# PHENOTYPIC SELECTION ON THE IMPROVEMENT OF GROWTH PERFORMANCE OF BLACK BENGAL KIDS

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## Summary

In the first step, birth weights and weights at 9 and 12 months were analysed and their variability were studied. Birth weight of kids had large within breed variation ranging from 0.50 to 1.60 kg. There were more than 100 kids with birth weights ranging from 1.2 to 1.6 kg. The birth weight of kids increased with the increase of kidding weight of dams. The weights of kids at 9 and 12 months also showed large within variation ranging from 5.0 to 18.0 kg and 16.0 to 19.0 kg respectively. In the second step, these existing large within breed variations were exploited selecting best animals for further mating. The birth weight of selected group (1.13 ± 0.2 kg) was significantly (p < 0.01) higher than the random group (0.93 ± 0.05 kg). The weights in selected group for 3 and 6 months were 4.94 ± 0.04 and 8.40 ± 0.05 kg and that of random group was 3.99 ± 0.08 and 7.07 ± 0.11 kg respectively and differences were significant. Significantly higher average daily gains were noticed for selected group (42.7 ± 0.43 g/day) as against random group (33.3 ± 0.81 g/day). From the results it may be concluded that selection and mating of best performing animals have some effect on the improvement of growth performance of kids which may be exploited for future planning and development in the field of goat production.

(**Key Words** : Phenotypic, Variation, Kid, Birth Wt.)

## Introduction

Birth weight of kids is considered to be a very important criterion as it is strongly correlated with growth rate, adult body weight and kid viability and hence determinant factor for overall productivity (Devendra and Burns, 1983). Adult body weight has more influence mainly on the growth behaviour of kids (Mc Gregor, 1984). In goat, growth rate is more emphasized specially where they are mainly used for meat production. In Bangladesh mostly dwarf type Black Bengal goats are being kept in the rural areas in a very extensive production system. From the general search of published literature either in home or abroad, information of Black Bengal goats specially on growth performance potentials is limited. Goat as a potential animal genetic resources of the country and mostly reared by poor landless peasants for maintaining their livelihood and income generation,

demands greatly for their improvement for increased productivity. The increased quantity of meat is determined principally by three factors as growth rate, live weight at slaughter and total number of goats available for slaughter (Devendra, 1985). The literature available so far revealed that growth rate of Black Bengal goat is low. The recent study showed the existence of large within breed variation in respect of birth weight, adult body weight and average daily gains (Husain, 1993).

Thus, the present investigation is viewed to explore the effect of phenotypic selection on the growth performance of Black Bengal kids under rural conditions.

## Materials and Methods

In the first phase of the work data on 892 birth weights, 256 9-month weights and 227 12-month weights were collected from the experimental units and were analysed for the extent of variability existing in each trait.

The second phase of the experiment was conducted with selected group of Black Bengal goats for improving growth performance of kids in the rural areas through selection of bucks and does. For this purpose, 50 mature does were selected from the farmers of the locality. Does

were mainly selected on the basis of phenotypic characteristics as body size, body weight and udder development. Another group consisting 25 mature does and two bucks were maintained and considered as random sample (control) from the farmers of the same locality. Bucks used for selected group were selected on the basis of body weight, body conformation and libido. Bucks were separately managed by project personnel and provided extra feed and care as and when necessary. All these animals were apparently free from diseases and anatomical abnormalities. Goats were dewormed and tag marked. All the information were recorded in an individual data sheet for each of the dam and sire. The records of all kids produced by the dams were also maintained in a separate data sheet. No additional inputs were provided for the two groups except grazing from morning to evening.

The sign of heat were observed by the farmers as well as by the project personnel in the morning and evening. Does in heat were mated naturally with the bucks selected for each group. The climatic and environmental effects were almost same for the two groups as they were maintained in the same locality and for the same period.

The work is presented in two phases. First phase included the information of random data collected from the foundation stocks and analysed for following attributes;

  − relationship of birth weight with the weight of dams and

  − distribution of birth weight, 9 and 12 months weight of kids.

For the second phase the following traits were measured for both the groups and were included in the analyses;

  − Birth weights and subsequent body weights recorded at 30 days interval from date of birth to 6 months of age.

  − average daily body weight gains were calculated from birth to 3 and 3 to 6 months.

Data were analysed with General Linear Model (GLM) Procedure of Harvey Mixed Model least Squares and maximum Likelihood Computer package (Harvey, 1990), SAS Statistical package (SAS Institute INC, 1991) and CSS program. The Least-squares Analysis of variance (LSANOVA) and Least-squares Means (LSM) were calculated for all the traits.

The following Statistical Model was used;

$$Y_{ijklm} = \mu + G_i + P_j + S_k + L_l + M_m$$
$$+ (G_i \times P_j) + (G_i \times S_k) + (G_i \times L_l)$$
$$+ (G_i \times M_m) + (L_l \times M_m)$$
$$+ e_{ijklm}$$

Where,

$Y_{ijklm}$ = Individual record

$\mu$ = Mean

$G_i$ = Effect of group (i = selected and random)

$P_j$ = Effect of birth (j = single, twin & triplet)

$S_k$ = Effect of Season (k = 1 to 3)

  1 = Summer (March to June)

  2 = Rainy (July to October)

  3 = Winter (November to February)

$L_l$ = Effect of litter Size (l = 1 to 3)

$M_m$ = Effect of Sex (m = 1 and 2)

$e_{ijklm}$ = Remainder

Data were analysed and evaluated with the technical assistance and facilities available under the Institute of Animal Sciences, Humboldt University of Berlin, Germany.

## Results and Discussion

The birth weights of 892 individual kids were analysed in the first phase. The relationship of birth weights to the relevant dam's weight is presented in table 1. It revealed that birth weight of kids increased with the increase in dam's weight at kidding. Average weight of dams of 9.30 and 17.50 kg, produced kids with birth weight of 0.93 and 1.20 kg respectively. Correlation between body weight of dams and the subsequent birth weights of their kids were calculated. The analysis revealed a strong correlatin (0.63 ± 0.13) between the traits.

TABLE 1. RELATIONSHIP OF KIDDING WEIGHTS OF DAMS AND SUBSEQUENT BIRTH WEIGHT OF KIDS (kg)

| Group | No. of Obs. | Weights of dam (kg) | | Birth weights of kids (kg) |
|---|---|---|---|---|
| | | Range | Means | |
| 1 | 55 | 7.5-10.0 | 9.3 | 0.93 |
| 2 | 238 | 10.0-13.0 | 12.1 | 0.98 |
| 3 | 423 | 13.2-16.0 | 14.7 | 1.01 |
| 4 | 176 | 16.2-20.5 | 17.5 | 1.20 |

There was also wide variation in birth weights of kids. The minimum and maximum birth weights of kids were 0.50 and 1.60 kg. The pattern of distribution of birth weights of kids can be seen from the figure 1. It is observed that there were more than 100 kids with birth weights ranging from 1.2 to 1.6 kg in random group. This variation might have contributed to the improvement of overall growth performances of kids and could be exploited for future generation. That is, animals with
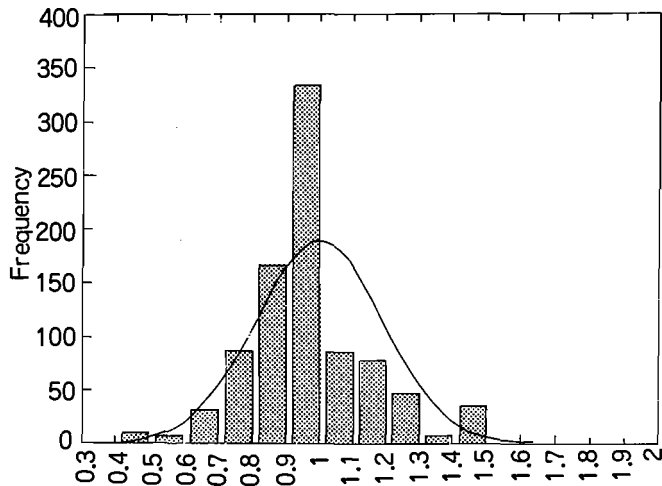
Figure 1. Distribution of birth weights of kids (kg)



Figure 3. Distribution of 12 months weights (kg)

higher body weight at kidding produced kids with higher birth weight which will ultimately lead to higher subsequent body weight. The phenotypic assciation of birth weight with weight at weaning is found to be positive and significant (p < 0.01) which suggested that the birth weight of kids could be utilized as a criterion for selection of kids for higher weight at 3 months of age (Singh et al., 1991).

The weights of kids at 9 and 12 months of age are presented in figure 2 and 3. Figure 2 showed the large variation in weight of kids ranging from 5.0 to 18.0 kg. There were 2.5 animals having the weights ranging from 13.0 to 18.0 kg which is much higher that the mean value of 10.7 kg. Similarly almost the same number of animals were observed with the range of 16.0 to 19.0 kg for 12 months weight (figure 3) having average weight of 12.8 kg. These variation particulary at 9 and 12 months of ages
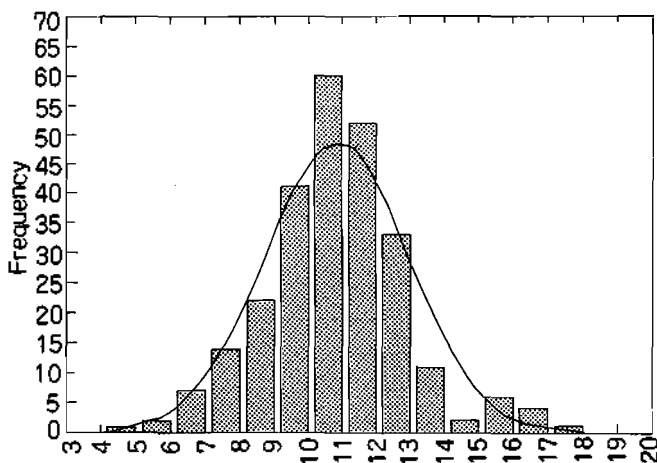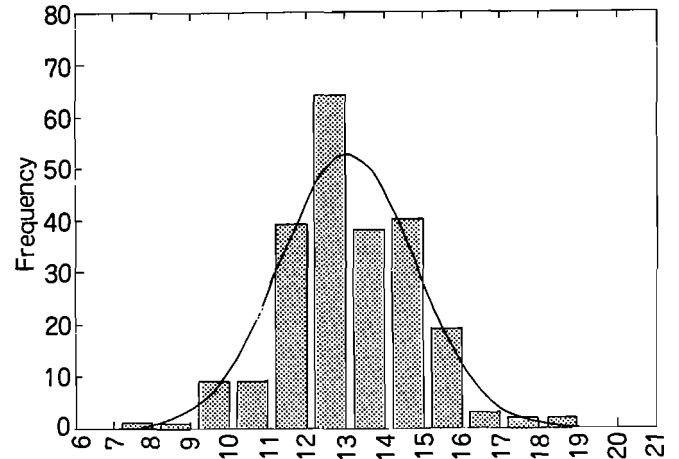


Figure 2. Distribution of 9 months weight (kg)

could be further exploited for future improvement in growth performance of kids.

Based on the above results the second phase of experiment was conducted in rural areas of the counny. This phase comprised of two groups of experimental animals i.e. selected group comprising selected bucks and does and random group with unselected bucks and does from the same locality which was maintained as a control group.

The Least-Squares Means of all the traits are presented in table 2. Birth weight of kids of selected group (1.13 ± 0.2 kg) diffefed significantly (p < 0.01) with that of random group (0.93 ± 0.5 kg). The weights from 1 to 6 months of age also differed significantly (p < 0.01) for the two groups (table 3). The weight of selected group was found to be superior over that of the random group for all the periods accounted for analysis.

The weights of progeny of selected group for 3 and 6 months were 4.94 ± 0.04 and 8.40 ± 0.05 kg which are significantly higher than that of 3.99 ± 0.08 and 7.07 ± 0.11 kg for random group respectively. The percent improvement of selected group over the random the birth, 3 and 6 months weights were 21.5, 23.8 and 18.8 respectively (table 2).

Average daily gains for two groups also differed significantly (p < 0.01). Average daily gains of selected and random groups for the period birth to 3 months were 42.7 ± 0.43 g/day and 33.3 ± 0.81 g/day and that of 3 to 6 months were 38.4 ± 0.39 g/day and 34.3 ± 0.81 g/day respectively (table 2).

The results on the comparative growth performances of two groups indicated significantly (p < 0.01) higher birth weight, subsequent body weights and average daily gains in the selected group. From the results it can be

TABLE 2. COMPARATIVE PERFORMANCE OF PHENOTYPICALLY SELECTED AND RANDOM GROUPS

| Traits | Random group | | | Selected group | | | % Improvement |
|---|---|---|---|---|---|---|---|
| | n | LSM | SE | n | LSM | SE | |
| Body weights | | | | | | | |
| Birth | 68 | 0.93 ± | 0.05b | 150 | 1.13 ± | 0.02a | 21.5 |
| 3 months | 54 | 3.99 ± | 0.08b | 122 | 4.94 ± | 0.04b | 23.8 |
| 6 months | 49 | 7.07 ± | 0.11b | 116 | 8.40 ± | 0.05a | 18.8 |
| Average daily gains (g/day) | | | | | | | |
| Birth to 3 months | 54 | 33.3 ± | 0.81b | 112 | 42.7 ± | 0.43a | 28.2 |
| 3 to 6 months | 49 | 34.3 ± | 0.81b | 116 | 38.4 ± | 0.39a | 11.9 |

Means with the same letter in the same column for each trait are not significantly different (p < 0.05).

TABLE 3. LEAST-SQUARES ANALYSIS OF VARIANCE FOR BODY WEIGHTS AND AVERAGE DAILY GAINS OF KIDS IN SELECTED GROUPS

| Source of Variation | d.f. | Age (months) | | | | | | | Gains | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Birth | 1 | 2 | 3 | 4 | 5 | 6 | Birth to 3 | 3 to 6 |
| | | MS | MS | MS | MS | MS | MS | MS | MS | MS |
| Group | 1 | 0.54** | 4.12** | 7.40** | 10.44** | 17.05** | 12.21** | 16.21** | 999.1** | 148.8** |
| Parity | 2 | 0.11* | 0.02 | 0.04 | 0.07 | 0.15 | 0.09 | 0.05 | 14.6 | 0.8 |
| Season | 2 | 0.03 | 0.01 | 0.04 | 0.00 | 0.07 | 0.02 | 0.05 | 0.7 | 6.4 |
| Birth type | 2 | 0.04 | 0.27** | 0.26** | 0.79** | 0.75** | 1.45** | 0.98** | 68.6** | 9.8 |
| Sex | 1 | 0.58** | 0.96** | 1.35** | 1.54** | 1.24** | 2.75** | 3.01** | 54.6** | 38.1* |
| Error d.f. | | 200 | 176 | 165 | 158 | 158 | 151 | 147 | 158 | 147 |
| $R^2$ | | 0.364 | 0.580 | 0.699 | 0.710 | 0.602 | 0.758 | 0.746 | 0.653 | 0.457 |
| CV | | 17.33 | 9.36 | 6.57 | 6.14 | 7.61 | 4.97 | 4.78 | 7.66 | 7.40 |

*$p<0.05$, **$p<0.01$.

postulated that phenotypic selection of males and females for improving growth performance may be considered as a tool for increasing meat production. These results are supported the statement that the selection for meat production can be based solely on 6 months weight of kids, which is highly heritable (Mishra and Acharya, 1985; Prakash et al., 1987). Similar statement has been forwarded by Singh (1994) as genetic and phenotypic parameters suggested that body weight at 3 and 6 months of age could be used as a criteria for selection to improve weight performance of small ruminant. For improving meat production both in sheep and goats, selection on 6-month body weight alone among kid born as twins, to the extent possible, may be most feasible and bring reasonable genetic progress in meat production through improving reproduction, body weight gains and carcass yield (Acharya and Battacharyya, 1992).

As, there is a growing realization of the importance of indigenous genetic resources because of their adaptation to specific agro-ecological and socio-economical conditions, emphasis should be given for their conservation by selecting best animals for future mating. Further intensive works on this aspect with reasonable number of experimental animals need to be conducted for future planning and development.

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