

**GROWTH PERFORMANCE OF BLACK BENGAL
GOAT AT GAIBANDHA DISTRICT IN
BANGLADESH**

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**GROWTH PERFORMANCE OF BLACK BENGAL GOAT
AT GAIBANDHA DISTRICT IN BANGLADESH**

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CERTIFICATE

This is to certify that thesis entitled, "GROWTH PERFORMANCE OF BLACK BENGAL GOAT AT GAIBANDHA DISTRICT IN BANGLADESH" submitted to the Faculty of Animal Science & Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE (MS) in ANIMAL SCIENCE, embodies the result of a piece of bona fide research work carried out by MD. MORSHEDUL ALAM Registration No. 12-04811 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation, has duly been acknowledged.

Dated:
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DEDICATED TO

My Beloved Parents

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The Author

GROWTH PERFORMANCE OF BLACK BENGAL GOAT AT GAIBANDHA DISTRICT IN BANGLADESH

ABSTRACT

Goat rearing in Bangladesh is increasingly becoming popular and has become an integral part of many farming systems in Bangladesh. It is estimated that more than 90% of goat population in Bangladesh comprised the Black Bengal goats (*Capra hircus*). The Black Bengal goat's meat is tastier and faces huge domestic demands with no social, cultural and religious restrictions. The growth performance of Black Bengal kids was studied in different locations at Gaibandha district in Bangladesh. The highest coefficient of variation (CV) was for body weight at 3 month of age (28.13%) and the lowest CV% was for 9-month body weight (18.30%). Higher body weights of males compared to females at all the ages might be due to aggressive behavior of males during feeding and suckling and male sex hormone which has an anabolic effect. The heavier body weight of male than female kids may also be due to differences in their endocrine profile. Litter size, sex, parity & season affected body weights in different periods where single, male kids, third parity & winter season had significantly higher weights for all period's respectively. Average daily gains had the same trend as body weights of kids in different periods and lowest in triplet, female kids, first parity & winter season respectively. The uterine space and available nutrient shared by more than one kid may be responsible for the reduced birth weight with increasing litter size. Birth weight increased with the progress of parity of dam. Mothering ability especially milk production, increases with parity. The lower body weights of rainy season born kids emphasized the need to provide supplementary feed and adequate management for these kids. From the results it is revealed that growth performance of Black Bengal kids varied in different regions, which might be caused by inappropriate management and poor feed accessibility round the year and stressful environmental conditions.

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LIST OF SYMBOLS AND ABBREVIATIONS

%	= Percentage
>	= Greater than
<	= Less than
±	= Plus minus
AI	= Artificial insemination
BAU	= Bangladesh Agricultural University
BBG	= Black Bengal Goat
BLRI	= Bangladesh Livestock Research Institute
BW	= Birth weight
CIRG	= Central Institute for Research on Goats
CHG	= Central Highland Goats
CV	= Coefficient of variation.
DLS	= Department of Livestock Services
<i>et al.</i>	= And others
FAO	= Food and Agricultural Organization
GDP	= Gross Domestic Product
gm	= Gram
GLM	= General linear model
MW	= Month Weight
NBF	= Nucleus Breeding Flock
Ibs	= Pound
kg	= Kilogram
LSD	= Least Squares Means
MFTSP	= Microfinance and Technical Support Project
mL	= Milliliter
n	= Number of observation
NS	= Non-significant
SAS	= Statistical Analysis
SAU	= Sher-e- Bangla Agricultural University

SAURES	= Sher-e Bangla Agricultural University Research System
SE	= Standard Error
WADG	= West African Dwarf goat
WW	= Weaning Weight
YW	= Yearling weight
BBS	= Bangladesh Bureau of Statistics
e.g.	= For example
etc.	= Etcetra
Hrs.	= Hours
i.e,	= That is
IU	= International Unit
J.	= Journal

CHAPTER I

INTRODUCTION

Goat is a very important and promising animal in Asia especially in the developing countries. In Asia goat population constitutes nearly 63.6% of the total livestock population (Bhuiyan, 2016). Goats are the integral part of Bangladesh's symbiotic system of crop and livestock production and make up a significant part of livestock wealth of country. Bangladesh has only one goat breed of its own, known as the Black Bengal goat. Goat rearing in Bangladesh is increasingly becoming popular, and has become an integral part of many farming systems in Bangladesh. As 25% of the local livestock are now goats. Total goat population in Bangladesh is 26.1 million & contribution of Livestock in Gross Domestic Product (GDP) is 1.54% (BBS, 2017) where Goat and Cattle contribution are 0.102 and 0.094 respectively. It is estimated that more than 90% of goat population in Bangladesh comprised the Black Bengal goats (*Capra hircus*), the remainder being Jamnapari and their crosses (Husain *et al.*, 2002).

The Black Bengal goats are dwarf goats and known to be famous for its adaptability, fertility fecundity, delicacy of meat superior skin quality (Devendra and Burns, 1983). Goats are preferred livestock for rearing especially in small holding farming system due to its unique ability to adapt and maintain them in harsh environment. They are among main meat producing animal's in Bangladesh and goat's meat faces huge domestic demands with no social, cultural and religious restrictions. They give more production per unit of investment, small sized, have earlier slaughter age and well established market. Black Bengal goat is a small animal and for this food demand of this animal is relatively low. It requires less space for living than other livestock. Diseases are relatively less than other domestic animal. It is very much popular for its productive and reproductive performances. The breed is suitable for meat, milk and skin production. The milk and meat of this goat is very tasty and nutritious than any other goat breed.

The goat milk prevents tuberculosis and asthma. For this reason it has a great demand to the Bangladeshi people.

Raising Black Bengal goat can be considered as an additional source of income for the landless farmer. The necessary capital and investment for starting goat farming business with this breed is very low and it is within the ability of general people. In Bangladesh goat farming is very common and most of them are in small scale. It plays an important role in reducing unemployment and poverty. The importance of goat is strongly emphasized for their versatile production profile and valuable contribution like meat, milk, industrial raw product such as skin, fiber and manure. Its native tract is Sunderban area of Bangladesh where typical animals having unique characteristics of Black Bengal goats are available. A large number of factors 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. These factors include low capital investment, prolific breeding, superior chevon quality, low kidding intervals, good adaptability, no religious taboos against consumption and steady returns. Despite these, Black Bengal goats face some constraints in rearing and management such as low milk production and higher kid mortality (Devendra, 2001). These might have resulted due to differences in prevailing production systems, management, feeding and overall environmental conditions. Goat meat has a high market share but its milk has only a small market share and has been consumed more as a medicine than as a food.

Improving growth performance is an important way of increasing meat output. The growth potential of the kids is one of the most important traits in a genetic improvement scheme. Birth weight and weaning weight are important when considering growth potential and muscle development in meat goats. The profitability of goat production for meat largely depends on kid weight as the growth performance of kid determines the meat producing ability at a marketable age. One way to achieve heavy market weight is to enhance growth performance of the kids by improving their growth potential and survival rate.

The present study attempts to investigate on the farming system of Gaibandha district. Therefore, the objectives of this study were to

- 1) Examine the effects of different body weights at different ages of Black Bengal goats.
- 2) Estimate variance components for body weights at different ages of Black Bengal goats.
- 3) Study the effect of sex of kid, parity of dam, litter size and season of birth of Black Bengal goats on important economic traits.

CHAPTER II

REVIEW OF LITERATURE

Work done in Bangladesh and abroad have been presented under following subheads viz. Growth performance and survivability rates which have a direct and indirect importance on the objectives of the present study.

2.1 Growth pattern in different ages of Black Bengal goat

2.1.1 Effect of birth ages

Ali *et al.* (1973) studied the reproductive performance of Black Bengal goats under farm condition in Bangladesh and found the average birth weight was 1.60 lbs.

Majumder (1976) observed the average birth weight of Pashmina goat to be 2.34 and 2.35 kg for male and female kid respectively.

Mishra (1976) observed the birth weight of Alpine, Beetal and Alpine x Beetal goats were 3.17, 2.82 and 3.09 kg respectively.

Some genetic parameters and production traits of Malabari goat and their crosses with Saanen and Alpine were studied by Mukundan and Bhat (1983). They reported that the average birth weight was 1.8, 2.8 and 1.9 kg for single and 1.7, 2.2 and 1.98 kg for twin respectively.

Ali (1980) while studying the relation of birth weight of kids to their postnatal growth in Black Bengal goat found that birth weight of male and female kids averaged 1.8 and 1.75 lbs respectively.

Mukundan *et al.* (1981) observed that birth weight of Malabari and Saanen x Malabari kids was 1.71 and 1.88 kg respectively. They also reported that the birth weight increased significantly with increasing body weight of dam. There were significant interactions of genetic group with sex and birth type.

Acharya (1982) studied the reproductive performance of Black Bengal goats in eastern India and found that the average birth weight was 1.31 ± 0.01 kg.

Adult body weight is an important and economic factor which influences the growth and production pattern of any goat enterprise and has more influence mainly on the growth behavior of kids (McGregor, 1984).

Banerjee (2004) observed that the birth weight of Black Bengal goat and Black Bengal goat Crossbred goats were 1.5 kg and 2.0 kg respectively under traditional farming condition of subcontinent.

Kumar (2009) reported the average birth weight of Black Bengal and Jamnapari x Black Bengal goat were 1.21 ± 0.07 and 1.32 ± 0.04 kg respectively.

Patnaik and Nayak (1988) reported that the average birth weight of Black Bengal goats was 1.52 ± 0.06 kg.

Kanujia and Pander (1988) reported the average birth weight of Black Bengal, Beetal x Black Bengal and Black Bengal x Beetal to be 1.13 ± 0.03 , 1.42 ± 0.03 and 2.26 ± 0.04 kg respectively.

Singh *et al.* (1990) reported the average birth weight of Black Bengal, Jamnapari half breds and Beetal half breds reported that 1.30 ± 0.12 , 2.07 ± 0.09 and 2.20 ± 0.08 kg respectively in village condition in Bihar.

Singh *et al.* (1991) reported the average birth weight of Black Bengal, Jamnapari half \pm Beetal half and Beetal half \pm Black Bengal half breds were 1.24 ± 0.02 , 1.75 ± 0.02 and 1.93 ± 0.04 kg respectively in Bihar.

Acharya (1992) reported the average birth weight of Black, brown and white coloured Bengal goats to be 0.99, 1.09 and 1.12 kg respectively.

Husain *et al.* (2002) reported the average birth weight of Black Bengal goats to be 0.99 ± 0.05 kg in Bangladesh.

Mia *et al.* (1993) found out that the average birth weight of Black Bengal goats was 1.35 ± 0.03 kg.

Singh and Singh (1998a) reported the average birth weight of Jamnapari x Black Bengal goats to be 1.827 ± 0.024 kg in Bihar.

Singh and Singh (1998b) observed that the average birth weight of Black Bengal and Beetal x Black Bengal goats were 1.459 ± 0.274 and 1.804 ± 0.256 kg in Bihar respectively.

Singh (1999) reported that the average birth weight of Black Bengal, Jamnapari x Black Bengal and Beetal x Black Bengal goats were 1.24 ± 0.02 , 1.75 ± 0.02 and 1.93 ± 0.04 kg respectively in Bihar.

Ghosh and Das (1999) studied birth weight of kids born to Black Bengal goat at Tripura and reported that the mean birth weight of single's kid (1.132 ± 0.013 kg) was more than that of individuals of twin (1.101 ± 0.008 kg) and triplet (1.077 ± 0.05 kg) kidding. They also reported the birth weight of male kid (1.164 ± 0.004 kg) was more than female kid (1.064 ± 0.008 kg). They concluded that the birth weight of single and individuals of twin kidding was not significant. However, a highly significant difference ($p < 0.01$) was observed between the birth weight of male and female kids irrespective of type of kidding.

Das and Roy (1999) recorded the birth weight of single's and twin born Black Bengal kids were 1.709 kg and 1.173 kg and the same for male and female kids it were 1.512 kg and 1.370 kg respectively.

Singh and Singh (1997) reported the average birth weight of Black Bengal goats was 1.352 ± 0.029 kg in Bihar.

Misra and Sinha (2001) studied the birth weight of Black Bengal goats and reported the same to be 1.40 ± 0.63 , 1.19 ± 0.70 and 1.15 ± 0.18 kg for single's, twin and triplet.

Kumar (2004) studied in 25 Black Bengal goats and found the average birth weight of male kid during first, second and third parity were 1.05 ± 0.04 , 1.22 ± 0.03 and 1.15 ± 0.03 kg respectively. While average birth weight of female kid during first, second and third parity were 1.02 ± 0.04 , 1.05 ± 0.03 and 1.11 ± 0.03 kg respectively.

Banerjee (2004) observed that the birth weight of Black Bengal goat and Black Bengal goat Crossbred goats were 1.5 kg and 2.0 kg respectively under traditional farming condition of subcontinent.

Kumar *et al.* (2005) studied at the data containing 236 the Tellicherry kids (123 male and 113 female) born in four seasons i.e. 1- Southwest monsoon (June to September), 2- Northeast Monsoon (October to December), 3- Winter (January to February) and 4- Summer (March to May) maintained at Mecheri Sheep Research Station, Pottaneri, Tamilnadu from 1991- 2001. In the experiment they observed that the least square mean in birth weight, 3-month and 6 month were 2.274 ± 0.08 , 9.303 ± 0.19 , 13.137 ± 0.022 kg respectively.

Akhtar *et al.* (2006) reported that the mean birth weight of Black Bengal goats in three generations of selected and control groups were 0.96 ± 0.04 , 1.02 ± 0.08 , 1.12 ± 0.11 and 0.82 ± 0.01 , 0.91 ± 0.02 , 1.05 ± 0.03 kg respectively.

Baiden (2007) reported that the 441 West African Dwarf goat (WADG) kids born from September 1999 to August 2002 at three locations in the Dangme West District of the Greater Accra Region in Ghana to determine the effect of environmental factors on birth weight, birth type and pre weaning survivability. Results of the experiment overall mean birth weight for kids was 1.32 ± 0.01 kg. Kids born at Baabi were significantly ($p < 0.05$) heavier than those born at Minya but closer ($p > 0.05$) in weight to those born at Sota.

Hassan *et al.* (2007) in a comparative study on reproductive performance and productivity of Black Bengal and crossbred goats at Bangladesh, and found the birth weight in Black Bengal and crossbred goats were $1.60 \pm .50$ and $1.90 \pm .75$ kg respectively.

Rahman *et al.* (2007) conducted at the Artificial Insemination Center, Bangladesh Agricultural University, Mymensingh to record the Black Bengal bucks morphology and to relate body weight with different body measurements. A total of 22 Black Bengal bucks of different ages were taken and were divided into six age groups (0, 3, 6, 9, 12 and 15 months). The body weight of Black Bengal bucks at 0,

3, 6, 9, 12 and 15 months of age were 1.21 ± 0.12 , 4.26 ± 0.25 , 7.68 ± 0.31 , 12.76 ± 0.42 , 16.56 ± 0.57 and 21.82 ± 0.70 kg respectively.

Rashidi *et al.* (2008) observed that in the genetic parameters for economic traits in Markhoz goats. Data collected from 1993 to 2006 by the Markhoz goat Performance Testing Station in Sanandaj, Iran, were analyzed. The traits recorded as body weight performance at birth (BW), weaning (WW), six month (6MW), nine month (9MW), yearling (YW) and yearling fleece weight (YFW) were investigated. Flocks were housed in semi-intensive conditions with dry summer and cold winter. The result of the experiment revealed that the highest coefficient of variation (CV) was observed for body weight at 6 month of age (24.57%) and the lowest CV was for birth weight (17.05%).

Dadi *et al.* (2008) found that at the effects of non-genetic factors on post weaning growth and reproductive performances of Arsi-Bale goats maintained at Adami Tulu Agricultural Research Center in the mid Rift Valley of Ethiopia from (1999-2003). The results of the experiment revealed that the year of birth had a significant effect ($P < 0.05$ and $P < 0.001$) on all traits studied except for 18MW. Live weights tended to increase from 1999 to 2001 and decreased thereafter.

Yadav and Khada (2009) studied the performances of goats (nondescript) in four villages of tribal regions of Dungarpur district in Rajasthan and found that the average birth weight of male and female was 2.10 ± 0.03 and 1.90 ± 0.01 kg respectively.

Kumar (2009) reported the average birth weight of Black Bengal and Jamnapari x Black Bengal goat were 1.21 ± 0.07 and 1.32 ± 0.04 kg respectively.

Ahuya *et al.* (2009) stated that the smallholder farmers participating in the Food and Agricultural Research Management in Africa (FARM-Africa) goat improvement project in the Meru Central and South districts, which are located 250km to the East of Nairobi on the slopes of Mt. Kenya. The goats were reared under zero-grazing system. In that study they reported that the highest coefficient

of variation (CV) was observed for body weight at the age of weaning weight (23.69%) and the lowest CV was for birth weight (21%).

Banerjee and Jana (2010) studied at a flock of Sirohi (45 does) goats that were/ are reared at the Government Livestock farm from 2003 to 2007 to study the factors affecting birth weight of Sirohi Goat kids reared in hot and humid climate of West Bengal. In that study they indicated that the single born kids were heavier than the twin and the triplet. The difference in body weights for different types of births may be due to that littermates had to share the prenatal maternal nourishment in contrast to the single born kids.

Thiruvankadan *et al.* (2009) reported at the body weight of 566 the Tellicherry goats, maintained at Mecheri Sheep Research Station Pottaneri, Tamil Nadu, India were collected over a period of 20 years (1988 - 2007). The body weights at different ages (i.e. at birth and at three, six, nine and 12 months) were recorded. The results of the experiment revealed that the highest body weight 2.24 kg in the period of (2000-2003) and the lowest body weight 2.07 kg in the period of (2004-2007).

Faruque *et al.* (2010) found at the “Improvement of Black Bengal goat through selective breeding” project and then continuation project “Improvement of Black Bengal goat through selective breeding, improved feeding and management practices” project conducted at Bangladesh Livestock Research Institute, Saver and Dhaka. Ninety elite pre-pubertal Black Bengal does and 15 bucks (both foundation stocks) were collected from different parts of Bangladesh. Goats were reared under intensive and semi-intensive management to compare performance. In the study they observed that the birth weight was highest ($P < 0.10$) in intensive rearing system (1.49 ± 0.13 kg) and lowest (1.28 ± 0.11 kg) in semi-intensive rearing system.

Halim *et al.* (2011) reported the average birth weight to be 0.93 ± 0.026 kg in Black Bengal kids.

Hasan *et al.* (2015) found that average birth weight of kids was 1.28 ± 0.11 kg and 1.25 ± 0.10 kg under semi intensive and extensive system of management respectively.

Paul *et al.* (2014) conducted at the productive and reproductive parameters of Black Bengal goat in a nucleus breeding flock of Bangladesh Agricultural University, and two other regions i.e., Modhupur (Tangail) and Dimla, (Nilphamari). Data were collected on a regular basis from January 2011 to January 2012. In that study they reported that the average birth weight of kid in NBF, Modhupur and Dimla were 1.09 ± 0.27 , 1.09 ± 0.25 , and 1.10 ± 0.27 kg, respectively.

Bhowmik *et al.* (2014) has reported that the average birth weight of Jamunapari, Black Bengal and cross bred goats were 1.53 ± 0.22 kg, 0.89 ± 0.09 and 1.26 ± 0.20 kg respectively.

2.1.2 Effect of ages at 3 months

Patnaik and Nayak (1988) reported the average body weight of Black Bengal goats at three-month age to be 5.85 ± 0.43 kg.

Kanujia and Pander (1988) reported that the average body weight at three month of Black Bengal, Beetal x Black Bengal and Black Bengal x Beetal was 5.41 ± 0.06 , 6.38 ± 0.13 and 8.62 ± 0.23 kg respectively.

Singh *et al.* (1991) observed that the body weight at three month of age was 5.65 ± 0.10 , 7.16 ± 0.07 and 7.83 ± 0.19 kg respectively for Black Bengal, $1/2$ Jamnapari $\pm 1/2$ Black Bengal and $1/2$ Beetal $\pm 1/2$ Black Bengal respectively.

Acharya (1992) reported the three month body weight of Black, brown and white coloured Bengal goats was 5.19, 5.64 and 6.11 kg respectively.

Singh (1997) found that the 3-month body weight of Black Bengal, Jamnapari x Black Bengal and Beetal x Black Bengal goats was 5.65 ± 0.10 , 7.16 ± 0.07 and 7.83 ± 0.19 kg respectively.

Singh and Singh (1998a) found that the average body weight at three month of Jamnapari x Black Bengal goats was 7.542 ± 0.552 kg.

Singh and Singh (1998b) recorded the 3-month body weight of Black Bengal, Beetal x Black Bengal goats was 5.670 ± 0.477 and 5.790 ± 0.477 kg respectively.

Singh and Singh (1997) recorded that the body weight of Black Bengal goats at 3 months of age was 5.663 ± 0.120 kg.

Misra and Sinha (2001) reported the body weight of Black Bengal goats was 7.01 ± 0.90 kg at 3-month of age.

Akhtar *et al.* (2006) reported that the mean body weight of Black Bengal at 3 months age were 4.99 ± 0.15 , 4.64 ± 0.33 , 4.07 ± 0.42 and 4.38 ± 0.13 , 4.39 ± 0.27 , 3.99 ± 0.47 kg respectively for three generations of selected and control groups.

Boujenane and Hazzab (2008) studied that there were raised in a station at Ouarzazate region (South-East of Morocco). Data were collected between 1988 and 2005 from a total of 1498 kids (735 males and 763 females), the progeny of 46 sires and 404 dams. All kids were weighed at birth, every 3 weeks up to weaning, then every month until 6 months of age. The result of the experiment observed that the highest coefficient of variation (CV) was observed for body weight at 6 month of age (22.4%) and the lowest CV was (17.05%) at 3 month.

Yadav and Khada (2009) reported the average body weight of male and female at three months were 12.42 ± 0.02 and 11.20 ± 0.01 kg respectively for non-descript goats of four villages of Dungarpur district in Rajasthan.

Halim *et al.* (2011) investigated at the reproductive and productive performances of Black Bengal goats reared by moderate and ultra-poor households at three different districts of Bangladesh during March, 2008 to June 2009. In the first stage, 3 districts were selected purposively from MFTSP areas under PKSF. Subsequently two villages were selected from an Upazila under each district. The selected villages were Domrakandi and Betbaria under Faridpur Sadar Upazilla; Gutia Dakkhin Para and Madhya Para under Uzirpur Upazila of Barishal and Uttar

Chowtul and Sayedpara of Habiganj sadar upazila. The result of the experiment revealed that the average weaning weight for herds of all sizes was found to be 4.82 ± 0.525 kg, the difference was statistically significant among groups ($P < 0.05$). The weaning weights of kids at 3 months of age observed in herd size-1, 2 and 3 were 5.20, 4.92 and 4.33 kg, respectively. In this study, it was found that the weaning weight was higher in herd size-1 and herd size-2 than herd size-3. The weaning weight of Black Bengal goats was 6.56 kg for intensive and semi-intensive condition.

Islam *et al.* (2016) reported body weight of female Black Bengal goats to be 4.67 ± 0.15 kg under extensive system of management.

Routa *et al.* (2018) investigated that the Jamunapari goats were introduced to the study area (CIRG) from their natural habitat, the Chakarnagar area of Etawah district of Uttar Pradesh, which is situated 150 km from the Central Institute for Research on Goats (CIRG) in Mathura, India, 1982 to 2012. The study area has semiarid climate and an average annual rainfall of about 375mm which is scattered during the months of June to September. The result of the experiment observed that the Season of birth had significant effect ($P < 0.01$) on body weight at 3 months of age.

2.1.3 Effect of ages on body weight at 6 months:

Kumar and Singh (1983) reported the body weight at six months of age was 7.82 ± 0.38 and 9.96 ± 0.42 kg respectively for Black Bengal and Jamnapari x Black Bengal goats.

Malik *et al.* (1986) found that the 6-month body weight of Black Bengal, Beetal x Black Bengal and Black Bengal x Beetal were 10.59 ± 0.29 , 11.10 ± 0.37 and 11.35 ± 0.36 kg respectively.

Kanujia and Pander (1988) reported the 6-month body weight of Black Bengal, Beetal x Black Bengal and Black Bengal x Beetal to be 7.96 ± 0.14 , 10.00 ± 0.22 and 12.23 ± 0.32 kg respectively.

Hossain *et al.* (1994) recorded the average 6-month body weight of Black Bengal goats was 8.14 ± 0.50 .

Mia *et al.* (1993) observed that the body weight of Black Bengal goats was 9.93 ± 0.45 kg at 6-month of age.

Singh (1997) found that the 6-month body weight of Black Bengal, Jamnapari x Black Bengal and Beetal x Black Bengal goats was 8.97 ± 0.14 , 11.40 ± 0.15 and 11.48 ± 0.15 kg respectively.

Singh and Singh (1998a) observed the body weight at six months of age for Jamnapari x Black Bengal goats to be 10.48 ± 0.339 .

The 6-month body weight of Black Bengal, Beetal x Black Bengal goats as observed by Singh and Singh (1998b) was 7.135 ± 0.258 and 9.909 ± 0.246 kg respectively.

Das (2008) recorded the average body weight at six months old Black Bengal goats was 8.206 ± 0.200 kg.

The body weight of Black Bengal at 6-month of age was 7.01 ± 0.90 kg as reported by Misra and Sinha (2001).

Akhtar *et al.* (2006) reported that the mean body weight at six months of Black Bengal goats in three generations of selected and control groups were 7.98 ± 0.29 , 7.63 ± 0.67 , 9.88 ± 0.82 , 6.82 ± 0.08 , 7.00 ± 0.17 and 6.93 ± 0.31 kg respectively.

Yadav and Khada (2009) observed the 6-month body weight male and female in tribal villages of Dungarpur district in Rajasthan was 17.02 ± 0.03 and 16.22 ± 0.02 kg respectively.

Islam *et al.* (2016) reported weight of female Black Bengal goats to be 7.12 ± 0.14 kg under extensive system of management.

2.1.4 Effect of ages on body weight at 9 months:

Mia *et al.* (1993) obtained average birth weight in Black Bengal goat kids to be 1.35 ± 0.03 kg. Body weight at 9 months was found 9.93 ± 0.45 kg in Black Bengal goat. Variation of body weight were found significant ($p<0.05$) due to age.

Husain *et al.* (1996) studied the variability of birth weight and body weight at 9 months in Black Bengal goat. The author observed that average birth weight of kids had a large within breed variation ranging from 0.500 kg to 1.60 kg. The authors reported that birth weight increased with the increase of body weight of dam. The author also obtained large variation in body weight at 9 months age ranging from 5 kg to 18 kg.

Mia *et al.* (2013) conducted at nucleus breeding flock (NBF) at artificial insemination centre, department of animal breeding and genetics, Bangladesh agricultural university, Mymensingh from April, 2007 to March 2011 to study the genetic evaluation of growth traits of Black Bengal goat. In that study a total of 63 Black Bengal does and 17 Black Bengal bucks were used as parental stock in this study. The does were reared semi intensively and stall fed twice daily on a diet consisting of Napier, German and / or maize fodder as per requirement. The result of the experiment revealed that, the highest coefficient of variation (CV) was observed for body weight at 3 month of age (27.46%) and the lowest CV was for 12 month body weight (13.32%).

Singh *et al.* (1997) recorded birth weight of Black Bengal goat at 9 months of age. The mean body weight was 11.79 ± 0.19 .

Singh and Singh (1998b) recorded the body weight in kg of Black Bengal goat at 9 months of age at Bihar. The mean body weight was 7.135 ± 0.258 .

Misra and Sinha (2001) reported the birth weight of Black Bengal goat at 9 months of age was 7.01 ± 0.90 at west Bengal.

Paul *et al.* (2011) observed at the Artificial Insemination (AI) Center under the Department of Animal Breeding and Genetics, Bangladesh Agricultural University

(BAU), Mymensingh to study Characterization of Black Bengal goat. In that study they revealed that the buck body growth rate rapidly increased 6 month (8.95 kg) to 9 month (12.05 kg) but then slowly increased 9 month (12.05 kg) to 12 month (14.20 kg). Similarly does body growth rate rapidly increased 3 month (3.93 kg) to 6 month (7.41 kg) but then slowly increased 6 month (9.53 kg) to 12 month (12.40 kg).

Jalil *et al.* (2016) observed that the productive and reproductive performances of Black Bengal Goat (BBG) under farming condition. Data were collected from Bangladesh Livestock Research Institute (BLRI) goat research farm during 2006 to June 2013. They revealed that the mean of body weight at birth 3, 6, 9 and 12 months were 1.31, 5.65, 9.63, 14.20 and 17.70 kg, respectively.

Routa *et al.* (2018) carried out an experiment in the Jamunapari goats were introduced to the study area (CIRG) from their natural habitat, the Chakarnagar area of Etawah district of Uttar Pradesh, which is situated 150 km from the Central Institute for Research on Goats (CIRG) in Mathura, India, 1982 to 2012. The study area has semiarid climate and an average annual rainfall of about 375mm which is scattered during the months of June to September. The result of the experiment observed that the highest coefficient of variation (CV) was observed for body weight at 9 month of age (25.4%) and the lowest CV was (21.3%) at birth weight.

2.2 Effect of sex on the body weight of kids

The perusal of results of Wilson (1958), Devendra (1966), Guha *et al.* (1968), Prasad *et al.* (1971), Singh and Singh (1982), Singh *et al.* (1983b), Kanaujia and Balaine (1983), Khan and Sahni (1983), Malik *et al.* (1986), Saxena *et al.* (1990), Singh *et al.* (1990), Singh *et al.* (1991a), Mia and Bhuiyan (1997), Roy *et al.* (1997), Singh and Singh (1998), Singh (1999), Singh *et al.* (1987) and Tomar *et al.* (2001) indicated significantly effect of sex on birth weight of kids.

Afjal *et al.* (2004) indicated that the birth weight of kids was affected significantly by the sex of kids.

Rashidi *et al.* (2008) studied that the estimate genetic parameters for economic traits in Markhoz goats. Data collected from 1993 to 2006 by the Markhoz goat Performance Testing Station in Sanandaj, Iran, were analyzed. The traits recorded as body weight performance at birth (BW), weaning (WW), six month (6MW), nine month (9MW) and yearling (YW) were investigated. Flocks were housed in semi-intensive conditions with dry summer and cold winter. In that study they observed that the effect of sex was significant ($p < 0.01$) and male weight was heavier than female weight in every stage.

Thiruvankadan *et al.* (2009) reported at the body weight of 566 Tellicherry goats, maintained at Mecheri Sheep Research Station Pottaneri, Tamil Nadu, India were collected over a period of 20 years (1988 - 2007). The body weights at different ages (i.e. at birth and at three, six, nine and 12 months) were recorded. They reported that the sex highly significant effects on body weights at different ages and male birth weight (2.28 ± 0.03) was heavier than female (2.07 ± 0.03).

Faruque *et al.* (2010) found at the “Improvement of Black Bengal goat through selective breeding” project and then continuation project “Improvement of Black Bengal goat through selective breeding, improved feeding and management practices” project conducted at Bangladesh Livestock Research Institute, Savar, Dhaka. Ninety elite pre-pubertal Black Bengal does and 15 bucks (both foundation stocks) were collected from different parts of Bangladesh. Goats were reared under intensive and semi-intensive management to compare performance. In the study they observed that overall birth weight was observed as $1.37 + 0.039$ kg and $1.37 + 0.10$ kg, respectively for male and female kid.

Choudhury and Sarker (2012) observed that males of Black Bengal goats showed significantly higher body weights than females in all groups.

Mia *et al.* (2013) observed that the nucleus breeding flock (NBF) at artificial insemination centre, department of animal breeding and genetics, Bangladesh agricultural university, Mymensingh from April, 2007 to March 2011 to study the genetic evaluation of growth traits of Black Bengal goat. In that study a total of 63

Black Bengal does and 17 Black Bengal bucks were used as parental stock in this study. The does were reared semi intensively and stall fed twice daily on a diet consisting of Napier, German and / or maize fodder as per requirement. In that study they reported that the male kids were heavier than females from birth to 12-month of age, and the differences between the two sexes were significant at all ages under study, except at birth and 3 month of age. Sex had an appreciable effect on growth after weaning until mature age of the goat.

Sodiq (2011) also observed significantly higher body weights for males in Ettawah goats contrary to the above scientist.

Paul (2008) reported an experiment on Black Bengal goats in the central part of Bangladesh and reported that body weight of Black Bengal bucks and does at 0, 3, 6, and 12 months of age were 1.08 ± 0.06 , 5.22 ± 0.33 , 8.95 ± 0.34 , 12.05 ± 0.47 , 14.20 ± 0.41 and 1.01 ± 0.23 , 3.93 ± 0.19 , 7.41 ± 0.27 , 9.53 ± 0.38 , 12.40 ± 0.41 kg, respectively. Body weight significantly ($p < 0.05$) differ with different groups.

Khan *et al.* (1979) and Singh and Singh (1998), Paul *et al.* (2008) reported non-significant effect of sex on birth weight of kids.

Body weight at different ages of growth have been influenced significantly by sex as per reports of several workers like Guha *et al.* (1968), Singh *et al.* (1993), Kanaujia and Balaine (1983), Mukundan *et al.* (1981), Nagpal and Chawla (1984), Singh (1987) and Singh (1989).

Non-significant effect of sex on bodyweight up to 6 months of age has been reported by Rana (1980).

Paul *et al.* (2014) reported at the productive and reproductive parameters of Black Bengal goat in a nucleus breeding flock of Bangladesh Agricultural University, and two other regions i.e., Modhupur (Tangail) and Dimla, (Nilphamari). Data were collected on a regular basis from January 2011 to January 2012. In that study they reported that the birth weight of kid was not significantly influenced by sex of kid at three different regions.

2.3 Effect of litter size on growth performance of kids

A significant effect of litter size on birth weight of kids had been reported by Moulick and Systard (1970), Belichon and Marques (1971), Castillo *et al.* (1972), Khan *et al.* (1979), Rana (1980), Montaldo and Juarez (1980), Siddiqui *et al.* (1981), Mukundan (1981), Mohd. Yusuf *et al.* (1981), Singh and Singh (1982), Singh and Singh (1983), Singh *et al.* (1983), Khan and Sahni (1983), Mavrogenus *et al.* (1984), Malik *et al.* (1986), Singh (1987), Saxena *et al.* (1990), Singh *et al.* (1991), Singh (1997), Husain *et al.* (1996), Roy *et al.* (1997), Singh and Singh (1998), Mourad and Anous (1998), Singh (1999), Singh *et al.* (1987) and Paul *et al.* (2014).

Findings of Rana (1980), Khan and Sahni (1983) and Mukundan *et al.* (1981) indicated significant effect of types of birth on body weights of kids at various ages. Some other scientists have also reported significant effects on different goats such as Mourad and Anous (1998) on common African and Alpine cross bred goats, Alexandre *et al.* (1999) on Guadeloupean creole goats, Al-Shorepy *et al.* (2002) on Eimariti goats, Portolauo *et al.* (2002) on Sicilan Girgentana goat, Browing *et al.* (2004) on Boer and Kiko goats, Baiden (2007) on west African dwarf goats, Boujenane and Elhazzab (2008) on Draa goats and Ince (2010) on Saanen goats. However non-significant effect of litter size on body weight of kids at 12th week of age was reported by Singh *et al.* (1983).

Kumar *et al.* (2005) showed that the data containing 236 the Tellicherry kids in Tamilnadu from 1991- 2001. In the experiment they observed that the effect of litter size on body weight at six months of age was significant ($P < 0.01$). As expected, the body weight of kids born as single was significantly heavier than the multiples.

Rashidi *et al.* (2008) studied that to estimate genetic parameters for economic traits in Markhoz goats. Data collected from 1993 to 2006 by the Markhoz goat Performance Testing Station in Sanandaj, Iran, were analyzed. The traits recorded as body weight performance at birth (BW), weaning (WW), six month (6MW),

nine month (9MW) and yearling (YW) were investigated. Flocks were housed in semi-intensive conditions with dry summer and cold winter. In that study they revealed that the birth weight of single born kids was significantly higher than both twin and triplet born kids; following the same lines the birth weight of twin was significantly higher than that of triplet. The respective values for birth weight of singles, twin and triplet were 2.56 ± 0.01 , 2.53 ± 0.01 and 2.27 ± 0.11 kg, respectively.

Baiden (2007) reported that the 441 West African Dwarf goat (WADG) kids born from September 1999 to August 2002 at three locations in the Dangme West District of the Greater Accra Region in Ghana to determine the effect of environmental factors on birth weight, birth type and pre weaning survivability. Results of the experiment showed that there was no significant difference ($p > 0.05$) between the average birth weights of singles and twin, but singles were significantly heavier ($p < 0.05$) than triplet. The average birth weight of quadruplets (1.25 ± 0.11 kg) was similar ($p > 0.05$) to that of triplet (1.24 ± 0.05 kg).

Bosso *et al.* (2007) stated at the genetic parameters for growth traits and to evaluate genetic trends in West African Dwarf goat and Djallonke sheep. The West African Dwarf is a goat breed found on the coast of west and central Africa. In that study they observed that the average birth weights for West African Dwarf kids and Djallonk'e lambs were about 1.57 and 2.01 kg, respectively. Kids and lambs were weaned at 5.75 and 8.51 kg, respectively.

Snyman (2007) conducted an investigation into reproductive performance and kid mortality aspects in South African Angora goats. This study was conducted from 2000 to 2004 on 12 South African Angora goat studs, kept under a variety of management systems. The result of the experiment revealed that coefficient variation (CV) of birth weight, weaning weight and 12 month weight 16.0%, 20.3% and 16.1% respectively.

Thiruvankadan *et al.* (2009) observed that the body weight of 566 Tellicherry goats, maintained at Mecheri Sheep Research Station Pottaneri, Tamil Nadu India were collected over a period of 20 years (1988 - 2007). The body weights at different ages (i.e. at birth and at three, six, nine and 12 months) were recorded. In that study they reported that the single type birth weight (2.34 ± 0.03 kg) was comparatively higher than multiple type birth weight (2.01 ± 0.03 kg).

Mia *et al.* (2013) reported at nucleus breeding flock (NBF) at artificial insemination centre, department of animal breeding and genetics, Bangladesh agricultural university, Mymensingh from April, 2007 to March 2011 to study the genetic evaluation of growth traits of Black Bengal goat. In that study a total of 63 Black Bengal does and 17 Black Bengal bucks were used as parental stock in this study. The does were reared semi intensively and stall fed twice daily on a diet consisting of Napier, German and / or maize fodder as per requirement. In that study they observed that the effect of litter size was significant ($P < 0.01$) on the body weight at birth only. Single and twin kids had a heavier weight at birth than the triplet, whilst no marked difference was found between single and twin kids.

Paul *et al.* (2014) studied at the productive and reproductive parameters of Black Bengal goat in a nucleus breeding flock of Bangladesh Agricultural University, and two other regions i.e., Modhupur (Tangail) and Dimla, (Nilphamari). Data were collected on a regular basis from January 2011 to January 2012. In that study they reported that the different types of birth, single kids showed the highest weight at birth followed by twin and triplet.

2.4 Effect of parity on the body weight of kids

Faruque *et al.* (2010), Hasan *et al.* (2015) and Paul *et al.* (2014) reported significant effect of parity on birth weight of kids which are in agreement with the present findings. However Singh *et al.* (1990) reported non-significant effect of parity of dams on birth weight of kids. A positive association between parity of dams and birth weight of their kids which is in agreement with the findings in this study. Positive association between them might be due to improvement in body weight of

dams at kidding with the advancement in parity and because of the fact that body weight of dams at kidding is directly associated with birth weight of their kids (Singh *et al.*,1981). The other reason might be the decrease in the growth hormone with increase in age of dam resulting higher birth weight of kids.

Kumar *et al.* (2005) reported in 236 the Tellicherry kids (123 male and 113 female) born in four seasons i.e. 1- Southwest monsoon (June to September), 2- Northeast Monsoon (October to December), 3- Winter (January to February) and 4- Summer (March to May) maintained at Mecheri Sheep Research Station, Pottaneri, Tamilnadu from 1991-2001. The result of the experiment revealed that the parity had significant effect on body weight at birth and three months of age. The mean birth weight was higher at 4th parity and the mean three month body weight was higher at the 3rd parity. The birth weight reached maximum at 4th parity but the three months weight was maximum at 3rd parity itself indicating that the kids can be selected from 3rd parity for higher growth rate than at 1st and above 4th parity.

Jimenez & Badillo *et al.* (2009) in Serrana Transmontano kids, Otume & Orakwe (2008b) in Nigeria Sahelian goats have reported significant effect of parity of dam on body weight of kids.

Thiruvankadan *et al.* (2009) conducted at the body weight of 566 the Tellicherry goats, maintained at Mecheri Sheep Research Station Pottaneri, Tamil Nadu India were collected over a period of 20 years (1988 - 2007). The body weights at different ages (i.e. at birth and at three, six, nine and 12 months) were recorded. The results of the experiment revealed that the increased birth body weight 1st to 3rd parity and then decline birth weight in 4th parity. Then again increased body weight 5th and 6th parity.

Faruque *et al.* (2010) reported at the “Improvement of Black Bengal goat through selective breeding” project and then continuation project “Improvement of Black Bengal goat through selective breeding, improved feeding and management practices” project conducted at Bangladesh Livestock Research Institute, Savar, Dhaka. Ninety elite pre-pubertal Black Bengal does and 15 bucks (both foundation

stocks) were collected from different parts of Bangladesh. Goats were reared under intensive and semi-intensive management to compare performance. In the study they observed that the birth weight of male kids was significantly ($P < 0.001$) affected by parity. Whereas, birth weight of female kids was not affected ($P > 0.05$) by parity.

Mia *et al.* (2013) stated at nucleus breeding flock (NBF) at artificial insemination centre, department of animal breeding and genetics, Bangladesh agricultural university, Mymensingh from April, 2007 to March 2011 to study the genetic evaluation of growth traits of Black Bengal goat. In that study a total of 63 Black Bengal does and 17 Black Bengal bucks were used as parental stock in this study. The does were reared semi intensively and stall fed twice daily on a diet consisting of Napier, German and / or maize fodder as per requirement. The result of the experiment revealed that parity of the dam has significant ($P < 0.01$) influence on birth weight. Birth weight increased with the progress of parity.

Paul *et al.* (2014) studied at the productive and reproductive parameters of Black Bengal goat in a nucleus breeding flock of Bangladesh Agricultural University, and two other regions i.e., Modhupur (Tangail) and Dimla, (Nilphamari). Data were collected on a regular basis from January 2011 to January 2012. In that study they reported that the parity of dam significantly ($p < 0.01$) influenced the birth weight in three different regions. There was a tendency to increase weight with the advance of parity in all regions. Significantly highest birth weight was observed in 3rd parity and lowest in 1st parity in all regions.

Routa *et al.* (2018) conducted that the Jamunapari goats were introduced to the study area (CIRG) from their natural habitat, the Chakarnagar area of Etawah district of Uttar Pradesh, which is situated 150 km from the Central Institute for Research on Goats (CIRG) in Mathura, India, 1982 to 2012. The study area has semiarid climate and an average annual rainfall of about 375mm which is scattered during the months of June to September. The result of the experiment observed that the parity of dam had significant effect ($P < 0.05$) on body weight at different ages.

2.5 Effect of season on growth performance of kids

Rana (1980), Siddiqui *et al.* (1981), Singh *et al.* (1983b), Mishra (1976), Misra and Rawat (1984), Nagpal and Chawla (1984), Singh *et al.* (1991), Singh *et al.* (1999b), Singh (1999), Singh *et al.* (1987) and Paul *et al.* (1991) observed significant effect of season of birth on birth weight. However Moulick and Systrad (1970), Mukundan *et al.* (1981), Khan and Sahni (1983), Singh and Singh (1998), Faruque *et al.* (2010), Hasan *et al.* (2015) reported significant effect of season of birth on birth weight of kids.

Significant effect of season of birth on body weight at different ages has also been reported by Mishra (1976), Khan and Sahni (1983), Nagpal and Chawla (1984), Singh (1989) and Singh *et al.* (1991). Non-significant effect of season on the body weight during pre-weaning period was observed by Singh *et al.* (1991).

Ray *et al.* (1990) reported non-significant effect of season of birth on the body weight at 6th months of age under extensive management in villages.

Kumar *et al.* (2005) analyzed in 236 the Tellicherry kids (123 male and 113 female) born in four seasons i.e. 1- Southwest monsoon (June to September), 2- Northeast Monsoon (October to December), 3- Winter (January to February) and 4- Summer (March to May) maintained at Mecheri Sheep Research Station, Pottaneri, Tamilnadu from 1991-2001. The result of the experiment revealed that the effect of season of kidding was found significant on birth weight of Tellicherry kids. The study showed that monsoon born kids continued to weigh heavier than those of summer born due to adequate availability of greens to dams during winter and the proceeding monsoon season, which resulted in improvement and availability of dam's milk to the kids. Season showed significant effect on three and six month body weight also.

Banerjee and Jana (2010) suggested in a flock of Sirohi (45 does) goats that were/are reared at the Government Livestock farm from 2003 to 2007 to study the factors affecting birth weight of Sirohi Goat kids reared in hot and humid climate of West Bengal. In that study they indicated that the kids born as twin in the summer months of the first year heavier than those of the monsoon and winter months respectively, the female kids born in the summer months are heavier than those born in monsoon and winter months respectively.

Faruque *et al.* (2010) observed that the “Improvement of Black Bengal goat through selective breeding” project and then continuation project “Improvement of Black Bengal goat through selective breeding, improved feeding and management practices” project conducted at Bangladesh Livestock Research Institute, Savar, Dhaka. Ninety elite pre-pubertal Black Bengal does and 15 bucks (both foundation stocks) were collected from different parts of Bangladesh. Goats were reared under intensive and semi-intensive management to compare performance. In the study they observed that there were no significant effects of season on birth weight of kids, but it was affected ($P < 0.10$) by rearing system.

Mia *et al.* (2013) stated at nucleus breeding flock (NBF) at artificial insemination centre, department of animal breeding and genetics, Bangladesh agricultural university, Mymensingh from April, 2007 to March 2011 to study the genetic evaluation of growth traits of Black Bengal goat. In that study a total of 63 Black Bengal does and 17 Black Bengal bucks were used as parental stock in this study. The does were reared semi intensively and stall fed twice daily on a diet consisting of Napier, German and / or maize fodder as per requirement. The result of the experiment reported that the different stages of growth, the variation in body weights due to season of birth was highly significant ($P < 0.05$). Winter born kids were significantly ($P < 0.05$) heavier at birth to 9 month of age, than their counterparts from the rainy season.

Paul *et al.* (2014) studied at the productive and reproductive parameters of Black Bengal goat in a nucleus breeding flock of Bangladesh Agricultural University, and two other regions i.e., Modhupur (Tangail) and Dimla, (Nilphamari). Data were

collected on a regular basis from January 2011 to January 2012. In that study they reported that the season of birth has a significant ($p < 0.05$) effect on birth weight. Winter born kids were significantly ($p < 0.05$) heavier than that of other seasons at three different regions.

Routa *et al.* (2018) investigated that the Jamunapari goats were introduced to the study area (CIRG) from their natural habitat, the Chakarnagar area of Etawah district of Uttar Pradesh, which is situated 150 km from the Central Institute for Research on Goats (CIRG) in Mathura, India, 1982 to 2012. The study area has semi-arid climate and an average annual rainfall of about 375mm which is scattered during the months of June to September. The result of the experiment observed that the Season of birth had significant effect ($P < 0.01$) on body weight at 3 months of age.

CHAPTER III

MATERIALS & METHODS

3.1 Study Area

The study was conducted at the selected areas of Gaibandha district of Bangladesh using a survey, developed mainly for collection of information on productive traits, i.e. birth weight, sex of kid, type of birth, parity of dam, seasonal birth etc. The information related to this study were collected with direct contact of farmers. Out of 7 upazilas, 3 upazilas namely Gobindaganj upazila, Palashbari upazila & Saghata upazila were selected for the study. Maps of Gaibandha district showing the study area are presented by figure 1.



Figure 1: Map of Gaibandha district shown selected upazila

3.2 Management & Feeding Practice

Most of the goats were kept by the poor marginal farmers, they had not the economic ability to house them separately. Hence, goat's were mostly kept in open places during the day time. At night they were mainly kept in the living room of the owner. Only few of the farmers had separate houses for their goat's. The house was not cleaned properly by the farmers. They also use corridor, kitchen, and cowshed for keeping their goat at night. The farmers not provide extra care for bedding or feeding. In most of the situations the goat is looked after by the women and children. Feeding practices in the village level was in two ways, viz. grazing and supplement of little homemade concentrate. Grazing was only the means of feeding the animals and they were grazed in the fellow lands of river, canals sides and road sides around the bushes and fields. Generally grazing allowed from 9.00 A.M to 3.00 P.M (6 hours) on continuous basis during winter season and from 7.00 A.M to 12.00 P.M & from 3.00 P.M to 6.00 P.M (8 hours) on intermittent basis during summer. During rainy season only few hours were allowed if the weather was favorable and there was supply of leaves. Farmers often practice tethering in place of free grazing lands. Certain percentages of farmers allow both grazing and tethering (grazing in the morning & tethering in the afternoon). During the critical months especially from late winter to early summer, there was acute shortage of green grasses on the field and farmers did not have any alternative sources of feeding their animals except collecting some tree leaves, household scrapes and kitchen wastes. In the study areas prevention and treatment facilities were seriously lacking. Due to financial constraints farmers were usually not able to practice vaccination and medication.

3.3 Collection of Data

A previously structured interview schedule was used as data gathering instrument by keeping in view the objectives of the study. Both open and closed questions were included in the schedule. A weight measuring digital balance was also used manually. The information regarding the present study were collected from 92 goats owners in respective areas with repeated interactions from June, 2018 to

February 2019. Relevant particulars of goats as well as growth in terms of body weight, survivability, and a reproductive trait has been specified below:

1. Identification of kids.
2. Sex of kids (male, female).
3. Litter size (single, twin and triplet).
4. Parity of dam (first, second and third).
5. Season of birth (winter, summer and rainy).

3.4 Parameters studied

In order to study growth performance of Black Bengal goats the following parameters were considered:

3.4.1 Growth pattern in different ages of Black Bengal goat

The purpose of this study was to evaluate the body weight of Black Bengal goat in different ages such as birth, 3 months, 6 months and 9 months. Generally birth weight of kids was recorded of kidding using digital balance and only those kids who remained alive were included in the analysis. It was measured in kg and weaning weight of kids was recorded at 3 months of age using digital balance. It was measured in kg.

3.4.2 Effect of sex on the body weight of kids

Sex of the kid was grouped into male and female. It is the gender identifying character. Body weight varied in all ages due to influence of sex. Effect of sex plays a vital role in growth performance of their body weight. Generally male is heavier than female in their body weight.

3.4.3 Effect of litter size on growth performance of kids

Litter size means that the animals give birth kids which may be single, twin or triplet. Litter size also influences the growth performance of their kids. Litter size

was grouped into single, twin and triplet. Single type birth kids always be heavier than twin and triplet.

3.4.4 Effect of parity of dam on the body weight of kids

Parity of the dam was grouped into first, second and third parity. Parity of dam means that when an animal gives birth 1st time then it is called first parity, when it gives birth 2nd time then it is called second parity, when it gives birth 3rd time then it is called third parity.

3.4.5 Effect of season on growth performance of kids

The cold season is from the middle November to the end of February. The period from June to August is summer season. The end of September, October and the first half of November constitute the Rainy season.

3.5 Statistical Analyses

Raw data were tabulated in Microsoft Excel and performed Statistical Package for Social Science 22 (SPSS Inc. 2009) for data analyses considering sex of kid, type of birth, parity of dam, season of birth as class variable. A probability value of $P < 0.05$ was described as statistically significant and that $P < 0.01$ was described as a trend. To make the graph Microsoft Excel was used.

The significance of fixed effects (non-genetic factors) was tested by least squares analyses of variance using the General Linear Model (GLM) procedure of the Statistical Analysis System (SAS, 1998) according to the following model:

$$Y_{ijklm} = \mu + S_i + M_j + R_k + T_l + E_{ijklm}$$

Where:

Y_{ijklm} : the dependent variable (individual animal record for the trait).

μ : the overall mean.

S_i : the fixed effect of i^{th} sex of kid.

M_j : the fixed effect of j^{th} type of birth.

R_k : the effect of k^{th} parity of dam.

T_l : the effect of l^{th} season of birth.

E_{ijklm} : the residual error.

CHAPTER IV

RESULTS & DISCUSSION

The results of the study obtained are discussed here after statistical analysis. The present study was carried in body weights at different ages (birth, 3 month, 6 month & 9 month), their effect of sex (male & female), litter size (single, twin & triplet), parity (First, second & third) and seasonal (winter, summer & rainy) effect of Black Bengal goats.

4.1 Body Weights at different ages of Black Bengal goat

Basic statistics of body weights (kg) at different ages of Black Bengal goat are presented in Table 1 and figure 2. It showed least- squares means for body weights at birth, 3, 6 and 9 month of age were 1.13, 5.22, 8.12 and 10.92 kg respectively. The highest coefficient of variation (CV) was for body weight at 3 month of age (28.13%) and the lowest CV% was for 9-month body weight (18.30%). The CV for 9-month is much lower than those for the other stages, probably the smaller effects of environment on 9-month weight than on other stages.

Table 1: Basic statistics of body weights (kg) at different ages of Black Bengal goat

Different Ages	No. of Records	Body weight (kg)		Least-squares Mean	Std. Deviation	CV (%)
		Minimum	Maximum			
Birth	188	0.53	2.18	1.13	0.28	24.78
3-month	132	2.52	9.40	5.22	1.46	28.13
6-month	106	3.65	12.64	8.12	2.27	26.85
9-month	94	6.80	16.75	10.92	2.72	18.30

CV= Coefficient of variation

Birth weight of kids is regarded as one of the most important contributory factors for improving growth performance. The mean birth weight in present study was comparable with those reported by Acharya *et al.* (1983), Kumar and Singh (1983), Singh (1987), Gupta *et al.* (1989), Singh *et al.* (1991), Hossain *et al.* (1994), Hossain *et al.* (1995), Akhtar *et al.* (2006) and Hossain *et al.* (2011) in Black Bengal goats.

Birth weights of this study seem to be lower than those reported by Devendra and Burns, (1983), Patnaik and Nayak (1988), Verma *et al.* (1991), Mia (1992), Singh and Singh (1998) and Chowdhury *et al.* (2002) for the same breed but higher as reported by Ali *et al.* (1973).

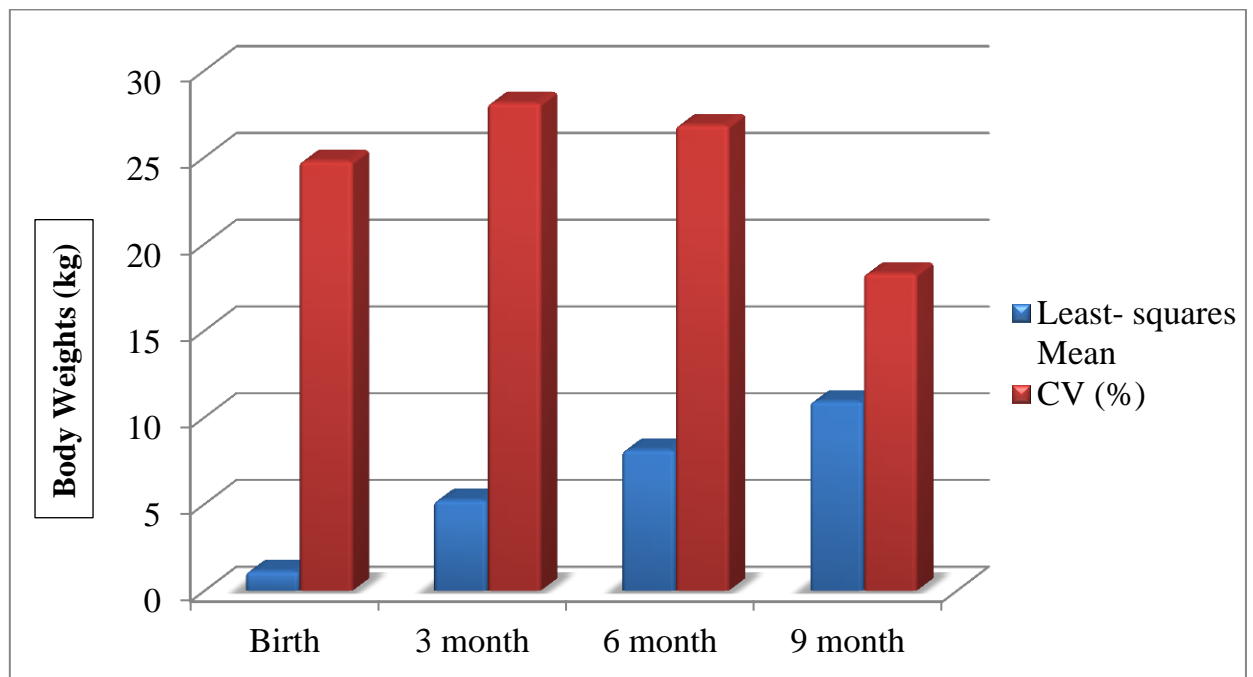


Figure 2: Coefficient of variation with least-square mean at different ages of Black Bengal goat

The mean for body weight at 3-month of age in the present study was comparable to those reported by Acharya *et al.* (1983), Kanaujia and Pander (1988), Patnaik and Nayak (1988), Singh and Sengar (1990), Singh *et al.* (1991), Acharya (1992), Mia *et al.* (1992), Husain *et al.* (1996), Singh (1997), Singh and Singh (1998) and Akhtar *et al.* (2006) reported lower values for 3-month body weight than those in the present study.

The mean for body weight at 6-month of age in the present study was comparable to those reported by Acharya (1982), Kumar *et al.* (1980), Kanaujia and Pander (1988), Singh and Sengar (1990), Acharya (1992), Mia *et al.* (1992), Hossain *et al.* (1992), Singh (1997) and Akhtar *et al.* (2006) reported lower for 6-month body weight than those in the present study.

The mean for body weight at 9-month of age in the present study was comparable to those reported by Acharya (1982), Singh and Sengar (1990), Acharya (1992), Miah and Alim (2009), Hossain *et al.* (1992) and Singh (1997). Differences in body weight reported by various authors could be due to the management and environment variation in different studies.

4.2 Effect of sex on the body weights (kg) of kids in different periods

The male kids were heavier than females from birth to 9 month of age in table 2 and figure 3. The differences between the two sexes were significant at all ages studied except at birth and 3-month of age. Sex had a significant effect on growth after weaning until mature age. The result was in agreement with the reports of Husain *et al.* (1996) and Akhtar *et al.* (2006). Khan and Sahni (1983) did not find differences between the sexes for birth weight in goats.

Table 2: Effect of body weights (kg) at different ages of Black Bengal Goat according to sex of kid

Sex of Kid	Body weights (kg) at			
	Birth	3 month	6 month	9 month
Male	1.16±0.07	5.70±0.21	8.65 ^a ±0.11	11.55 ^a ±0.33
Female	1.07±0.07	5.01±0.17	7.40 ^b ±0.27	9.93 ^b ±0.30
Level of Significance	NS	NS	*	**

Means±SE with different superscripts within each column and trait differ significantly, NS= Not Significant; * = (P<0.05); ** = (P<0.01).

The progressive increases in the male weights compared to the females even after puberty suggests that genetic and hormonal differences between male and female animals are manifesting their effect. In this study, males were significantly heavier and grew faster from weaning to onward, implying that sex effects are more pronounced with age after weaning. These effects have been attributed to hormonal differences between sexes and their resultant effects on growth. Higher body weights of males compared to females at all the ages might be due to aggressive behavior of males during feeding and suckling and male sex hormone which has an anabolic effect.

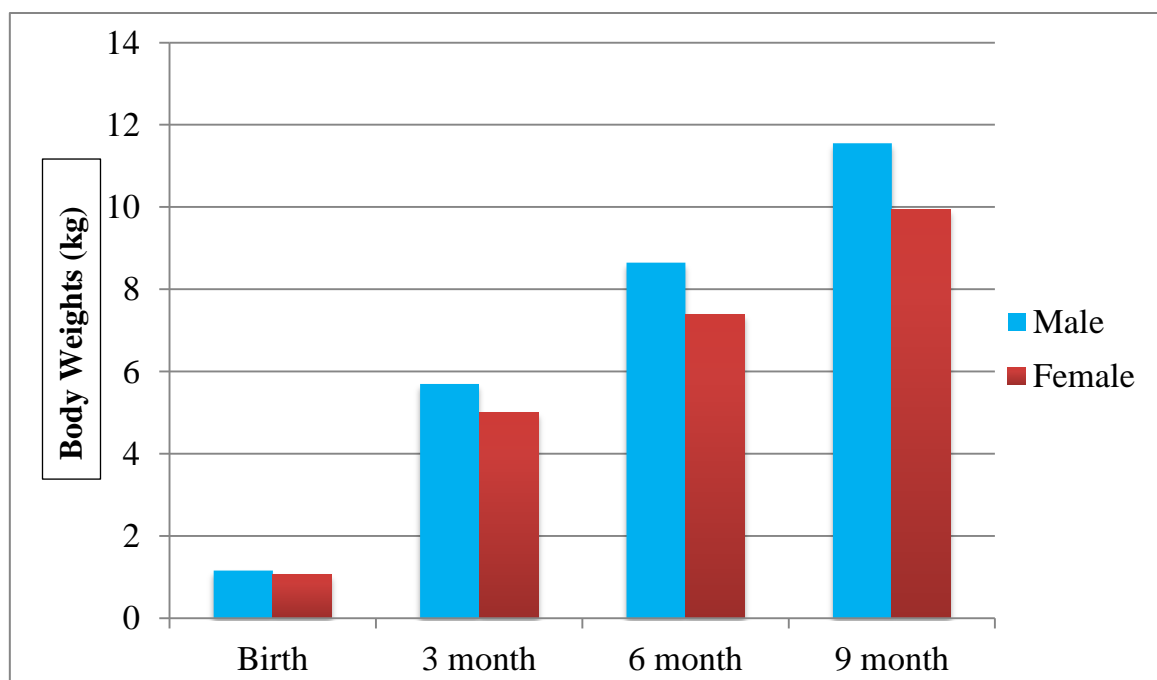


Figure 3: Effect of sex on the body weights (kg) of kids in different periods

The heavier body weight of male than female kids may also be due to differences in their endocrine profile. Non-significance influence of sex on body weight at birth and 3-months of age in the present study agrees with the findings of Singh and Singh (1998) in Black Bengal and Beetal \times Black Bengal kids but disagrees with the findings of Al-Shorepy *et al.* (2002) in Emirati goat. Singh (1997) reported significant effect of sex on body weights at 3, 6 and 9-month of age. Husain *et al.* (1996) also observed significant effect of sex on body weights at birth, 3, 6 and 9-month of age of Black Bengal goat under extensive system.

4.3 Effect of litter size on the body weights (kg) of kids in different periods

The effect of litter size was significant ($P<0.01$) on the body weight at birth only. Table 3 and figure 4 showed single and twin kids had heavier weight at birth than triplet, whilst no significant difference was found between single and twin kids. These results are in accordance with those obtained in other goat breeds reared in tropical and subtropical environments (Mourad, 1998). Single-born kids were 1.80% heavier at birth compared to average weight of kids born as twin and 22.52% heavier than those born as triplet.

Table 3: Effect of body weights (Kg) at different ages of Black Bengal Goat according to litter size

Litter size	Body weights (kg) at			
	Birth	3 month	6 month	9 month
Single	1.11 ^a ±0.01	5.48±0.19	8.58±0.13	11.66±0.31
Twin	1.09 ^a ±0.01	5.23±0.16	7.76±0.16	11.56±0.28
Triplet	0.86 ^b ±0.01	4.78±0.11	7.57±0.16	10.72±0.24
Level of Significance	**	NS	NS	NS

Means±SE with different superscripts within each column and trait differ significantly, NS=Not Significant; ** = ($P<0.01$).

The lower birth weight with increasing litter size have also been reported by Singh *et al.* (1983), Singh *et al.* (1984), Mavrogenis *et al.* (1984b), Wilson (1958), Mia and Bhuiyan (1997), Mourad and Anous (1998) and Al-Shorepy *et al.* (2002). This difference is probably due to the intrauterine environment where a higher availability of nutrients to the single kid, lack of competition as well as more space may facilitate growth. The uterine space and available nutrient shared by more than one kid may be responsible for the reduced birth weight with increasing litter size. Singh *et al.* (1990) noticed that birth weight of single born kids was highest

followed by twin and triplet but the differences in their study were not significant in the local and crossbred kids.

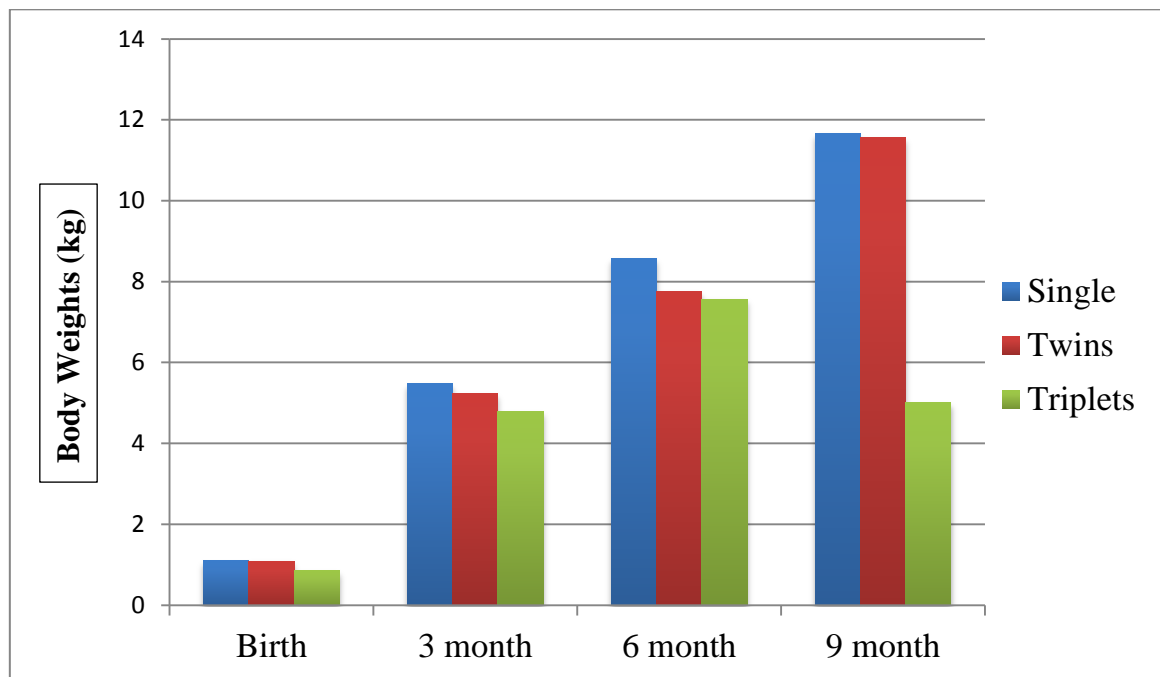


Figure 4: Effect of litter size on the body weights (kg) of kids in different periods

Single born kids maintained their highest weight followed by twin and triplet for all the period. Singh (1990) reported non-significant variation in birth weight of kids because of litter size under village condition of management. Hossain *et al.* (1995) observed significant effect of litter size on body weights of Black Bengal goat under extensive system. Negative linear relationship of kid's growth with litter size at birth, probably due to difference in birth weight and availability of mother's milk to their kids during early stage of life. Robinson *et al.* (1977) reported that for lambs/kids in uterus, as the number of fetuses increases, the number of caruncles attached to each foetus decreases, thus reducing the feed supply to the foetus and hence reduction in the birth weight of the lambs or kids.

4.4 Effect of parity on the body weights (kg) of kids in different periods

Parity of dam has significant ($P < 0.01$) influence on birth weight of Black Bengal goat. Birth weight increased with the progress of parity of dam. Table 4 and figure 5 showed significantly higher birth weight was observed in 2nd and 3rd parity of dam and birth weights were lowest in 1st parity of dam.

Table 4: Effect of body weights (kg) at different ages of Black Bengal Goat according to parity of dam

Parity of Dam	Body weights (kg) at			
	Birth	3 month	6 month	9 month
First	1.03 ^b ±0.10	4.70±0.11	7.76±0.16	11.06±0.23
Second	1.17 ^a ±0.17	5.62±0.18	8.51±0.13	11.01±0.22
Third	1.24 ^a ±0.10	5.70±0.17	8.33±0.13	10.63±0.18
Level of Significance	**	NS	NS	NS

Means±SE with different superscripts within each column and trait differ significantly, NS=Not Significant; **=(P<0.01).

The difference in birth weight between 2nd and 3rd parity was non-significant. Wilson (1958) found that the effect of age of dam was significant on birth weight and growth rate at pre-weaning and those young ewes/kids tend to produce smaller progeny at birth. Mothering ability especially milk production, increases with parity. Older kids are larger in body and tend to be better milkers. The effect of parity of dam on kids is thus imparted as a maternal influence whose direct influence is limited to the nursing period.

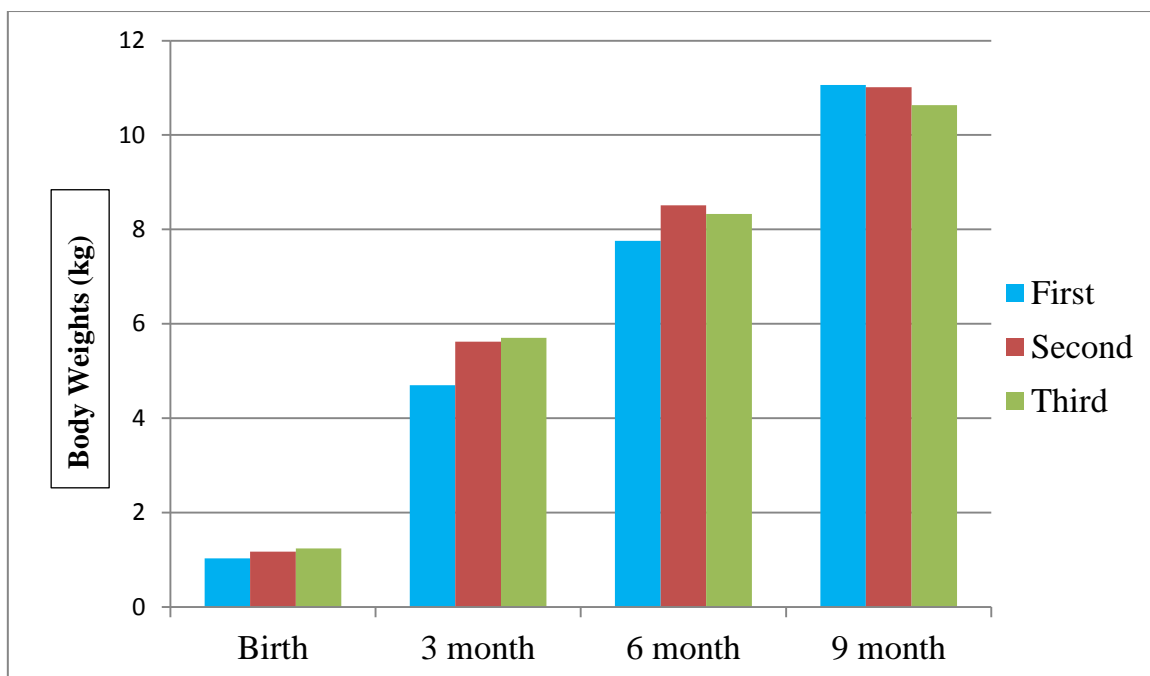


Figure 5: Effect of parity on the body weights (kg) of kids in different periods

4.5 Effect of season on the body weights (kg) of kids in different periods

At different stages of growth the variation in body weights due to season of birth was significant ($p < 0.05$). Table 5 and Figure 6 showed winter born kids were significantly ($p < 0.05$) heavier at birth to 9-month of age than their counterparts from the rainy season.

Table 5: Effect of body weights (kg) at different ages of Black Bengal Goat according to season of kid Birth

Season of birth	Body weights (kg) at			
	Birth	3 month	6 month	9 month
Winter	1.21 ^a ±0.01	5.54 ^a ±0.17	8.47 ^a ±0.12	10.80 ^a ±0.18
Summer	1.10 ^{ab} ±0.01	5.14 ^a ±0.13	8.12 ^a ±0.17	11.33 ^a ±0.24
Rainy	0.96 ^b ±0.02	3.97 ^b ±0.09	6.60 ^b ±0.21	7.18 ^b ±0.17
Level of Significance	*	*	*	*

Means±SE with different superscripts within each column and trait differ significantly, NS=Not Significant; * = ($P < 0.05$).

The effect of season may be explained partly by the climate conditions, however, feeding practice in different seasons for dams and offspring were similar. Important influences of season on kid live weights have been reported in several breeds.

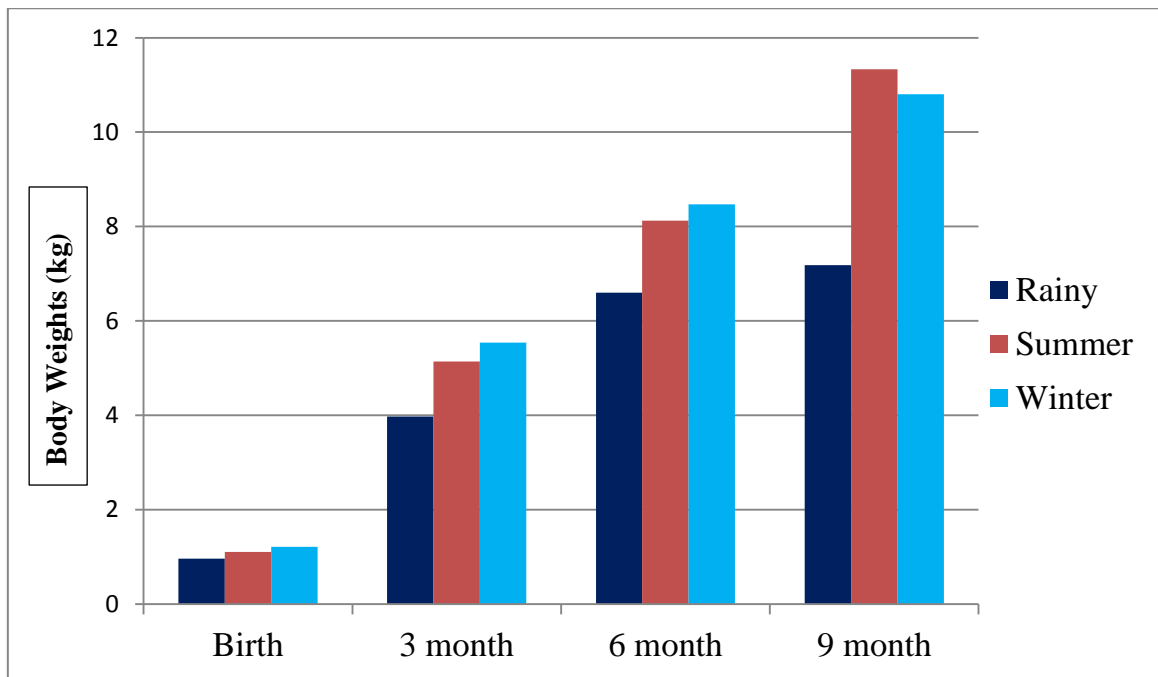


Figure 6: Effect of season on the body weights (kg) of kids in different periods

Singh (1997) observed significant effect of season of birth on body weights at 3 and 6-month of age whereas non-significant effect at 9-month of age. Seasonal influences on birth weight operate through its effect on the dam's uterine environment mostly in late gestation (Eltawil *et al.*, 1970). Season of birth plays an important role in growth performance indirectly through its influence on the dam's nutrition and hence amount of milk available to the unweaned kids in the post-weaning period its influence is related to its effect on the quantity of pasture available to the weaned kids. The lower body weights of rainy season born kids emphasized the need to provide supplementary feed and adequate supervision for these kids.

CHAPTER V

SUMMARY AND CONCLUSION

The study was conducted at Gaibandha District, out of 7 upazilas, 3 upazilas are namely Gobindaganj, Polashbari and Saghata from June (2018) to February (2019). The present experiment was conducted under the Department of Animal Production and Management in Sher-e-Bangla Agricultural University (SAU), Dhaka-1207. The main objectives of this study was growth performance of Black Bengal goat in village condition based on different factors. Males had higher body weight than females so for meat purpose, selective breeding for more number of male kids could be done. Sex had a significant effect on growth after weaning until mature age. The male kids were heavier than females from birth to 9 month of age. Single and twin kids had a heavier weight at birth than triplet, whilst no significant different was found between single and twin kids. Single born kids maintained their highest weight followed by twin and triplet for all the period. Birth weight increased with the progress of parity of dam. Significantly higher birth weight was observed in 2nd and 3rd parity of dam and birth weights were lowest in 1st parity of dam. The lower body weights of rainy season born kids emphasized the need to provide supplementary feed and adequate management for these kids. Winter born kids have significantly higher body weight than other seasons in village conditions thus estrus synchronization could be done to have maximum kidding during winter. Black Bengal goats exhibit good performance with respect to all productive and economic traits in the current research. So more number of farmers should be encouraged to keep this breed of goat for their economic upliftment.

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APPENDICES

Appendix 1:

Questionnaire on performance traits study of Black Bengal goat in Gaibandha District

Name of the owner:						
Name of the area/ Village:						
Occupation:						
Types and source of breed:			Black Bengal		Cross	
Number of goat:			Doe		Buck	
Parity number	Season of kidding	Litter size at birth	Body wt. (kg) at birth	Body wt. (kg) at 3 month	Body wt. (kg) at 6 month	Body wt. (kg) at 9 month
First	Winter	Single				
	Summer	Twin				
	Rainy	Triplet				
Second	Winter	Single				
	Summer	Twin				
	Rainy	Triplet				
Third	Winter	Single				
	Summer	Twin				
	Rainy	Triplet				

Date: