



Influence of non-genetic factors on body weight in Black Bengal goats maintained under field condition



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Abstract:

Data recorded on 10,148 Black Bengal kids maintained at farmer's herds in different districts of West Bengal from 2008 to 2019 were used to study the effect of non-genetic factors on body weight from birth to 12 months of age. The data were analysed using least squares technique. The effect of year of kidding on body weight of Black Bengal kids at different ages was significant ($p < 0.05$). Influence of season and parity of the dam had significant effect ($p < 0.05$) on body weight of kids from birth to 6 months of age. Sex of the kid significantly influenced body weight from birth to 12 months of age. Effect of types of birth on body weight at different ages up to 12 months of age of Black Bengal kids were significant ($p < 0.05$). Significantly higher body weight at birth was recorded in single born kid, followed by twin, triplets and so on.

Key words: Black Bengal goat; non-genetic factors; body weight

The Black Bengal goat (*Capra hircus bengalensis*), is a dwarf breed seen throughout West Bengal and in its nearby states, like Jharkhand, Bihar, Assam, Orissa and certain parts of Tripura. This breed is famous for its adaptability, fertility, prolificacy, delicacy of meat and superior quality of skin (Islam, 2016).

The research work was conducted on 10,148 kids of Black Bengal breed born from 2008 to 2019 and maintained at farmer's herds under All India Coordinated Research Project (AICRP) on goat improvement. The effect of various non-genetic factors (agro-climatic zone, year, season of birth, sex of kid, parity of birth, type of birth) on growth performance was analysed by One way ANOVA using IBM SPSS software (v. 21.0) and the means were compared by Duncan's Multiple Range Test. The following mathematical model was used for identifying the effects of non-genetic factors on growth traits.

$$Y_{ijklmn} = \mu + A_i + B_j + C_k + D_l + E_m + e_{ijklmn}$$

Whereas, Y_{ijklmn} is the observation of n^{th} kid born in i^{th} cluster, j^{th} period, k^{th} season, l^{th} sex and m^{th} parity.

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μ is the overall mean,

A_i is the fixed effect of i^{th} cluster,

B_j is the fixed effect of j^{th} period,

C_k is the fixed effect of k^{th} season,

D_l is the fixed effect of l^{th} sex,

E_m is the fixed effect of m^{th} parity and

e_{ijklmn} is the residual random error with Y_{ijklmn} observation, assumed to be NID $(0, \sigma^2_e)$

The average body weight at birth of Black Bengal Goat was observed to be 1.326 ± 0.003 kg. The result was in close agreement with the reports of Malik *et al.* (1986) for birth weight of Black Bengal kids. The weight of Black Bengal Goat at six months of age (7.724 ± 0.021 kg) was found to be in close agreement with the report of Akhtar *et al.* (2006). The average body weight of Black Bengal Goat at 12 months age was found to be 13.226 ± 0.030 kg.

The highest birth weight of kid and body weight at three month of age was recorded in Jhargram cluster. At twelve months of age, the highest body weight was recorded in Murshidabad cluster. The kids born during the period 2008-09 to 2011-12 showed the lowest birth weight but maintained the highest body weight from 3 to 12 months of age. Malik *et al.* (1986) reported that the year of birth has a significant effect on the body weights at birth and 3 months of age.

Table 1. Cluster and period wise variation of body weight (Mean \pm SE) of Black Bengal Goats

Effect	Birth	3 months	6 months	9 months	12 months
Cluster					
Average	1.326\pm0.003 (10148)	5.200\pm0.016 (8626)	7.724\pm0.021 (7522)	10.441\pm0.024 (6010)	13.226\pm0.030 (4064)
Nadia	1.253 ^a \pm 0.002	4.927 ^a \pm 0.015	7.395 ^a \pm 0.020	10.115 ^a \pm 0.022	12.984 ^a \pm 0.028
Sundarban	1.155 ^b \pm 0.003	5.130 ^b \pm 0.019	8.072 ^b \pm 0.025	10.698 ^b \pm 0.027	13.532 ^b \pm 0.032
Murshidabad	1.287 ^c \pm 0.007	4.991 ^{ac} \pm 0.042	7.543 ^{ca} \pm 0.054	10.301 ^c \pm 0.060	13.627 ^{bc} \pm 0.074
Jhargram	1.608 ^d \pm 0.007	5.752 ^d \pm 0.041	7.886 ^d \pm 0.058	10.648 ^{bd} \pm 0.068	12.761 ^{ad} \pm 0.086
Period					
2008-09 to 2011-12	1.235 ^a \pm 0.004	5.214 ^a \pm 0.022	7.892 ^a \pm 0.029	10.540 ^a \pm 0.032	13.490 ^a \pm 0.039
2012-13 to 2015-16	1.245 ^{ab} \pm 0.003	4.965 ^b \pm 0.018	7.534 ^b \pm 0.023	10.253 ^b \pm 0.025	13.099 ^b \pm 0.031
2016-17 to 2018-19	1.273 ^c \pm 0.004	5.037 ^{bc} \pm 0.018	7.628 ^c \pm 0.025	10.338 ^{bc} \pm 0.028	13.183 ^{bc} \pm 0.036

Values in parenthesis are number of observations, means with different superscripts are significantly different at $P < 0.05$

The effect of season on body weights of Black Bengal kids was reported by Malik *et al.* (1986) in Black Bengal Goat in India. The summer born kids were heavier than monsoon and winter born kids except at 6 and 9 months of age. The male kids were found to be heavier than female kids at all the ages. Similar results were reported by Choudhary *et al.* (2012) in Black Bengal Goat. The differences in body weights of two sexes are due to sex hormones, the females have slower growth rate than males because of their early maturing constitution and reach a smaller mature size due to effect of oestrogen, which restrict the growth of long bones.

Higher birth weight was recorded in 4th parity. At six months of age, higher body weight was recorded at 3rd parity, whereas, at nine and twelve months of age there was no significant effect of parity of doe on body weight of kids. Higher body weight at birth and at three, nine and twelve months of age, was noticed in singles. Husain *et al.* (1997) also reported the importance of the type of birth on birth weight of Black Bengal kids.

Summary

Growth traits are affected by number of genetic and non-genetic factors. Among the

Table 2. Season and sex wise variation of body weight (Mean \pm SE) of Black Bengal Goat

Effect	Birth	3 months	6 months	9 months	12 months
Season of birth					
Summer	1.273 ^a \pm 0.004	5.143 ^a \pm 0.018	7.658 ^a \pm 0.024	10.340 \pm 0.028	13.262 \pm 0.035
Monsoon	1.245 ^b \pm 0.004	4.942 ^b \pm 0.023	7.538 ^b \pm 0.03	10.389 \pm 0.034	13.181 \pm 0.041
Winter	1.239 ^{bc} \pm 0.003	5.035 ^c \pm 0.018	7.727 ^{ac} \pm 0.02	10.347 \pm 0.025	13.227 \pm 0.031
Sex of kid					
Male	1.274 ^a \pm 0.003	5.127 ^a \pm 0.015	7.763 ^a \pm 0.020	10.459 ^a \pm 0.02	13.351 ^a \pm 0.029
Female	1.229 ^b \pm 0.003	4.975 ^b \pm 0.016	7.546 ^b \pm 0.02	10.244 ^b \pm 0.02	13.110 ^b \pm 0.028

Means with different superscripts are significantly different at $P < 0.05$

Table 3. Parity and birth type wise variation of body weight (Mean \pm SE) of Black

Effect	Birth	3 months	6 months	9 months	12 months
Parity of birth					
1 st	1.242 ^a \pm 0.005	5.117 ^a \pm 0.028	7.671 ^a \pm 0.037	10.402 \pm 0.040	13.281 \pm 0.049
2 nd	1.248 ^{ab} \pm 0.005	5.045 ^b \pm 0.025	7.676 ^{ab} \pm 0.033	10.351 \pm 0.036	13.236 \pm 0.044
3 rd	1.260 ^{bc} \pm 0.005	5.123 ^{ab} \pm 0.025	7.793 ^{ac} \pm 0.034	10.430 \pm 0.037	13.255 \pm 0.048
4 th	1.263 ^{bc} \pm 0.005	4.995 ^{abc} \pm 0.028	7.583 ^{abc} \pm 0.04	10.343 \pm 0.040	13.273 \pm 0.050
Type of birth					
Single	1.317 ^a \pm 0.005	5.291 ^a \pm 0.025	7.862 ^a \pm 0.033	10.557 ^a \pm 0.036	13.376 ^a \pm 0.04
Twin	1.249 ^b \pm 0.003	5.036 ^b \pm 0.014	7.862 ^a \pm 0.033	10.361 ^b \pm 0.021	13.232 ^b \pm 0.03
Triplet	1.210 ^c \pm 0.005	4.900 ^c \pm 0.025	7.425 ^c \pm 0.034	10.127 ^c \pm 0.038	13.048 ^c \pm 0.05

Means with different superscripts are significantly different at $P < 0.05$

non-genetic factors, the ones that are likely to influence the growth traits are season, year of birth, type of birth, sex of kid *etc.* The single born Black Bengal kids had a higher body weight in all ages. The seasonal variations had the least effect on body weight of goats after six months of age in their home tract.

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Conflict of interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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