



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2021; 9(1): 197-201

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Received: 13-11-2020

Accepted: 18-12-2020

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A study of effect of sex, season, type and parity of birth on absolute and relative body weight of Black Bengal goats at different ages under farm condition of management

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DOI: <https://doi.org/10.22271/j.ento.2021.v9.i1c.8146>

Abstract

Goats are an important contributor to the rural economy providing food and nutritional security along with self-employment opportunities to the small and marginal farmers. It being free from any religious taboos is the choicest meat in India with huge demand for chevon. Medicinal properties of goat milk is arousing the interest and the demand of goat meat a step further. Black Bengal goats are the dwarf goats found in northeastern India like West Bengal, Odisha, Jharkhand etc. which are a good source of meat, milk, and leather. The productivity of goats under the prevailing traditional production system is very low because they are maintained under the extensive system on natural vegetation on degraded common grazing lands and tree lopping. Therefore it is imperative and mandatory to rear goat under intensive and semi-intensive system using improved technologies for commercial production. Current study deals with the growth traits, absolute as well as relative, as recorded in Black Bengal goats under farm system of management. Absolute growth traits observed included body weight at birth, 1months, 2months, 3 months and 6months. Relative Growth traits included 1-3 months body weight gain and 3-6 months body weight gain. Significant effect of different factors i.e. sex, parity, type and season of birth was observed on various traits under study. It might be concluded that the intensive and semi-intensive system of management will help in realizing the full potential of Black Bengal goats and will also meet the increasing demand of chevon (goat meat) in the domestic as well as international markets.

Keywords: Weaning weight, reproductive traits, intensive system, semi intensive system, parity, selective breeding

Introduction

According to 19th livestock census, 2012, the total population of goats in India is 135.17 million numbers (<https://www.nabard.org>). Goat farming is extremely helpful in reducing unemployment and poverty by increasing meat or milk production and also in earning currency from foreign country. By virtue of their higher fecundity and greater productivity, goats assure income to rural population with low input cost in diverse agroclimatic condition. Black Bengal goats through its high prolificacy is the meat animal of choice in the Chhotanagpur region ^[10]. There are various factors which make the rearing of Black Bengal goats a preferred option among the marginal and small farmers (those having less than one hectare of land) and even the landless farmers who depends on common grazing and forest land for fodders. Few important amongst them are low capital investment, prolific breeding, superior chevon quality, low kidding intervals, good adaptability, no religious taboos against consumption, and steady returns ^[3]. Still, Black Bengal goats face some constraints in rearing and management such as low milk production and higher kid mortality ^[2]. One of the important reasons might be lack of adoption of scientific husbandry practices and proper training to the goat farmers regarding the same.

Therefore, the current experiment has been designed with the objectives to study the pattern of body weight gain of Black Bengal goats under farm conditions of management.

Materials and Methods

The study was conducted in the farm of Ranchi Veterinary College, Ranchi, India. The farm is located at 23.44 °N and 85.31 °E and altitude 625 meters above mean sea level. A total of 323 goats from RVC farm were selected for growth traits.

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The data for growth performance such as absolute body weight at birth, 1month, 2months, 3 months and 6 months of age were recorded. Relative growth rate at 0-3 month of age were recorded.

Seasons' description

In this study seasons were described as Mar- Jun (summer), July –Oct (monsoon) and Nov- Feb (winter).

Managemental procedure

Goats were housed in a concrete floor with asbestos roof during night time and were sent for grazing for 4-6 hours daily after 8:A.M. All goats were housed separately according to age and sex.

Management

Initially after birth of kids their naval cord was cut and

cleaned with weak solution of iodine. Male were castrated after 2 months of age from burdizoo castrator. Anticoccidial drugs were given from 2-3 months of age as preventive measures.

Feeding

Initially after 15-20 minutes of birth the kids were fed colostrums and later on they were allowed to suckle at 6-hours interval. They were separated from their mother after 7th day of birth. Kids were fed vitamin B complex (5ml/kid/day) for 10 days orally per month for 3 months of age. Creep mixture was provided from 15th day onwards. Adults goats were provided concentrate mixture @200-300gm/day/animal. Pregnant goats were provided concentrate mixture @ 400-500 gm/day/goat.

Results

Table 1: Analysis of variance showing effect of different factors on body weights of kids at different stages of growth under farm condition of management

Sources of variation	Body weights at					
	Birth		1 months		2 months	
	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.
Sex	1	0.004	1	0.037	1	0.104
Season of birth	2	0.005	2	0.190*	2	0.183*
Type of birth	1	0.180*	1	0.060	1	0.01
Parity of dam	3	0.088*	3	0.016	3	0.06
Error	315	0.032	310	0.057	305	0.06

* $P < 0.05$

Table 2: Analysis of variance showing effect of different factors on body weights of kids at different stages of growth under farm condition of management

Sources of variation	Body weights at			
	3 months		6 months	
	d.f.	M.S.	d.f.	M.S.
Sex	1	0.224*	1	3.79**
Season of birth	2	0.004	2	1.347*
Type of birth	1	0.018	1	0.019
Parity of dam	3	0.052	3	0.822
Error	302	0.040	293	0.316

** $P < 0.01$; * $P < 0.05$

Table 3: Body weight of kids at different stages of growth under farm condition of management

Factors	Body weight (kg) at		
	Birth	1-M	2-M
Overall Mean	1.48±0.01 (323)	2.57±0.01 (318)	3.85±0.01 (312)
Sex Male	1.48±0.02 (153)	2.56±0.02 (151)	3.88±0.02 (151)
Female	1.47±0.01 (170)	2.57±0.02 (167)	3.83±.02 (162)
Season Summer	1.48±0.018 (96)	2.52±0.03 ^a (94)	3.82±0.03 ^a (92)
Monsoon	1.48±0.02 (105)	2.58±0.02 ^{ab} (104)	3.83±0.02 ^b (103)
Winter	1.47±0.02 (122)	2.60±0.02 ^b (120)	3.90±0.02 ^b (118)
Type of Birth Single	1.50±0.02 ^a (139)	2.58±0.02 (137)	3.86±0.02 (137)
Multiple	1.45±0.01 ^b (184)	2.55±0.02 (181)	3.84±0.02 (176)
Parity of dam 1 st	1.45±0.02 ^a (83)	2.57±0.03 (81)	3.83±0.03 (78)
2 nd	1.45±0.02 ^{ab} (78)	2.56±0.03 (78)	3.83±0.03 (77)
3 rd	1.51±0.02 ^b (78)	2.59±0.03 (78)	3.84±0.03 (78)
4 th or above	1.51±0.02 ^b (84)	2.56±0.03 (81)	3.88±0.03(80)

[Values bearing same superscript in a column did not differ significantly for each effect separately; Figures in parentheses are number of observations.]

Table 4: Body weight of kids at different stages of growth under farm condition of management

Factors	Body weight (kg) at	
	3-M	6-M
Overall Mean	5.07±0.01 (310)	8.03±0.03 (301)
Sex		
Male	5.1±0.02 ^a (151)	8.15±0.05 ^a (147)
Female	5.03±0.02 ^b (159)	7.93±0.05 ^b (154)
Season		
Summer	5.07±0.02 (91)	7.93±0.07 (91)
Monsoon	5.07±0.02 (102)	8.16±0.07 (95)
Winter	5.06±0.02 (117)	8.03±0.07 (115)
Type of Birth		
Single	5.06±0.02 (136)	8.05±0.05 (132)
Multiple	5.07±0.02 (174)	8.03±0.05 (169)
Parity of dam		
1 st	5.03±0.02 ^a (75)	8.02±0.08 (70)
2 nd	5.07±0.02 ^{ab} (77)	7.92±0.08 (76)
3 rd	5.07±0.02 ^b (78)	8.04±0.08 (75)
4 th or above	5.09±0.02 ^b (80)	8.17±0.08 (80)

[Values bearing same superscript in a column for an effect separately didnot differ significantly, Figures in parentheses are number of observations.]

Table 5: Analysis of variance showing effect of different factors on relative growth rate during different stages of growth under farm condition of management

Sources of variation	Relative growth rate			
	0-3 months		3- 6 months	
	d.f.	M.S.	d.f.	M.S.
Sex	1	0.094	1	0.058
Season of birth	2	0.041	2	0.050*
Type of birth	1	1.310**	1	0.005
Parity of dam	3	0.374	3	0.025
Error	302	0.192	293	0.016

** $P < 0.01$; * $P < 0.05$

Table 6: Relative growth during different stages of growth under farm condition of management

Factors	Relative growth rate during	
	0-3 Months	3- 6 Months
Overall Mean	2.48±0.03 (310)	0.589±0.01 (301)
Sex		
Male	2.49±0.04 (151)	0.60±0.01 (147)
Female	2.46±0.04 (159)	0.58±0.01 (154)
Season		
Summer	2.45±0.05 (91)	0.57±0.02 ^a (91)
Monsoon	2.48±0.04 (102)	0.61±0.02 ^b (95)
Winter	2.49±0.04 (117)	0.59±0.01 ^b (115)
Type of Birth		
Single	2.41±0.04 ^a (136)	0.59±0.01 (132)
Multiple	2.54±0.03 ^b (174)	0.59±0.01 (169)
Parity of dam		
1 st	2.53±0.05 (75)	0.59±0.02 (70)
2 nd	2.54±0.05 (77)	0.57±0.01 (76)
3 rd	2.42±0.05 (78)	0.59±0.02 (75)
4 th or above	2.42±0.05 (80)	0.60±.01 (80)

[Values bearing same superscript in a column did not differ significantly for each effect separately. Figures in parentheses are number of observations]

Results pertaining to growth in terms of body weight up to 6 months of age, under semi intensive (farm condition) have been presented under the following subheads:-

Growth

Growth of kids was measured by increase in body weight at birth, 1month, 2months, 3months and 6 months of age under farm conditions of management.

Absolute body weight

The variations in body weight due to season of birth, sex of kid, type of birth, parity of dam, were assessed. The overall body weight at birth, 1month, 2months, 3months and 6 months of age were 1.48± 0.01, 2.57±0.01, 3.85 ±0.01, 5.07 ±0.01 and 8.03±0.03 kg respectively (Tables 3-4).

Sex of kid

Sex of kid had significant effect ($P < 0.05$) on body weight at 3months and 6 months of age (Table 2 and 4) with male being heavier than female except at 1 month of age. There was non-significant effect of sex on body weight at birth, 1month and 2months of age (Table 1and 3). The average value of body weight at birth, 1 month, 2 months, 3months and 6 months were recorded for male as 1.48 ± 0.02, 2.56±0.02, 3.88±0.02, 5.10±0.02 and 8.15 ±0.06kg respectively (Tables 1-4). Corresponding values for female were found to be 1.47 ± 0.01, 2.57± 0.02, 3.83± 0.02, 5.03 ± 0.02 and 7.93 ±0.06 kg respectively (Tables 1-4).

The effect of sex of kids on birth weight was not significant ($P \geq 0.05$) indicating similar pre-natal growth or both sexes. However, males weighed heavier than females. This might be due to production of testosterone hormone is prenatal life by the age of 45 days resulting in increased anabolic process in body. Non-significant effect of sex on birth weight of Black Bengal kids was reported [8, 12, 14], but significant effect of sex on birth weight of kids was also reported by several scientist [1, 15, 17]. Male kids weighed significantly heavier than the females at 3 and 6 months of age (Table 3 & 4). At other ages also, males weighed heavier than females although the difference was not significant [16, 18]. Differences in sex chromosomes, probably in the position of genes related to growth, physiological characteristics, difference in individual system and measure of hormone secretion especially sex hormone lead to difference in animal growth. In relation to endocrinal system, estrogen hormone has effect (although limited) on the growth of long bones in females. That could be one of the reason in which females have smaller body and lighter weight against males [4].

Season of birth

Season of birth had significant influence on weight at 1-month, 2-months and 6-months of age (Table 1 and 2).

Monsoon born kids were heavier than winter and summer born kids at all stages of growth except at 1-month and 2-months of age (Tables 3 & 4). The average value of body weight of summer born kids at birth, 1-month, 2-months, 3-months and 6-months were recorded to be 1.48 ± 0.018 , 2.52 ± 0.03 , 3.82 ± 0.03 , 5.07 ± 0.02 and 7.93 ± 0.07 kg respectively (Tables 3 and 4). The average value of body weight of monsoon born kids at birth, 1 month, 2 months, 3 months and 6 months were recorded to be 1.48 ± 0.018 , 2.58 ± 0.03 , 3.83 ± 0.02 , 5.07 ± 0.02 and 8.16 ± 0.07 kg respectively (Tables 3 and 4). The average value body weight of winter born kids at birth, 1 month, 2 months, 3 months and 6 months were recorded to be 1.47 ± 0.018 , 2.60 ± 0.03 , 3.90 ± 0.03 , 5.06 ± 0.02 and 8.03 ± 0.07 kg respectively (Tables 3 and 4). The influence of season of birth on birth weight of kids was not significant [5, 6]. However many scientists did not agree with the present findings [12, 15] and they reported significant effect of season of birth on birth weight of kids. Under farm condition, the variation in body weights at 1st, 2nd and 6th month of age due to season of birth was found to be significant (Tables 1-4). Winter born kids weighed heavier than those born during summer and monsoon. Difference in results with respect to seasonal effect on birth weight of kids might be due to agro climatic variations, availability of greens and nutrients to dams particularly during advance stage of pregnancy.

Type of birth

Type of birth had significant effect on birth weight ($P < 0.05$) (Tables 1 & 3). The average value for single born kids were found to be 1.50 ± 0.02 , 2.58 ± 0.02 , 3.86 ± 0.02 , 5.06 ± 0.02 and 8.09 ± 0.06 kg at birth, 1 month, 2 months, 3 months and 6 months respectively (Tables 3 & 4). Corresponding values for multiple born kids were observed to be 1.45 ± 0.01 , 2.55 ± 0.02 , 3.84 ± 0.02 , 5.07 ± 0.02 and 8.03 ± 0.05 respectively (Tables 3 & 4).

The effect of type of birth on birth weight of kids was significant ($P < 0.05$) and single born kids weighed heavier followed by multiples [12, 15]. Negative linear association between birth weight and litter size might be possibly due to the fact that the uterine space and available nutrition would be shared by more than one or more kids in twins and triplets during pre-natal life leading to lower birth weight of kids and subsequently a negative relationship between birth weight and litter size was observed and another factor might be the average proportion of birth weight of kids to the body weight of their dams.

Variation in body weight due to type of birth was found to be non-significant ($P > 0.05$) at 1 month, 2 months, 3 month and 6 months of age and it was noticed that singlet weighed heavier than multiple born kids at all ages. This might be due to the fact that single born kids do not have to compete for space or nutrients in their mother's uterus [7]. Twins receive less milk than singles [4]. Therefore, singles born kids might be heavier than twins

Parity of Dam

Parity of dam had significant effect ($P \leq 0.05$) on weight at birth (Table 1 and 3). There was an increase in body weight with increase in parity. The average value of body weight at birth, 1 month, 2 months, 3 months and 6 months during 1st parity were found to be 1.45 ± 0.02 , 2.57 ± 0.03 , 3.83 ± 0.03 , 5.03 ± 0.02 and 8.02 ± 0.08 kg respectively (Tables 3 and 4). The average value of body weight at birth, 1 month, 2 months, 3

months and 6 months during 2nd parity were found to be 1.45 ± 0.02 , 2.56 ± 0.03 , 3.83 ± 0.03 , 5.03 ± 0.02 and 8.02 ± 0.08 kg respectively (Tables 3 and 4). The average value of body weight at birth, 1 month, 2 months, 3 months and 6 months during 3rd parity were found to be 1.51 ± 0.02 , 2.59 ± 0.03 , 3.84 ± 0.03 , 5.07 ± 0.02 and 8.04 ± 0.08 kg respectively (Table 3 and 4). The average value of body weight at birth, 1 month, 2 months, 3 months and 6 months during 4th or above parity were found to be 1.51 ± 0.02 , 2.56 ± 0.03 , 3.88 ± 0.03 , 5.09 ± 0.02 and 8.17 ± 0.08 kg respectively (Tables 3 and 4). Variation in birth weight due to parity was significant. Tables revealed that the birth weight of Black Bengal kids increased with the increase in parity of their dams up to 4th parity and it is clearly evident that the birth weight of kids of 1st parity was lower than those of higher parity groups. This fact is probably due to development of the physiological processes with increase in parity of the dam. Several scientists [5, 6, 12] reported significant effect of parity of dams on birth weights of kids which are in agreement with the present findings.

Relative Growth rate

Relative growth rates of body weight were estimated during 0-3 and 3-6 months of age. Analysis of variance for factors affecting relative growth rate in body weights of goats during different stages of growth have been presented in Table 5. The mean relative growth rate for body weight of Black Bengal goat during 0-3 months, 3-6 months of age was observed to be 2.48 ± 0.03 kg and 0.589 ± 0.01 kg (per kg of initial body weights) respectively (Table 6).

Sex

Effect of sex on relative increase in body weight during 0-3 months of age and 3-6 months of age was not significant (Table 5) however for males, the value was more than that for females. The average value of body weight for males during 0-3 months and 3-6 months was 2.49 ± 0.04 kg and 0.60 ± 0.01 kg respectively (Table 6). Corresponding values for females were found to be 2.46 ± 0.04 kg and 0.58 ± 0.01 kg respectively (Table 6). However few scientist [10] found significant effect of sex on relative growth rate. The difference in findings could be due to sampling fluctuations.

Season of birth

Effect of season of birth was found to be non-significant on relative growth rate during 0-3 months but was found to be significant at 3-6 month of age at 95% confidence interval (Table 5). The average value of body weight for kids born in summer season during 0-3 months and 3-6 months of age were 2.45 ± 0.05 kg and 0.57 ± 0.02 kg respectively (Table 6). Corresponding values for kids born during monsoon season were found to be 2.48 ± 0.04 kg and 0.61 ± 0.02 kg respectively (Table 6). Kids born during winter season had the average body weight of 2.49 ± 0.04 kg and 0.59 ± 0.01 kg during 0-3 and 3-6 months respectively (Table 6).

Type of birth

The average relative growth during 0-3 months of age for single and multiple born kids were 2.41 ± 0.04 and 2.54 ± 0.03 kg respectively (Table 6). Corresponding values during 3-6 months of age for the single and multiple born kids were 0.59 ± 0.01 kg respectively (Table 6). Type of birth had significant effect ($P < 0.01$) during 0-3 months whereas during 3-6 month of age it was found to be non-significant. Multiple born kids had higher relative growth rate than single born kids

during 0-3 months of age. Higher relative growth rate for twins as compared to single born kids have been reported in literatures [9].

Parity of dam

Effect of Parity was non-significant during both 0-3 and 3-6 months of age for relative growth in body weight (Table 5). The mean relative growth in bodyweight during 0-3 months of age for kids born of 1st, 2nd, 3rd and 4th or above parity dam were 2.53±0.05, 2.54±0.05, 2.42±0.05 and 2.42±0.05kg respectively (Table 6). Corresponding values for 3-6 months of age were 0.59±0.02kg, 0.57±0.01kg, 0.59±0.02, 0.60±0.01 kg respectively (Table 6).

Conclusions

Body weight of Kids at birth was significantly affected by parity and all other body weights at all other ages showed a non-significant increase with parity so the selection or culling should be done only after keeping it for higher parity. Males had higher body weight than females so for meat purpose, selective breeding for more number of male kids could be done. Research delving into sexing of spermatozoa for Goats in general and Black Bengal Goats in particular can have far-reaching scope. The higher body weight of summer born kids (although non-significant) showed that the stress arising from summer could be mitigated with proper managerial practices.

Acknowledgement

The author is obliged to Ranchi Veterinary College and Birsa Agricultural University for providing all the facility and financial grant during my PG research work. The author also takes it as an opportunity to thank its major advisor Dr. A.K. Shrivastava, ex- Dean RVC for being extremely supportive at every stage. The author is also grateful to all the members of its advisory committee in supporting the research work and thesis submission as well as PG degree. The author finally thanks all the concerned, all the co- authors, all the teachers involved directly and indirectly in the research as well as in paper writing including current Dean RVC Dr. Sushil Prasad and ex Dean Dr. A.K. Shrivastava.

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