0.690	0.305	0.445	-0.141	1.299	7
	10022	0.625	0.270	0.399	-0.118	1.176	9
	10033	-0.120	0.198	0.952	0.704	1.734	3
	10034	-0.126	0.163	0.907	0.291	1.235	8
	10053	0.365	0.317	0.696	0.329	1.707	4
	10054	0.300	0.283	0.650	0.549	1.782	1

The estimated the breeding value of service per conception rate, number of kid, milk yield and live weight of dam were ranged from -0.38 to .47, -0.14 to 0.60, -0.30 to 0.78, and 0.73 to 0.34, respectively. The estimated the breeding value of service per conception rate, number of kid, milk yield and live weight of animal were ranged from –0.12 to 0.87, 0.19 to .99, 0.14 to 0.95 and -0.39 to 0.70, respectively. The estimate the breeding value of number of kid and live weight of sire were ranged from -0.23 to 0.78, -0.29 to 0.13, respectively.

In this study, the Breeding Value (Bvs) of different traits of all individual was aggregated by summing the breeding values in each trait. According to the aggregation value the ranking were done. The range of the aggregated breeding value of service per conception, number of kid, milk yield and live weight of dam and animal were -0.16 to 1.79 and -1.11 to 1.78, respectively. According to the highest breeding value top 5 sire, dam and animals were presented as an example.

Chapter 4: Discussion

The services required for successful conception of goat in the flocks were ranged from 1 to 2 which were strongly similar to the finding of (Akhter *et al.,* 2006*)* and (Faruque *et al.,* 2002*).* The service per conception were lower in the flock no. 2 and 7 than other flock due to replacement the female, using the proper breeding program and that's finding were strongly similar with (Chowdhury *et al.,* 2012*),* they identified the similar factors were responsible for SPC.

The kid numbers in the flocks were ranged from 1.52 to 2.62 which were almost similar with the study of (Mamabolo *et al.,* 2010*).* The litter size is affected by the age of the goat, genetic and environmental factor such as feed and increased significantly as parity progressed. In this study, highest litter sizes were observed at the 3rd parity in all the flocks. This study was similar with the study with (Chowdhury *et al.,* 2002*).*

In this study, the milk yield in the flocks was ranged from 1.3 to 1.75. Milk yield was gradually increased with the progress of the parity. Highest milk yield was obtained at the 3rd lactation (1.75±0.50) whereas lowest in first lactation. These results of this study were strongly agreed with *Jahangir et al., 2003, (*Hasanat *et al*., 2003; Hossain *et al.,* 2004*).*

The average live weights of a black Bengal and crossbred are 10.50±0.86 and 11.23±1.34 respectively. This similar finding was reported by (Paul *et al.,* 2008*).*

The heritability value of conception rate was very low (0.204±0.364) which was similar to the findings with (Piwczynski *et al.,* 2009; Lee *et al.,* 2009) and the heritability value of milk yield was 0.340±0.381 which was similar with (Muller, 2005*).* The heritability value of live weight varies between breed, places, flocks and method of estimation. Here in this study the heritability value of live weight was 0.269±0.402. That similar value was reported by (Thair *et al.,* 1995*).*

In this study the breeding value of the goat was estimated based on the reproductive and productive traits and the ranking was done by aggregation of the traits value.

Breeding values are depends on the value of traits heritability and phenotypic performances. The results obtained in this area correspond with earlier result in studies by (Piwczynski *et al., 2009*; Sousa *et al.,* 2000*).*

Conclusion

This study revealed that the productive and reproductive performance of a goat depends on breed, parity, sex and system of management. Estimated heritability and breeding value of different productive and reproductive traits obtained in this study were less and near similar to those obtained in the previous study. Estimated breeding values of individual were aggregated and ranking was performed. There was some limitation in this study, such as small population, short period of time. It is suggested that if the proper breeding program and scientific management could be ensured to the village goat flock level, it will surely improve the phenotypic performances as well as improve the breeding values.

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The author,

December, 2015

Annex

Information collection form for goat of a flock

A. Basic information:

1. Name of the flock: ……2.Name of the owner:……..

3. Address of the flock: …… …4.Flock size:…….

4. Owners mobile number: …….....

B. Information about goat of the flock:

Goat ID	Breed	Sex	Parity	SPC	NK	MY	LWT

C. Flock management:

1. Housing and rearing……

2. Feeding system……..

3. Reproductive management.....…….

D. Vaccination and medication:

1. Disease history and treatment……..

2. Deworming……

3. Vaccination……..

Biography

I am Sonnet Podder, author of this clinical report would like to introduce myself as an intern student of Chittagong Veterinary and Animal Sciences University (CVASU), Khulshi, Chittagong, Bangladesh. I have completed my four years academic career under the faculty of veterinary medicine with a good academic background. As a student of veterinary medicine I got the opportunity to learn a lot of animal related diseases, their treatment and management procedure from different placement during my internship program in Bangladesh, India and Thailand. As it is a noble profession and recognized through the world I found my interest in the healing of animals and wishes to pay much interest for the betterment of livestock and as well as betterment for the human and thus overall betterment for the world. Here in this production report, I have performed all the works and all information's have been collected from books, national and international journals and websites.