# ASSESSMENT OF REPRODUCTIVE PERFORMANCE OF BLACK BENGAL GOAT IN VILLAGE CONDITION

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# ASSESSMENT OF REPRODUCTIVE PERFORMANCE OF BLACK BENGAL GOAT IN VILLAGE CONDITION

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### CERTIFICATE

This is to certify that the thesis entitled *"ASSESSMENT OF REPRODUCTIVE PERFORMANCE OF BLACK BENGAL GOAT IN VILLAGE CONDITION"* submitted to the Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University, Dhaka in partial fulfillment of the requirements for the degree of *MASTER OF SCIENCE (M.S.) in ANIMAL BREEDING AND GENETICS,* embodies the results of a piece of bona fide research work carried out by *BISHRAT FARHANA AMY,* Registration No. *12-04743* under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma in any other institution.

I further certify that any help or sources of information received during the course of this investigation has duly been acknowledged.

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# Acknowledgement

# ASSESSMENT OF REPRODUCTIVE PERFORMANCE OF BLACK BENGAL GOAT IN VILLAGE CONDITION

## ABSTRACT

The Black Bengal goat is one of the potential genetic resources in our country. This present study was compiled to investigate the reproductive performance of Black Bengal goat in village condition at Saver Upazilla under the Dhaka district from July/2017 to June/2018. All goats of this study was rearing under extensive conditions. Least-squares means for body weight at birth for $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were 0.92±0.01, 0.99±0.01 and 0.97±0.01 kg respectively. Parity of dam at birth weight of Black Bengal goat has significant effect ($p<0.05$). The body weight at birth of Black Bengal goat for winter, summer and rainy season were 0.92±0.01, 0.99±0.1 and 0.97±0.01 kg respectively. Season of birth has significant ($p<0.05$) effect on the birth weight. Non-significant effect of parity of dam on body weight at weaning age of Black Bengal goat. The body weight of Black Bengal goat at weaning period were 5.12±0.06, 5.03±0.05 and 4.97±0.06 kg respectively at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity. The body weight at weaning were 4.89±0.05, 5.27±0.05 and 4.93±0.09 kg respectively at winter, summer and rainy season. There are significant ($p<0.05$) effect of season on body weight at weaning of black Bengal goat. Parity of dam has highly significant ($p<0.01$) effect on litter size at birth of Black Bengal goat. The litter size of Black Bengal goat at birth were 1.21±0.06, 2.07±0.08 and 2.43±0.12 respectively at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity. The litter size of Black Bengal goat at birth were 1.83±0.09, 1.80±0.09 and 1.75±0.14 respectively at winter, summer and rainy season. Although there is significant effect of parity on litter size but there is no significant effect of season on litter size at birth. Highly significant effect ($p<0.01$) of parity on litter size at weaning of Black Bengal goat. The litter size at weaning were 1.18±0.05, 1.56±0.06 and 1.91±0.12 respectively at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity. Season at birth of Black Bengal goat has significant ($p<0.05$) effect on litter size at weaning. The litter size at weaning were 1.60±0.08, 1.40±0.07 and 1.30±0.08 respectively at winter, summer and rainy season. Non-significant effect of parity of dam and season of birth on gestation period of Black Bengal goat. The gestation period of black Bengal goat at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were 144.1±0.43. 143.5±0.40 and 144.1±0.48 days respectively and at winter, summer and rainy season were 143.9±0.37, 143.9±0.41 and 143.6±0.59 days respectively. It is concluded that third parity and summer season was better performance under extensive rearing system in village condition.

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# LIST OF ABBREVIATIONS AND SYMBOLS

| | | |
|---|---|---|
| % | = | Percentage |
| > | = | Greater than |
| < | = | Less than |
| ± | = | Plus minus |
| AI | = | Artificial insemination |
| ANOVA | = | Analysis of Variance |
| BAU | = | Bangladesh Agricultural University |
| BBG | = | Black Bengal goat |
| B.C. | = | Before Christ |
| BLRI | = | Bangladesh livestock Research Institute |
| BW | = | Birth weight |
| CIRG | = | Central institute for Research on Goats |
| DF | = | Degree of freedom |
| DM | = | Dry matter |
| DLS | = | Department of livestock  Services |
| *et al.* | = | Associate |
| FAO | = | Food and Agricultural Organization |
| FAOSTAT | = | Food and Agricultural Organization  Statistics |
| GDP | = | Gross Domestic Product |
| Gm | = | Gram |
| GLM | = | General linear model |
| MW | = | Month Weight |
| MS | = | Mean Square |
| NBF | = | Nucleus Breeding Flock |
| Lbs | = | Pound |
| Kg | = | Kilogram |
| LSD | = | Least Squares Means |
| Ml | = | Milliliter |
| no. | = | Number |
| NS | = | Non-significant |
| PPR | = | Peste des Petits Ruminants |

# LIST OF ABBREVIATIONS AND SYMBOLS (cont'd)

| | | |
|---|---|---|
| SAARC | = | South Asian Association for Regional Co-operation |
| SAS | = | Statistical Analysis |
| SAU | = | Sher-e-Bangla Agricultural University |
| SAURES | = | Sher-e-Bangla Agricultural University Research System |
| SE | = | Standard Error |
| SS | = | Sum of Squares |
| Viz. | = | Namely |

# CHAPTER 1

# INTRODUCTION

Among domesticated animal goat (*Capra hircus*) is the first ruminant livestock after dog that domesticated around 90000 B.C. (Luikart *et al*., 2006). Out of world goat population, about 90% goats are found in developing country. Among the Asiatic countries, Bangladesh has fourth highest population of goats (DLS, 2008). In Bangladesh goat population is about 26.1 million (FAO, 2018). Black Bengal goat (BBG) is the own breed of Bangladesh. Black Bengal goat comprises more than 90% of total goat population with variation in color and size. Most of Black Bengal goat are black in color but black and white, brown and white coat color also common. The average number of goats per household is about 2.31 in Bangladesh (Faruque, 2010). "The goat is the poor man's cow" old man saying (MacHugh and Bradley, 2001). According to archeological evidence that the wild Bezoar species of the Capra genus of Zagor mountains is the original ancestor of todays goats which is first domesticated by humans around 10,000 years ago at Neolithic period (Joshi *et al*., 2004; Pringle, 1998 and Porter, 1996). Goats played a central role in agricultural revolution and the human civilization (Pringle, 1998). More than 80% of the world's goats live in Asia and Africa as domesticated animals. Goats were domesticated around 6000-7000 B.C. in Western Asia. Then rapidly spread in Indian subcontinent area. During last 20 years compared to cattle, the goat production i.e. milk, meat and cheeses extended about 66% (Dubeuf and Boyazoglu, 2009). From early times in human civilization, goats have fulfilled agricultural, economic, cultural and even religious roles. Goats have become very important in rural economy even throughout the country, while dairy cattle and poultry industry are making significant impact as a provider of animal protein in the country (Lebbie, 2004). The goat recognized as a significant food source due to good convertor of feed DM into milk.

Goats are economically important & promising animal genetic resources in the developing country. Black Bengal goat is more popular for its high fertility, prolificacy, short generation period, early sexual maturity, delicious meat and superior skin, resistant to disease and found in almost in all villages of Bangladesh (Husain *et al*., 1996; Husain, 1993; Islam *et al*., 1991; Singh *et al*., 1991 and Devendra and Burns, 1983 ). Superior skin is a valuable assets which used as an industrial raw material and earn foreign currency. There is no prejudice about the consumption of goat meat. Black Bengal goat recognized as a tool of poverty alleviation. It is also known as

dwarf breed. But Black Bengal goats are mainly reared for meat production. Although adverse climate condition in our country, goat is known as an important source of nutrients for people in our country (Birthal *et al*., 2006). They grow naturally even without concentrate feeds. As a result landless rural farmers prefer goats other than livestock animals. Though have good characteristics, low birth weight, insufficient milk, slow growth rate and high kid mortality are major constraints in goat production in our country. Besides, there are reported that some Black Bengal goats produce sustaintial quantity of milk and enough to support their kids (Choudhury *et al*., 2012). Manure and urine from goats is a source of organic fertilizer for improving agricultural production. The intestine of goat is used to make catgut which is still in use as a material for internal sutures. It has an excellent ability to accommodate with fluctuation in environment. It has ability to utilize poor quality forage and browse, to walk long distances. About 98% of goat is being reared in the traditional village system that means in extensive rearing system. Women and children are mostly involved in goat rearing system. They are grazing based on road-side land grass, various tree leaves such as jackfruit leaves, mango leaves etc. They are best convertor of low quality roughage, green grasses, shrubs and various tree leave which are provided. Farmers provide small house with bamboo, straw or polythin sheet for their goats. Some farmers provide house for their goats with galvanized iron sheet with wooden floor. At winter season they provide some bedding materials i.e. rice straw, old cloths and rice bran etc. Government or private breeding service and best quality bucks are not available in the village. Farmers keep cattle, chicken with goats and also produce agricultural products. They favor to rear goat due to it require lower feed and capital and care than others. About 41% of the total income provided by goats in farmers house (Husain, 1993). It also serve as a store of value and instant cash asset (Morand- Fehr *et al*., 2004).

In the world about 300 different goat breeds are present. Among the domesticated animals goats are wide spread and found in all place more or less of the world. Statistically the total number of goats in the world about 975.8 million (FAOSTAT, 2015) in 2013. The contribution of livestock in GDP 1.54% and GDP growth rate of livestock is 3.40%. In our country meat demand is 72.14 lak metric ton, milk demand 150.29 lak metric ton, egg 1712.88 crore number per year but surplus in meat 0.46 lak metric ton, deficiency 56.23 lak metric ton milk and 160.88 crore number egg per year (DLS. Livestock economy at a glance 2017-18). In our country, goat farming contributes in small, landless and marginal farmers about 75.8% and about 24.2% are

contributed by medium and large farmers (Huque, 2008). If we want fulfill our demand first of all developed our breed and conservation of our local breed. The production of animal will be increased if we can improved the reproductive performance of our animals. For higher demand of meat and skin in local and foreign markets must be focused on the goat production in the existing socio-economic condition of the country (Husain, 1993). Among the livestock Black Bengal goat is the only recognized breed amongst the domestic species available throughout Bangladesh.

Reproduction and production performance of goat is affected by both genetic and environmental factors and the interaction between these factors (Land, 1978). Due to these interaction genetic improvement of reproductive traits is very complicated (Snowder, 2008). The raw materials for the breeder is genetic variation which is utilized for changing the genetic variation of the species to suitable for our demands. Improvement in reproductive performance of goat can arise through improvement in management and feeding system. Melton, (1995) showed that reproductive traits are four times more important than productive traits. Reproductive traits of goats is a major components of productivity and economic viability of commercial goat farms. The high rate of reproductive performance of goats is dependent on genetic and environmental factors (Devendra and Burns, 1970; Riera, 1982 and Song *et al*., 2006). The reproductive efficiency in female goats is determined by different methods (Shelton, 1978). Reproductive efficiency can be measured by litter size, birth weight, gestation length, weaning rate and length of reproductive cycle (Greyling, 1988 and Greyling, 2000). The Black Bengal goat is the most prolific under tropical and sub-tropical conditions throughout the year (Hofmeyr *et al*., 1965 and Devendra and Burns, 1983) compared to Angora which have a restricted breeding season (Shelton, 1978 and Vander Westhuysen, 1980). Hossain *et al*., (2005) described that the benefits of farmers in Bangladesh through goat farming by increasing cash income and savings, greater investments in children's education, health care, clothes and improved social status. Improvement of reproductive traits are more important to increase production (Dickerson, 1978). Improvement of reproductive traits have also impact economically on growth rate or production performances of goats (Wang and Dickerson, 1991). Flock reproductive improvement also affected by selection intensity and the rate of genetic improvement in all traits under selection (Abegaz *et al*., 2002). Under government control, there are five goat development farms in different parts of our country such as Dhaka, Sylhet, Rajshahi, Chuadanga and Jhenaidah. Different Agricultural Universities, Science and

Technology Universities especially Bangladesh Livestock Research Institute (BLRI) are involve with the research activities of Black Bengal goats.

Reproductive traits are an important factor which have lifetime influence on the production of an animal (Banergee, 1989). During selection body weight, birth weight, mature weight, litter size, gestation period etc. should be considered to improve animal. Birth weight and body weight of goat is important traits which have positive correlation between birth weight and growth rate which influence the reproductive performance of the animal. There are genetic variations in different reproductive traits between individuals in Black Bengal goat within and between locations (Amin *et al*., 2000). The reproductive trait is a complex trait which influenced by many components such as puberty, estrus, ovulation, fertilization, embryo implantation, pregnancy, parturition, lactation and mothering ability. Reproductive efficiency is the pre-conditions for increasing production potential in any given environment. Reproductive performance depends on genetic potentialities of dam and sire. Expression of genetic potentialities are affected by different factors such as season, parity of dam, environment, management, health, nutrition, fertility etc. In order to evaluate the productive ability of goats, prolificacy and birth weight are considered the most important and economic criteria. If reproductive performance increase then finally increase production which contribution in poverty alleviation particularly small and landless farmer families at rural level.

Systemic information on reproductive performance of Black Bengal goat under extensive rearing system is limited, although a lot of work have been done on productive and reproductive parameters (Faruque *et al*., 2010 and Amin *et al*., 2001). So it is essential to collect systemic information on reproductive parameters of Black Bengal goat which will be helped for farmers or breeders to improve or selection of goats. The goal of livestock breeding is to produce a quantity products with maximum efficiency. The maximum efficiency is controlled by reproduction and production of female and growth of offspring. The achievement of this goal is genetically improvement of goats. Selection is major element to achieve the genetic improvement. For conservation of genetic resources and avoid fore coming extinction of the breed, selective breeding is very important tools. To take any improvement policy in the rural area, problem and prospects of goats should be identified. So to gather update information this

study was designed with the objectives to learn about present status of Black Bengal goat reproductive performance in village condition.

**OBJECTIVES:**

1. To estimate the litter size and body weight at birth and weaning of Black Bengal goat.
2. To estimate the gestation period of Black Bengal goat.
3. To observe the effect of different factors on reproductive traits of black Bengal goat.

**CHAPTER 2**

**REVIEW OF LITERATURE**

Many researcher and scientist in different countries of the world have been carried out substantial research works related to the reproductive performance of Black Bengal goat in village condition. In different areas of our country this type of works have also been done but limited. Besides, village area in Savar upozilla until there is no research work done about reproductive performance of Black Bengal goat. For this reason I am selected this area for my study. This chapter includes selective review of research works which is done by previous researchers & scientists related to the study although limited work has been done on the reproductive performance of Black Bengal goat under village condition in Bangladesh.

**2.1 Origin of goat**

Among the domesticated animals, goats and dogs are the earliest domesticated animals by humans. The most recent genetic analysis confirms the archeological evidence that the wild Bezoar ibex of the Zagors Mountains is the original ancestor of goats today. Archaeological evidence reported that goat has been associated with man for about 10,000 years ago at the dawn of the Neolithic period in the Fertile Crescent (Porter 1996; Pringle 1998). Goats played a central role in the Neolithic agricultural revolution. Neolithic farmers began to herd wild goats for milk, meat, dung, fuel, bones, hair for clothing, building and tools. Goats are domesticated in Western Asia at between 8000 and 9000 years ago. The domesticated goat is a subspecies of *Capra aegagrus* domesticated from the wild goat of Southwest Asia and Western Europe. The goat is a member of the animal family Bovidae and the goat antelope subfamily Caprinae. The domesticated goat is originated from wild goat, *Capra aegagrus* and considered a subspecies *Capra aegagrus hircus* and sometimes a distinct species *Capra hircus*.

The modern goat has developed as a result of the domestication of many different populations wild goat which must have been isolated from each other. Mutation is the main cause and almost all deleterious genes have disappeared over the long periods the goat has been kept as extensive or under semi-intensive conditions. Only goats from Southern parts of Asia have any fixed deleterious mutations because they were transported from the north (China and Mongolia) under

conditions that created genetic bottlenecks. There are over 300 distinct breeds of goats. Goats and sheep can be assumed to have become separate species at least 250,000 years ago. This is much older than fossil-based estimates. The Markhor, a central Asian species, split from other goats about 340,000 years ago. Goats and sheep has been subdivided into two genera (French, 1970). These are-

- Capra
- Hemitragus

Again goats are divided into three groups such as bezoar groups, ibex group and markhor groups. In bezoar groups two sub-species were found. In ibex group about nine sub-species were found in Europe, Asia and Africa. There are seven sub-species were found in markhor groups from Afghanistan to Kashmir.

## 2.2 History of Domestication

Goat is a member of the genus Capra of the bovidae family of the even-toed ungulates or hoofed mammals. Todays domesticated goat is originated from wild goat *Capra aegagrus* specifically sub-species *Capra aegagrus hircus*. More than 80% of the world's goats live in Asia and Africa as domesticated animals. Goats originated in warm dry, Mediterranean and Western Asian countries. The domesticated goat first domesticated from the wild bezoar goat during Neolithic age. The rapid spread of domestic goats worldwide was probably the result of different activities, including the migration of people with their livestock. The domesticated goats were first introduced into the African continent from Southwest Asia (Mason, 1988). Goats were domesticated around 6000-7000 B.C. in Western Asia. The goats of hircus species reached undivided Indian subcontinent from the Western-Asia at around 7000-7500 B.C. Devendra and Neozawa, (1976) have found that routes of migration of domesticated goats from the Western Asia to Eastern region. The other route is Northern via Afghanistan and Turkistan to Mongolia and China. Besides sea route, another route is through Khyber pass to the Indian subcontinent and South East Asia.

## 2.3 Goat is an Animal Genetic Resource

Like other SAARC countries of Asia, Bangladesh is rich in Farm Animal Genetic Resource. Among them goat is an important genetic resource in our country. Most of them are raised by small-scale farmers who own 1-2 heads of cattle, 2-3 heads of goat/ sheep and a few poultry birds. Out of 300 breeds, about 20 breeds found in South East Asia (most of which are found in India, Bangladesh and Pakistan). Among the goats breeds, Black Bengal goat and Jamnapari as indigenous breed, Beetal as exotic breed and crossbred of Black Bengal goat and Jamnapari have been found in our country. Among the native species Black Bengal goat is the awarding breed in Bangladesh. It is an important breed due to its genetic superiority in the low quality type farming system of our country (Husain, 1993). Among the Asiatic countries, Bangladesh has fourth highest population of goats (DLS, 2008).

## 2.4 Body weight at birth

Bhowmik *et al.* (2014) conducted the study to know the reproductive performance of Jamunapari, Black Bengal and crossbred goats in Chittagong district from May to December 2012. The data were collected from 324 goats for productive and reproductive traits. The birth weight of Jamunapari, Black Bengal and crossbred goats were average $1.53 \pm 0.22$, $0.89 \pm 0.09$ and $1.26 \pm 0.20$ kg respectively.

Faruque *et al.* (2016) evaluated the performance of Black Bengal goat at three different village of namely Kaichapur, Salia, Shimulia at Phulpur  upazilla of Mymensingh district in Bangladesh. In this study data was collected from those areas and showed that the average body weight at birth was $1.04 \pm 0.00$, $1.03 \pm 0.00$, $1.00 \pm 0.01$ kg respectively.

Hossain *et al.* (2004) reported that average body weight of male kids at birth of Black Bengal goat were $1.05\pm0.04$, $1.22\pm0.03$ & $1.15\pm0.03$ kg at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity respectively. The study is also showed that the average body weight of female kids at birth of Black Bengal goat at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were $1.02\pm0.04$, $1.05\pm0.03$ and $1.11\pm0.03$ kg respectively. The study was done to investigate the production and reproductive performance of Black Bengal goat in different parity which reared in semi intensive system.

The study was reported that the average body weight at birth of Black Bengal goat was 1.21 ± 0.12 kg. This experiment was done at the Artificial Insemination Center, Bangladesh Agricultural University, Mymensingh. In this study conducted morphological characteristics of Black Bengal goats which related to different body measurements which is founded by Rahman *et al.* (2007).

Faruque *et al.* (2010) used 120 does of different generations (70=foundation stock, 45=First generation and 5=Second generation) and 20 bucks (15=Foundation stock and 5=First generation) to study the genetic parameters of Black Bengal goat on reproductive traits. Under intensive and semi-intensive condition goats were reared and bred naturally. In the Bangladesh Livestock Research Institute established a Nucleus-breeding flock of selected Black Bengal goats for conservation and improvement of the breed. The study reported that the average birth weight of Black Bengal goat were 1.49 ± 0.13 kg and 1.28 ± 0.11 kg respectively for intensive and semi-intensive rearing system.

Jalil *et al.* (2016) conducted the study to evaluate the productive and reproductive performances of Black Bengal goat (BBG) under farming condition. From Bangladesh Livestock Research Institute (BLRI) goat research farm from 2006 to June 2013 data were collected. All animals were maintained mostly under intensive management. Average birth weight of Black Bengal goat was reported in this experiment at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were 1.18 ± 0.02, 1.22 ± 0.02 and 1.23 ± 0.03 kg respectively. Average birth weight of Black Bengal goat at $generation_o$, $generation_1$ and $generation_2$ were 1.24±0.01, 1.33±0.02 and 1.32±0.04 kg respectively. This results showed that, there need to be improved for production in spite of having promising prolificacy and breeding and reproductive efficiency of Black Bengal goats.

The study was taken to evaluate reproductive performances. The data was collected from different parts of Bangladesh. In this study the goats are kept under semi-intensive management and vaccinated, drenched with anthelmentics. Different physiological productive and reproductive data of breed were recorded. The average birth weight of male and female Black Bengal goats were 1.24 ± 0.036 kg and 1.19 ± 0.128 kg respectively which is reported by S. A. Chowdhury *et al.* (2002). He showed that at low feeding system birth weight of male and female kids of Black Bengal goat respectively were 1.20±0.032 and 1.20±0.102 kg and at high feeding system birth weight were 1.46±0.059 and 1.27±0.227 kg respectively of male and female kids of

Black Bengal goat. He also found that the birth weight of male kids at 1$^{st}$, 2$^{nd}$, 3$^{rd}$ and 4$^{th}$ parity were 1.14±0.048, 1.33±0.053, 1.20±0.058 and 1.48±0.075 kg respectively and for female kids the birth weight at 1$^{st}$, 2$^{nd}$, 3$^{rd}$ and 4$^{th}$ parity were respectively 1.05±0.151, 1.40±0.170, 1.16±0.192 and 1.38±0.288 kg.

Paul *et al.* (2014) reported that the average birth weight of kids with the effect of parity, season, sex, type of birth in three different regions of Bangladesh. The average birth weight in Nucleus breeding flock, Modhupur, and Dimla were 1.09 ± 0.27, 1.09 ± 0.25, and 1.10 ± 0.27 kg. The experiment was conducted in a nucleus breeding flock of Bangladesh Agricultural University, Modhupur and Dimla to know the productive and reproductive parameters of Black Bengal goat and data was collected from January 2011 to January 2012.

The experiment was conducted at Rajshahi district in Bangladesh on Black Bengal goat under semi-intensive and extensive condition. The data was collected from about 200 Black Bengal goats which were reared under semi-intensive and extensive conditions. The goats were selected on the basis of age, weight, confirmation and body shape. Jahid *et al.* (2015) reported that the average body weight in semi-intensive and extensive condition of Black Bengal goat at birth was 1.28 ± 0.11 and 1.25 ± 0.10 kg respectively which is differ with season. Under both conditions body weight at birth of male higher than female. The study is also showed that the birth weight at season 1 (March to June), season 2 (July to October) and season 3 (November to February) were 1.36±0.10, 1.38±0.18 and 1.15±0.14 kg respectively.

Paul *et al.* (2011) observed birth weight at 1$^{st}$ day was 1.08 ± 0.06 kg. This study was performed for characterization of Black Bengal bucks and does. About 50 goats were observed for experiment at different aged for measuring heart girth, body length, wither height, hip height, fore and hind leg length, head length and width, head length and width, ear length and ear breath, scrotal length and scrotal circumference. Body weight of Black Bengal goat has a positive relation with heart girth, body length and height at wither. All parameters are higher in male than female in this study.

Islam *et al.* (2016) reported that the average birth weight of female and male kid of Black Bengal goat were 1.35 ± 0.06 kg and 1.65 ± 0.10 kg respectively. In this study data were collected from rural villages of Mymensingh sadar upazilla under Mymensingh district in Bangladesh. The

Black Bengal goats reared in semi-intensive condition and farmers provide green grass with concentrates once in a day with bedding materials at winter season.

In this study Haque *et al.* (2013) showed that the average litter weight was 1.74 ± 0.06 kg in Modhupur and 1.48 ± 0.02 kg in Dimla. Progeny tested Black Bengal does and bucks were used as parents for reproductive performance. Black Bengal Breeding does were reared in semi-intensive rearing system at different flock. For the improvement of the reproductive potentials of Black Bengal goat through artificial insemination by using progeny tested bucks. The low heritability of reproductive traits indicated that progeny testing selection will be beneficial to the farmers and fulfill their demand by providing best sires of high genetic potential.

Akter *et al.* (2006) showed the average body weight at birth of Black Bengal goat was 0.96 ± 0.04, 1.02 ± 0.08 and 1.12 ± 0.11 kg at $1^{st}$, $2^{nd}$ and $3^{rd}$ generation respectively in selected group. In control groups average birth weight of $1^{st}$, $2^{nd}$ and $3^{rd}$ generation were 0.82 ± 0.01, 0.91 ± 0.02, 1.05 ± 0.03 kg respectively. The data was collected from some village around Bangladesh Agricultural University. Three generations were selected for data collection. Among them two groups were maintained simultaneously as selected and control group.

Gous Miah *et al.* (2016) collected the data from the selected areas of Cox's Bazar and Chittagong district of Bangladesh on productive and reproductive traits. The data were collected on Black Bengal and Jamnapari goats respectively of those areas. The average birth weight of Black Bengal and Jamnapari goat was 956.13±19.72 and 1776.56±75.13 gms respectively which reared under semi-intensive system.

Khan *et al.* (2013) accumulate the data to know the live weight gain of goats under semi-intensive conditions of Chittagong district of Bangladesh from July 2012 to January, 2013. The information for the experiment was collected from 72 black Bengal and 32 Jamunapari goats and the kids birth weight and their subsequent live weight at weekly intervals up to age. The weight of weaning at sexual maturity was also recorded. Under 2 different farms the weight gains from birth to sexual maturity of two different breeds were studied. The average birth weight of male and female black Bengal goats kids were respectively 1.22±0.15, 1.01±0.14 kg for farm 1 and 1.42±0.10 and 1.12±0.27 kg respectively of male and female for farm 2. The average birth

weight were 1.51±0.07 and 1.42±0.09 kg, for male and females Jamunapari respectively in the farm 2.

Hasan *et al.* (2014) conducted the experiment at rural areas in Bangladesh to investigate the effect of housing system on reproductive traits. About 200 Black Bengal goat were selected which reared under semi-intensive and extensive conditions. In this experiment reported that under semi-intensive condition give better reproductive performances than extensive housing system in Black Bengal goat at rural areas in Bangladesh. The average birth weight of Black Bengal goat was 1.86±0.02 kg and 1.66±0.09 kg under semi-intensive and extensive housing system respectively.

Kabirul *et al.* (2013) collected the data from the research farm of Chittagong Veterinary and Animal Sciences University, Bangladesh. About 16 Black Bengal goat and 3 buck were collected from village and village market. After purchasing goats were kept in quarantine shed for 15 days. The study reported about productive and reproductive performance of Black Bengal goat under two feeding system. The body weight of kids increased faster than mature age. In this experiment goats were reared with 5 to 6 hours grazing and whole goats were divided into 2 groups with 6 goats in each group such as group A and B. The average birth weight in group A of male and female Black Bengal goats were 1.90±0.32 and 1.63±0.29 kg respectively. In group B, the average birth weight of female Black Bengal goats was 1.70±0.18 kg.

The aim of the experiment was to investigate genetic and phenotypic parameters for some reproductive traits of Black Bengal goats. The data for this study was collected from Nucleus Breeding Flock of Bangladesh Agricultural University. Mia *et al.* (2013) reported that the average litter weight at birth 1.58 kg. The study also showed that litter weight at birth in 1st, 2nd and 3rd parity were respectively 1.25±0.09, 1.69±0.13 and 2.05±0.17 kg. The litter weight at winter, summer and rainy season respectively were at birth 1.77±0.12, 1.64±0.09, 1.41±0.18 kg.

Halim *et al.* (2011) reported that the average birth weight of Black Bengal goats at moderate and ultra-poor households system was 0.93±0.026 kg. The aim of the study to evaluate the reproductive and productive performances of Black Bengal goats. For this experiment goats were reared by moderate and ultra-poor households system. The data was collected from three different districts of Bangladesh. About 12 moderate and 12 ultra-poor households were selected

for data collection. For rearing of bucks for breeding of the does three separate ultra poor households were selected of the study areas. It also reported that the birth weight of Black Bengal goats at herd size 1, 2 and 3 under moderate household system were 1.07, 0.97 & 0.85 kg and at ultra poor household system were 0.97, 0.89 & 0.83 kg respectively.

**2.5 Body weight at weaning**

Islam *et al.* (2009) the experiment was done to investigate and compare the growth, milk production and reproductive performances of Black Bengal goat under semi-intensive production (IP) and scavenging production (SP) system. In this study goats were grouped into two having 3 in each group. Six hours grass was supplied with concentrate and roughage for IP group and landless farmer as scavenging system maintained for SP group. The study was reported that the average body weight at weaning under IP and SP system were 5.43 ± 0.05 kg and 4.17 ± 0.03 kg respectively. Weaning weight was higher in IP than SP group.

Jalil *et al.* (2016) observed that the weaning weight were 5.15±0.37 kg in first generation (G1), in second generation (G2) 5.34±0.16 kg, 4.87±0.39 kg in third generation (G3) and 4.17±0.14 kg in foundation stock (G0) with average mean 4.88±0.07 kg. The experiment was undertaken to evaluate the productive and reproductive performances of Black Bengal goat (BBG) under farming condition from Bangladesh Livestock Research Institute (BLRI) goat research farm from 2006 to June 2013. All animals were maintained mostly under intensive management. This result showed that, there need to be improved for production in spite of having promising prolificacy, breeding and reproductive efficiency of Black Bengal goats.

Islam *et al*. (2016) reported that the weaning weight of female and male kids of Black Bengal goat were 5.02±0.12 kg and 5.49±0.14 kg respectively. The study was done at Beltoli and Sobagia villages under Sadar upazila of Mymensingh district using pre-structured questionnaire through door to visit. The Black Bengal goats reared in semi-intensive condition and farmers provide green grass with concentrates once in a day with bedding materials at winter season.

Paul *et al.* (2011) observed body weight at weaning period (at 3 months) was 5.22±0.33 kg. In this study was performed for characterization of Black Bengal bucks and does. About 50 goats were observed for experiment at different aged for measuring heart girth, body length, wither

height, hip height, fore and hind leg length, head length and width, head length and width, ear length and ear breath, scrotal length and scrotal circumference. All parameters are higher in male than female in this study.

The study was reported that the average body weight at weaning period (at 3 months) of Black Bengal goat was 4.26 ± 0.25 kg. This experiment was done at the Artificial Insemination Center, Bangladesh Agricultural University, Mymensingh. In this study conducted morphological characteristics of Black Bengal goats which related to different body measurements which is reported by Rahman *et al*. (2007*)*.

Khan *et al.* (2013) collected the data to know the live weight gain of goats under semi-intensive conditions of Chittagong district of Bangladesh from July 2012 to January, 2013. Under 2 different farms the weight gains from birth to sexual maturity of two different breeds were studied. In this reported that the average weaning age was 4 months and the average weaning weight of male and female black Bengal goats were respectively 5.19±0.358, 5.05±0.28 kg in farm 1 and 5.63±0.61 and 5.54±0.41 kg of male and female in the farm 2 respectively. However, the average weaning weight of male and female Jamunapari was 6.59±0.69 and 6.79±0.31 kg, respectively in farm 2 which was higher than black Bengal.

The study was taken to evaluate reproductive performances. The data was collected from different parts of Bangladesh. In this study the goats are kept under semi-intensive management and vaccinated, drenched with anthelmentics. Different physiological productive and reproductive data of breed were recorded. The average weaning age 90 days and weaning weight of Black Bengal goats at low feeding and high feeding were 3.76 ± 0.032 kg and 9.50 ± 0.81 kg respectively which is founded by S. A. Chowdhury *et al.* (2002). He also reported that total litter weight at weaning of Black Bengal goat at $1^{st}$, $2^{nd}$, $3^{rd}$ and $4^{th}$ parity were respectively 2.59±0.484, 4.39±0.554, 5.36±0.609 and 9.13±0.941 kg.

Akter *et al*. (2006) collected the data from some village around Bangladesh Agricultural University. Three generations were selected for data collection. Among them two groups were maintained simultaneously as selected and control group. The average weaning age is 3 months and in this experiment showed that the average weaning weight in selected groups of Black Bengal goat was 4.99 ± 0.15, 4.64 ± 0.33 and 4.07 ± 0.42 kg at $1^{st}$, $2^{nd}$ and $3^{rd}$ generation

respectively. In control groups average weaning weight of $1^{st}$, $2^{nd}$ and $3^{rd}$ generation were 4.38± 0.13, 4.39 ± 0.27, 3.99 ± 0.47 kg respectively.

Halim *et al.* (2011) founded the average weaning weights of kids at 3 months of age in herd size-1, 2 and 3 were 5.20, 4.92 and 4.33 kg, respectively. It also found that weaning weight of Black Bengal goats was 6.56 kg for intensive and semi-intensive system. The experiment was conducted to investigate the reproductive and productive performances of Black Bengal goats which reared by moderate and ultra-poor households at three different districts of Bangladesh from March 2008 to June 2009. Adequate nutrition malnutrition, poor hygienic management and inadequate health status of doe influence low weaning weight. He also reported that the average weaning weight for herds of all sizes was 4.82±0.525 kg.

Kabirul *et al.* (2013) collected the data from the research farm of Chittagong Veterinary and Animal Sciences University, Bangladesh. About 16 Black Bengal goat and 3 buck were collected from village and village market. After purchasing goats were kept in quarantined shed for 15 days. The study reported about productive and reproductive performance of Black Bengal goat under two feeding system. The body weight of kids increased faster than mature age. In this experiment goats were reared with 5 to 6 hours grazing and whole goats were divided into 2 groups with 6 goats in each group such as group A and B. The average body weight at 120 days age in group A of male and female Black Bengal goats were 7.00±0.254 and 5.50±0.71 kg respectively. In group B, the average body weight at 120 days age of female Black Bengal goats was 5.68±0.31 kg.

Mia *et al.* (2013) reported that the average litter weight at weaning 6.37 kg. Parity effect was significant of doe for litter weight at birth, litter weight at weaning, litter size at birth and litter size at weaning. The aim of the experiment was to investigate genetic and phenotypic parameters for some reproductive traits of Black Bengal goats. The data for this study was collected from Nucleus Breeding Flock of Bangladesh Agricultural University.

**2.6 litter size**

The data was collected by Akter *et al.* (2006) from some village around Bangladesh Agricultural University. Three generations were selected for data collection. Among them two groups were

maintained simultaneously as selected and control group. This experiment showed that the average litter size of Black Bengal goat was 2.10±0.13 and 1.93±0.15 at selected & control group respectively.

Faruque *et al.* (2010) used 120 does of different generations (70=foundation stock, 45=First generation and 5=Second generation) and 20 bucks (15=Foundation stock and 5=First generation) to study the genetic parameters of Black Bengal goat on reproductive traits. Under intensive and semi-intensive condition goats were reared and bred naturally. The study reported that the average litter size of Black Bengal goat was 1.5 ± 0.16 and 1.06 ± 0.13 respectively for intensive and semi-intensive rearing system. In this study also showed that at season 1 (March to June), season 2 (July to October), season 3 (November to February) litter size were 1.37±0.1, 1±0.23, 1±0.17 respectively.

Gous Miah *et al.* (2016) at this study data was collected from the selected areas of Cox's Bazar and Chittagong district of Bangladesh on productive and reproductive traits. The data were collected on Black Bengal and Jamnapari goats respectively of those areas. The average litter size of Black Bengal and Jamnapari goat was 2.13±0.102 and 1.59±0.109 respectively which reared under semi-intensive system.

In this study Haque *et al.* (2013) showed that the average litter size was 1.53±0.06, 1.45±0.09, 1.40±0.20 respectively in BAU, Modhupur and Dimla. In this experiment also reported that the litter size at 1$^{st}$, 2$^{nd}$& 3$^{rd}$ parity were respectively 1.33±0.04, 1.54±0.07 & 1.77±0.09. The average litter size at winter, summer and rainy were 1.54±0.10, 1.47±0.08, 1.52±0.14 respectively.

Hasan *et al.* (2014) conducted the experiment at rural areas in Bangladesh to investigate the effect of housing system on reproductive traits. About 200 Black Bengal goat were selected which reared under semi-intensive and extensive conditions. In this experiment reported that under semi-intensive condition give better reproductive performances than extensive housing system in Black Bengal goat at rural areas in Bangladesh. Under semi-intensive condition, litter size at 1$^{st}$, 2$^{nd}$ and 3$^{rd}$ parity were respectively 1.06±0.13, 1.76±0.12 and 1.96±0.12. This study also reported that under extensive condition the litter size at 1$^{st}$, 2$^{nd}$ and 3$^{rd}$ parity were 1.01±0.10, 1.62±0.12 and 1.75±0.11 respectively.

The aim of the experiment was to investigate genetic and phenotypic parameters for some reproductive traits of Black Bengal goats. The data for this study was collected from Nucleus Breeding Flock of Bangladesh Agricultural University. Mia *et al.* (2013) reported that the average litter size at birth and weaning were 1.50 and 1.29 respectively. The study also showed that litter size at birth at 1st, 2nd and 3rd parity were respectively 1.37±0.07, 1.52±0.10, 1.84±0.14 and at weaning at 1st, 2nd and 3rd parity were 1.04±0.09, 1.12±0.12, 1.21±0.17 respectively. The litter size at winter, summer and rainy season respectively were at birth 1.54±0.10, 1.47±0.08, 1.52±0.14 and at weaning 1.27±0.19, 1.04±0.16 & 0.81±0.23.

Hossain *et al.* (2004) reported that average litter production at birth of Black Bengal goat was 1.22±0.13, 1.79±0.13 & 2.03±0.13 days at 1st, 2nd and 3rd parity respectively. The study is showed that effect of parity on litter size and litter size at 1st, 2nd and 3rd parity were 1.08±0.11, 1.76±0.12 and 1.96±0.12 respectively. The study was done to investigate the production and reproductive performance of Black Bengal goat in different parity which reared in semi intensive system. The female goats were selected from Goat Development Farm Savar, Dhaka on the basis of their phenotypic characteristics and their ancestral history.

The study was taken to evaluate reproductive performances. The data was collected from different parts of Bangladesh. In this study the goats are kept under semi-intensive management and vaccinated, drenched with anthelmentics. Different physiological productive and reproductive data of breed were recorded. The litter production of Black Bengal goat at birth was 1.69±0.061 and 2.67±0.132 respectively under low feeding and high feeding which showed by S. A. Chowdhury *et al.* (2002). This experiment also reported that average litter size at 1st, 2nd, 3rd and 4th parity were respectively 1.29±0.070, 1.71±0.079, 1.87±0.087 and 2.17±0.119 kids.

Paul *et al*. (2014) reported that the average litter size of does with the effect of parity, season, sex, type of birth in three different regions of Bangladesh. The average litter size in Nucleus breeding flock at 1st, 2nd and 3rd parity were 1.37± 0.07, 1.52± 0.10 and 1.84±0.14 respectively. In Modhupur area the average litter size at 1st, 2nd and 3rd parity were 1.50±0.07, 1.47±0.02 and 1.81±0.11 respectively. In Dimla area the average litter size at 1st, 2nd and 3rd parity were 1.54±0.05, 1.49±0.05 and 1.92±0.14 respectively. In this experiment also showed the effect of

season in litter size of does. The litter size in Nucleus breeding flock at winter, summer and rainy season were 1.54± 0.10, 1.47± 0.08 and 1.52±0.14 respectively. In Modhupur area the average litter size at winter, summer and rainy season were 1.51±0.02, 1.47±0.08 and 1.56±0.04 respectively. In Dimla area the average litter size at winter, summer and rainy season were 1.61±0.07, 1.67±0.07 and 1.66±0.09 respectively. The experiment was conducted in a nucleus breeding flock of Bangladesh Agricultural University, Modhupur and Dimla to know the productive and reproductive parameters of Black Bengal goat and data was collected from January 2011 to January 2012.

Jalil *et al. (*2016) the study was conducted to evaluate the productive and reproductive performances of Black Bengal goat (BBG) under farming condition. Average litter size of Black Bengal goat was reported in this experiment at 1st, 2nd and 3rd parity were 1.31±0.04, 1.81±0.06 and 2.05±0.08 respectively. Average litter size of Black Bengal goat at generation$_o$, generation$_1$ and generation$_2$ were 1.89±0.04, 1.70±0.57 and 1.67±0.13 respectively. The results showed that, there need to be improved for production in spite of having promising prolificacy and breeding and reproductive efficiency of Black Bengal goats.

The experiment was conducted at Rajshahi district in Bangladesh on Black Bengal goat under semi-intensive and extensive condition. The data was collected from about 200 Black Bengal goats which were reared under semi-intensive and extensive conditions. The goats were selected on the basis of age, weight, confirmation and body shape. Jahid *et al.* (2015) reported that in this study the average litter size in semi-intensive and extensive condition of Black Bengal goat was 1.06±0.13 and 1.01±0.10 respectively which differ with season. Under both conditions body weight at birth of male higher than female. The study also reported that litter size at 1st, 2nd and 3rd parity were 1.06±0.13, 1.76±0.12 & 1.96±0.12 respectively under semi-intensive condition and under extension condition the average litter size were respectively 1.01±0.10, 1.62±0.12 and 1.75±0.11. The study is also showed that the litter size at season 1(March to June), season 2 (July to October) and season 3 (November to February) were 1.37±0.11, 1.00±0.23 and 1.00±0.17 respectively.

Hamed *et al.* (2009) showed that the litter size of Zaraibi goat at March and October were 2.21±0.02 and 2.13±0.02 at birth respectively and at weaning period litter size were 1.61±0.02 and 1.67±0.03 respectively. In this study also reported that the litter size at birth at 1st, 2nd and 3rd

parity were 1.92±0.02, 2.14±0.02 and 2.25±0.03 respectively. At weaning period the litter size at 1st, 2nd and 3rd parity were 1.39±0.03, 1.64±0.03 and 1.75±0.03 respectively. The data collection was conducted for the experiment from EL-Serw station which is located in the north eastern part of the Nile Delta, Egypt belonging to Animal Production Research Institution to estimate genetic parameter of Zaraibi goats.

The aim of the study to evaluate the reproductive and productive performances of Black Bengal goats. For this experiment goats were reared by moderate and ultra-poor households system. The data was collected from three different districts of Bangladesh. About 12 moderate and 12 ultra-poor households were selected for data collection. For rearing of bucks for breeding of the does three separate ultra poor households were selected of the study areas. Halim *et al*. (2011) reported that the average litter size of Black Bengal goats at moderate and ultra-poor households system was 1.68±0.001. It also reported that the litter size at herd no. 1, 2 and 3 under moderate household system were 1.77, 1.83 & 1.72 and ultra poor household system were 1.59, 1.68 & 1.51 kids respectively.

Faruque *et al.* (2002) selected sixty three farmers from land-less and small category were selected. For data collection three genetic groups such as Jamunapari × Black Bengal goat, selected Black Bengal goat male × selected Black Bengal goat female and random Black Bengal goat were selected. The goats were rearing at extension household system with no extra inputs except grazing from morning to evening. In this study showed that the average litter size of Jamunapari × Black Bengal goat, selected Black Bengal goat male × selected Black Bengal goat female and random Black Bengal goat were respectively 1.15±0.07, 1.29±0.07 and 1.11±0.07 kids.

## 2.7 Gestation period

Faruque *et al.* (2010) used 120 does of different generations (70=foundation stock, 45=First generation and 5=Second generation) and 20 bucks (15=Foundation stock and 5=First generation) to study the genetic parameters of Black Bengal goat on reproductive traits. Average gestation length observed in this trial was 143.33+0.68 days. The study reported that the average gestation period of Black Bengal goat was 143.0±1.71 and 142.8±1.4 days respectively for intensive and semi-intensive rearing system.

In this study Haque *et al.* (2013) showed that the average the gestation length was 145.34 days. Progeny tested Black Bengal does bucks were used as parents for reproductive performance. In this study Black Bengal breeding does were reared in semi-intensive rearing system at different flock.

Bhowmik *et al.* (2014) conducted the study to know the reproductive performance of Jamunapari, Black Bengal and crossbred goats in Chittagong district from May to December 2012. The data were collected from 324 goats for productive and reproductive traits. The average gestation period of Jamunapari, Black Bengal and crossbred goats were 151.71 ± 8.19, 146.72 ± 7.61 and 147.85 ± 7.74 days respectively.

Gous Miah *et al.* (2016) collected the data from the selected areas of Cox's Bazar and Chittagong district of Bangladesh on productive and reproductive traits. The data were collected on Black Bengal and Jamnapari goats respectively of those areas. The average gestation period of Black Bengal and Jamnapari goat was 147.90±0.25 and 150.88±4.7 days respectively which reared under semi-intensive system.

Hossain *et al.* (2004) reported that average gestation length of Black Bengal goat was 148, 147 & 149 days at $1^{st}$, $2^{nd}$, $3^{rd}$ parity respectively. The study was done to investigate the production and reproductive performance of Black Bengal goat in different parity which reared in semi intensive system. The female goats were selected from Goat Development Farm Savar, Dhaka on the basis of their phenotypic characteristics and their ancestral history.

The study was taken to evaluate reproductive performances. The data was collected from different parts of Bangladesh. In this study the goats are kept under semi-intensive management and vaccinated, drenched with anthelmentics. Different physiological productive and reproductive data of breed were recorded. The gestation period of Black Bengal goat at $1^{st}$, $2^{nd}$, $3^{rd}$ and $4^{th}$ parity was 146, 147, 142 and 146 days respectively which is reported by S. A. Chowdhury *et al.* (2002). This study also reported that the gestation period was 144±1.75 and 146±2.53 days respectively under low and high feeding system.

Faruque *et al.* (2002) selected sixty three farmers from land-less and small category. For data collection three genetic groups such as Jamunapari × Black Bengal goat, selected Black Bengal

goat male × selected Black Bengal goat female and random Black Bengal goat were selected. The goats were rearing at extension household system with no extra inputs except grazing from morning to evening. In this study showed that the average gestation period of Jamunapari × Black Bengal goat, selected Black Bengal goat male × selected Black Bengal goat female and random Black Bengal goat were respectively 142.06±0.32, 143.10±0.24 and 143.22±0.24 days.

Jalil *et al.* (2016) conducted the study to evaluate the productive and reproductive performances of Black Bengal Goat (BBG) under farming condition. From Bangladesh Livestock Research Institute (BLRI) goat research farm data were collected from 2006 to June 2013. All animals were maintained mostly under intensive management. Average gestation length was 142.45±0.31 days. This results showed that, there need to be improved for production in spite of having promising prolificacy, breeding and reproductive efficiency of Black Bengal goats.

Kabirul *et al.* (2013) collected the data from the research farm of Chittagong Veterinary and Animal Sciences University, Bangladesh. About 16 Black Bengal goat and 3 buck were collected from village and village market. After purchasing goats were kept in quarantined shed for 15 days. The study reported about productive and reproductive performance of Black Bengal goat under two feeding system. The body weight of kids increased faster than mature age. In this experiment goats were reared with 5 to 6 hours grazing and whole goats were divided into 2 groups with 6 goats in each group such as group A and B. The average gestation period of Black Bengal goat in group A 149.00±2.00 days. In group B, the average gestation period of Black Bengal goats was 148±3.50 days.

The aim of the experiment was to investigate genetic and phenotypic parameters for some reproductive traits of Black Bengal goats. The data for this study was collected from Nucleus Breeding Flock of Bangladesh Agricultural University. Mia *et al.* (2013) reported that the average gestation period was 144.71 days. The study also showed that gestation period in 1st, 2nd and 3rd parity were respectively 144.26±1.01, 145.07±1.17 and 143.25±1.61 days. The gestation period at winter, summer and rainy season respectively were 144.55±1.12, 144.80±1.12 and 143.23±1.90 days.

The aim of the study to evaluate the reproductive and productive performances of Black Bengal goats. For this experiment goats were reared by moderate and ultra-poor households system. The

data was collected from three different districts of Bangladesh. About 12 moderate and 12 ultra-poor households were selected for data collection. For rearing of bucks for breeding of the does three separate ultra poor households were selected of the study areas. Halim *et al.* (2011) reported that the average gestation period of Black Bengal goats at moderate and ultra-poor households system was 145.61±2.17 days. It also reported that the gestation period at herd no. 1, 2 and 3 under moderate household system were 141.00, 144.67 and 147.67 days and ultra poor household system were 144.33, 147 and 149 days respectively.

# CHAPTER 3

# MATERIALS AND METHODS

Methodology is an important elements in a scientific research. Methodology of any study helps the researcher to accumulate the valid and reliable information to analyze the results and to arrive at appropriate decisions. Following methods and procedures is followed in this study have been discussed in this chapter. This study was conducted under the Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University (SAU), Dhaka, with the financial support of the Sher-e-Bangla Agricultural University Research System (SAURES) in a project. The title of the project was "Performance traits study of Black Bengal goat in Savar Upazilla in Dhaka district."

## 3.1 Experiment site and period

The data of the experiment was collected during July 2017 to June 2018, through door to door visit of farmers' house in village at Savar, Dhaka of Bangladesh. Information on reproductive performances, i.e. body weight at birth, body weight at weaning, gestation period, litter size at birth and weaning was collected from some villages namely Kalma, Uttar Kalma, Adorshagram, Anakali and Dusaed of Savar Upozilla. These information is related to this study were collected with direct contact of farmers. The study area is presented Figure 1.

## 3.2 Selection of experimental goats

Black Bengal goats were selected for data collection which were reared under extensive rearing system.

**Figure 1: Map showing the study area in Savar Upazilla**

## 3.3 Management of goats

Most of the farmers, goats were reared under extensive condition. They provide small place for stay night or in adverse climate or for rest. Some farmers made their goats house with galvanized iron sheet with wooden floor. Some farmers provide bamboo, straw or polythin sheet to make house for their goats. At winter season they provided some bedding materials e.g. rice straw, rice bran etc. About 8-10 goats kept in one shed. There was no separate shed for male or female and for kids of black Bengal goats. The goat was allowed to graze in the field. Sometimes goats are tethered by rope at road side or suitable pasture land of the farmers. Sometimes they supplied some concentrates like broken rice, banana residues and also provided green grass, tree leaves such as mango leaves, jack fruits leaves banana leaves and household residues etc. Kids are fed milk from their dam up to weaning. All does were naturally mated. At the end of estrus the goats were allowed for natural service. During pregnancy period, the owner gives extra concern for kids and proper care for both mother and kids after birth. Tubewell is the major source of drinking water for their goats. Little bit green grass and more concentrates feeds were supplied to

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their pregnant animals. During rainy season farmers provide green grass or tree leaves by cutting at their stall. In extensive system they allowed their goats of feeding naturally from natural available feeds in day times and kept confinement in night. The bio-security system was not strictly maintain. Some farmers are aware but most of them do not follow that. Village farmers are not careful with their goat for treatment and feeding management. So that they are mostly faced with PPR, fever, coughing, diarrhea, naval infection, kid mortality etc. Few farmers vaccinated and dewormed their goats. Treatment of their goats when disease was prevailed. The goats were dewormed with broad spectrum anthelmintics twice in a year. Sometimes anti-diaorrheal drug and saline also used for their goats. The performance of goats were better if farmer gives more attention about care, health, feeding and breeding management of goats.

## 3.4 Requirements for data collection

An interview schedule was used for data collection with objectives of the study. In English version, copy of interview schedule has been given in Appendix-1. A digital weight balance was also used for measuring body weight.

## 3.5 Methods of data collection

In the study areas farmers' house was selected for data collection by visiting door to door. Direct interview method was used for collection of information. Collected information from goats' owners were recorded on pre-structured questionnaire. These traits which were considered in the study were:

**3.5.1 Body weight at birth:** The body weight which were recorded within 24 hours of birth is called body weight at birth. The data was collected by digital weighing balance and recorded in the data sheet. In the analysis were included those kids only who remained alive.

**3.5.2 Body weight at weaning:** The weaning period is that period when kids separated from milk of their dam. Milk provides until 84 to 112 days. During weaning period body weight were recorded and include in data sheet.

**3.5.3 Litter size at birth:** Litter size means the number of kids which born per birth per doe. It may be occurred in single, twin or triplet or quadrate. During birth count the number of kids and recorded in the data sheet.

**3.5.4 Litter size at weaning:** At the weaning stage the total number of kids alive remain per doe is called litter size at weaning. The total number of kids were counted and recorded in the data sheet.

**3.5.5 Gestation period:** Gestation period is also known as pregnancy period. Gestation period is the time in which a fetus develops, beginning with fertilization and ending at birth. The period from conception to parturition.

**3.5.6 Parity:** Parity is the number of times that does had kidded. Parity of dam can be grouped into first, second, third and fourth or fifth. First parity of dam means when dam gives birth first time then called first parity of dam. In this study first, second and third parity of dam is counted for data analysis. Parity effect on reproductive performance of goats.

**3.5.7 Season:** A year is divided into three seasons such as winter (from November to February), summer (from March to June) and rainy (from July to October). Season also effect on reproductive performance of goats.

### 3.6 Statistical analysis

For analysis of the collecting data were coded and entered in Microsoft Excel Worksheet. Duncan test was performed to see the significant differences among mean values. For Statistical analyses considering parity of dam and season of birth, simple ANOVA was performed by using Statistical Analysis System (SAS, 1998) according to the following model:

$Y_{ijk} = \mu + S_i + M_j + E_{ijk}$

Where:

$Y_{ijk}$: the dependent variable.

$\mu$: the overall mean.

$S_i$: the fixed effect of $i^{th}$ parity.

M$_j$: the fixed effect of j$^{th}$ season.

E$_{ijk}$: the residual error.



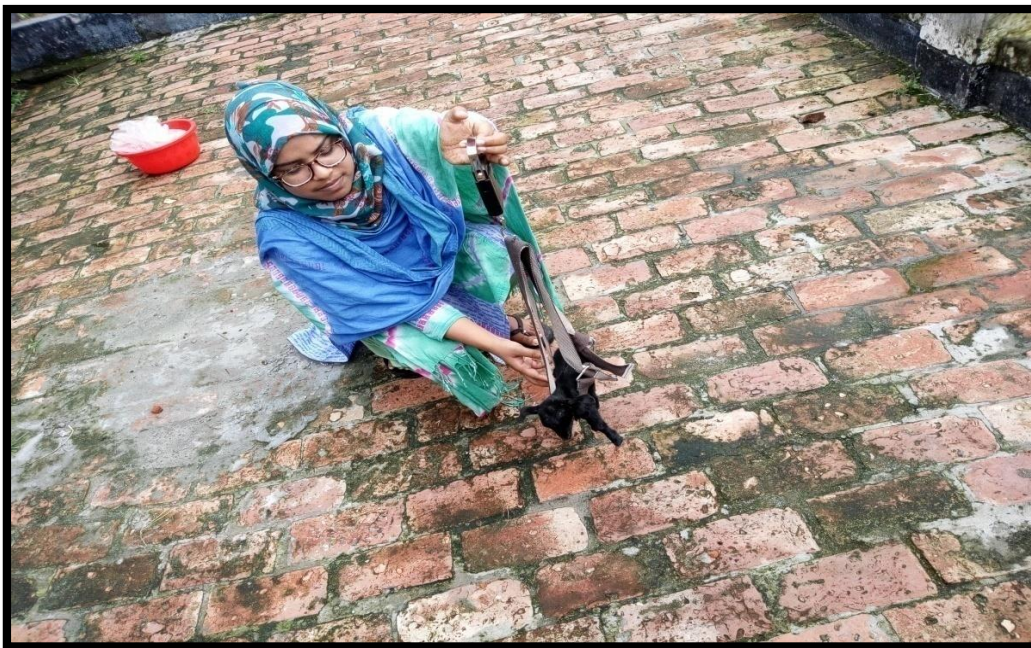**Plate 1: Weight balance for measuring body weight.**



**Plate 2: Body weight at birth measuring of kids.**

**Plate 3: Body weight measuring of Black Bengal goat.**



**Plate 4: Housing system of Black Bengal goat in village.**

# CHAPTER 4

# RESULTS AND DISCUSSION

Reproductive traits of Black Bengal goat was measured such as body weight at birth, body weight at weaning, litter size at birth and weaning and gestation period which are presented in different Tables and Figures. The body weight at birth, body weight at weaning, litter size at birth and weaning and gestation period were affected by season and parity.

## 4.1 Body weight at birth

The average birth weight of Black Bengal goat is presented in Table 1. The body weight at birth was at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were 0.92±0.01, 0.99±0.01 and 0.97±0.01 kg respectively. Body weight at birth higher in $2^{nd}$ parity than $1^{st}$ parity and $3^{rd}$ parity. The birth weight was significantly ($p<0.05$) influenced by parity. The birth weight at $1^{st}$ parity and $2^{nd}$ parity which has significant different. Significantly difference of birth weight between $1^{st}$ parity and $3^{rd}$ parity of dam. But there is no difference of birth weight between $2^{nd}$ parity and $3^{rd}$ parity of dam. The body weight at birth was 0.92±0.01, 0.99±0.01 and 0.97±0.01 kg at winter, summer and rainy season respectively. The birth weight also significantly ($p<0.05$) affected by season. The birth weight higher in summer season than winter and rainy. The effect of parity and season is presented in Figure 2.

The body weight at birth in intensive management (1.49 kg) is higher than semi-intensive management system (1.28kg) showed by Faruque *et al.* (2010). The birth weight at present study for $1^{st}$, $2^{nd}$ and $3^{rd}$ parity are 0.92, 0.99 and 0.97 kg which is lower than the intensive (1.49 kg) and semi-intensive (1.28 kg) management system. The lower body weight at birth in the present study due to extensive management system, poor feeding, disease and poor breeding management. Some environmental factors also responsible for poor body weight at birth. Bhowmik *et al.* (2014) showed that the average birth weight of Jamnapari, Black Bengal goat and cross breed goats were 1.53±0.22, 0.89±0.09 and 1.29±0.20 kg respectively in which weight of Black Bengal goat lower than the present study. Almost similar result was reported by Faruque *et al.* (2016) for body weight at birth 1.05±0.04, 1.22±0.03 and 1.15±0.03 kg of male and 1.02±0.04, 1.05±0.03 and 1.11±0.03 kg of female kids respectively at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity.

**Table 1: Effect of different factors on body weight at birth of Black Bengal goat**

| Factors | Body weight at birth (kg) | |
|---|---|---|
| | No. of observation | LSM±SE |
| Parity of dam | | |
| First | 73 | 0.92[c]±0.01 |
| Second | 77 | 0.99[a]±0.01 |
| Third | 33 | 0.97[ab]±0.01 |
| Level of significance | | * |
| Season of kidding | | |
| Winter | 73 | 0.92[c]±0.01 |
| Summer | 76 | 0.99[a]±0.01 |
| Rainy | 33 | 0.97[ab]±0.01 |
| Level of significance | | * |

Means with different superscripts within each column and trait differ significantly *, ($p<0.05$), No: number, LSM: Least-squares means, SE: Standard error.

The result in the present study was lower than those of Hossain *et al*. (2004), Rahman *et al*. (2007), Faruque *et al*. (2010), Jalil *et al*. (2016) and Chowdhury *et al*. (2002). Halim *et al*. (2011) reported that there is a negative correlation between birth weight and litter size. Almost similar result with the present study which was observed by Halim *et al*. (2011). He was found the average birth weight of Black Bengal goat 0.93±0.026 kg at moderate and ultra-poor households system. Chowdhury *et al*. (2002) observed that the birth weight of male and female Black Bengal goat was respectively 1.24±0.036 kg and 1.19±0.128 kg which is higher than the present findings. Paul *et al*. (2014) was found the birth weight 1.09±0.27, 1.09±0.25 and 1.10±0.27 kg in Nucleus Breeding flock, Modhupur and Dimla which is almost similar to the present study. Jahid *et al*. (2015) reported the birth weight 1.28±0.11 kg in semi-intensive and 1.25±0.10 kg in extensive condition of Black Bengal goat which is higher than the present study. Paul *et al*. (2011) showed the positive correlation between body weight, heart girth, body length and height of wither. The result of present study is similar to Paul *et al.* (2011) was found birth weight

1.08±0.06 kg. Islam *et al*. (2016) observed average birth weight of female and male kid of Black Bengal goat 1.35±0.06 kg and 1.65±0.10 kg which is higher than this present findings. The result of this study lower may be due to extensive management include poor feeding and poor care management. The result in the present study was lower than those result of Haque *et al*. (2013), Khan *et al*. (2013) and Hasan *et al*. (2014). Kabirul *et al*. (2013) reported 1.70±0.18 kg birth weight which is higher than the average birth weight of present study. Mia *et al*. (2013) observed birth weight 1.25±0.09, 1.52±0.10 and 1.69±0.13 kg respectively 1st, 2nd and 3rd parity. The birth weight was found by Mia *et al*. (2013) which is higher than the present study. He collected the data from Nucleus Breeding Flock of Bangladesh Agricultural University. The variation of birth weight due to breed and genetic variation but largely variation due to environment specially nutrition and health (Devendra and Burns, 1983).
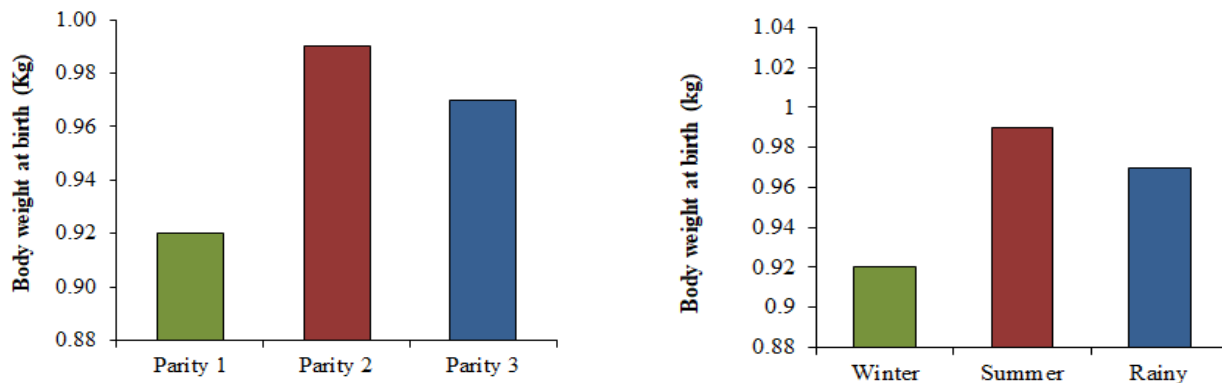


**Figure 2: Effect of parity and season on body weight at birth**

## 4.2 Body weight at weaning

Average body weight at weaning is presented in Table 2. There was no significant effect of parity on body weight at weaning. But there was statistically significant effect of season on body weight at weaning. The body weight at weaning were 5.12±0.06 kg, 5.03±0.05 kg and 4.97±0.06 kg at 1st, 2nd and 3rd parity respectively. At winter, summer and rainy season the body weight at weaning were 4.89±0.05 kg, 5.27±0.05 kg and 4.93±0.09 kg respectively. In this study showed that the weaning weight of Black Bengal goat was higher in summer season than others.

**Table 2: Effect of different factors on body weight at weaning of Black Bengal goat**

| Factors | Body weight at weaning (kg) | |
|---|---|---|
| | No. of observation | LSM±SE |
| Parity of dam | | |
| First | 66 | 5.12±0.06 |
| Second | 73 | 5.03±0.05 |
| Third | 44 | 4.97±0.06 |
| Level of significance | | NS |
| Season of kidding | | |
| Winter | 73 | 4.89[b]±0.05 |
| Summer | 76 | 5.27[a]±0.05 |
| Rainy | 33 | 4.93[b]±0.09 |
| Level of significance | | * |

Means with different superscripts within each column and trait differ significantly *, (p< 0.05), NS: non-significant, No: number, LSM: Least-squares means, SE: Standard error.

The lower weaning weight found at winter season due to disease, lacking of feed and management system etc. Islam *et al*. (2009) reported that the average weaning weight under semi-intensive production (IP) and scavenging production (SP) system were 5.43±0.05 kg and 4.17±0.03 kg respectively. In this study compare the weaning weight under different rearing system and showed that lower weaning weight at scavenging production system. The result of semi-intensive production system (5.43 kg) is almost similar with the present study. Under scavenging production system, the body weight (4.17 kg) which is lower than this findings. The body weight at weaning period of Black Bengal goat is lower than the finding of Rahman *et al*. (2007), Akter *et al*. (2006) and Halim *et al*. (2011). Chowdhury *et al*. (2002) evaluated the weaning weight at low and high feeding system was 3.76±0.032 kg and 9.50±0.81 kg respectively. The result of low feeding system (3.76 kg) which is lower than the present study (Table 2) and due to high feeding system (9.50 kg) at weaning period which is higher than this study (Table 2). Differences in body weight within breed are influenced partly by genetic factors

but largely variation due to environmental factors. Kabirul *et al.* (2013) found the body weight at weaning 7.00±0.254 and 5.50±0.71 kg respectively for male and female kids in group A and average weaning weight of female Black Bengal goats in group B was 5.68 kg which is similar with the present study. Mia *et al.* (2013) reported that average body weight at weaning 6.37 kg in which had significant effect of parity. The result of those were higher than the present study. This variation occurred due to age, nutritional status, management practice and genotype of buck etc. Jalil *et al.* (2016) observed the weaning weight of Black Bengal goat in different generation which is almost similar with the present study. Jalil *et al.* (2016) found the weaning weight of black Bengal goat were in generation$_1$, generation$_2$, generation$_3$ and generation$_0$ 5.15±0.37 kg, 5.34±0.16 kg, 4.87±0.39 kg and 4.17±0.14 kg respectively. Islam *et al.* (2016) showed the weaning weight of female and male kids of Black Bengal goats were 5.02±0.12 kg and 5.49±0.14 kg respectively. These results are almost similar with the present study. The findings of the present study strongly supported by the result of Paul *et al.* (2011) and Khan *et al.* (2013) who reported the almost similar result. The variation of body weight at weaning period due to management factors, feeding system, poor care, environmental stress etc. Although non-significant effect of parity on weaning weight of Black Bengal goat, significant ($p<0.05$) effect of season at weaning weight. There are significant difference between summer season showed significantly higher value (5.27 kg) than rainy (4.93 kg) and winter (4.89 kg) season. The effect parity and season in body weight at weaning is showed in Figure 3.
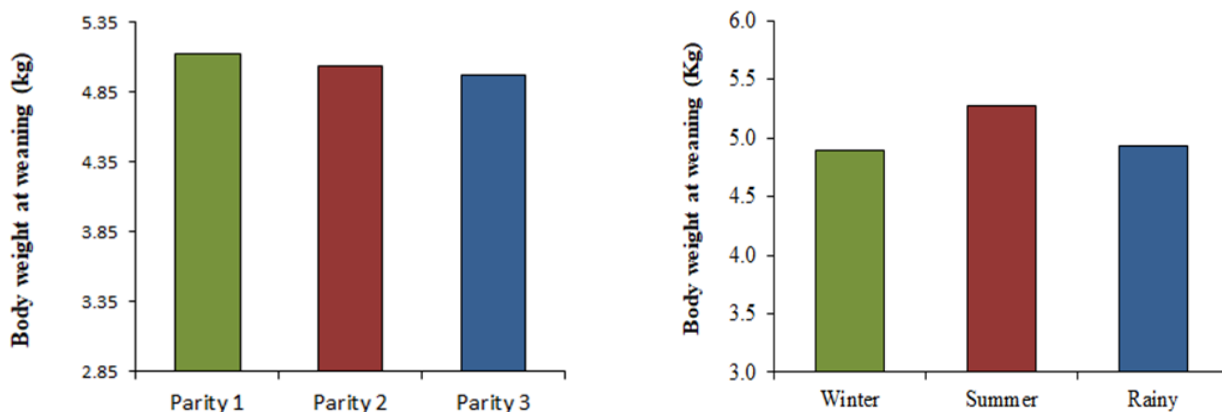


**Figure 3: Effect of parity and season on body weight at weaning**

## 4.3 Litter size

### 4.3.1 Litter size at birth

Litter size is major components to evaluate the ability of goat prolificacy. The average litter size at birth of Black Bengal goat were 1.21±0.06, 2.07±0.08 and 2.43±0.12 at 1st, 2nd and 3rd parity of dam respectively. Statistically highest litter size at birth was observed at 3rd parity (2.43) of dam. At winter, summer and rainy season the average litter size at birth of Black Bengal goat were 1.83±0.09, 1.80±0.09 and 1.75±0.14 respectively. There is no significant effect existed for season of kids even though highest litter size at birth were seen in winter. Parity of dam has highly significant (p< 0.01) effect on litter size at birth of Black Bengal goat. There is significant different between 1st parity (1.21) and 2nd parity (2.07). Between 1st parity (1.21) and 3rd parity (2.43) also have significant difference. Significantly different result showed between 2nd parity (2.07) and 3rd parity (2.43) of dam. Effect of different factors such as parity of dam and season at birth on litter size at birth of Black Bengal goat is presented in Table 3.

**Table 3: Effect of different factors on litter size at birth of Black Bengal goat**

| Factors | Litter size at birth (no.) | |
|---|---|---|
| | No. of observation | LSM±SE |
| Parity of dam | | |
| First | 66 | $1.21^c \pm 0.06$ |
| Second | 73 | $2.07^b \pm 0.08$ |
| Third | 44 | $2.43^a \pm 0.12$ |
| Level of significance | | ** |
| Season of kidding | | |
| Winter | 92 | 1.83±0.09 |
| Summer | 66 | 1.80±0.09 |
| Rainy | 24 | 1.75±0.14 |
| Level of significance | | NS |

Means with different superscripts within each column and trait differ significantly **, (p<0.01), NS: non-significant, No: number, LSM: Least-squares means, SE: Standard error.

Average litter size of Black Bengal goat was 2.10 and 1.93 at selected and control groups respectively reported by Akter *et al.* (2006) which is almost similar to the present study. Gous Miah *et al*. (2016) reported that the litter size of Black Bengal goat and Jamnapari goat was 2.13 and 1.59 respectively under semi-intensive system and average litter size 1.4 showed by Devendra and Burns (1983), and Amin *et al*. (2001) reported litter size 2.15 which is confirmed that the prolificacy of Black Bengal goat is high. The average litter size of Black Bengal goat has been reported by Faruque *et al*. (2010) 1.5 and 1.06 respectively for intensive and semi-intensive rearing system. Faruque *et al*. (2010) also reported that at winter (November to February), summer (March to June) and rainy (July to October) litter size were 1.0, 1.37 and 1.0 respectively which is lower than the present study. Faruque *et al.* (2002) reported that overall litter size was 1.18±0.04 which is lower than the present study. He showed that the effects of genetic group and genetic group × parity interaction on litter size were significant ($p < 0.05$). Haque *et al.* (2013), Hasan *et al*. (2014), Paul *et al*. (2014) and Jahid *et al*. (2015) found that litter size of Black Bengal goat which is lower than this study. Jahid *et al*. (2015) reported that the average number of kid born per kidding increased significantly ($p < 0.05$) from first parity up to third parity under semi-intensive and extensive condition. He showed that litter size at 1st, 2nd and 3rd parity were 1.06, 1.76 and 1.96 respectively. This result was in agreement with the present study. Litter size at birth is affected by parity and season is presented in Figure 4. Litter size was also affected by nutrient level, body weight, parity, age and genetic factors.

Paul *et al*. (2014) reported that the average litter size of Black Bengal goat in Nucleus breeding flock, Modhupur and Dimla were 1.49±0.14, 1.52±0.11 and 1.65±0.03 respectively which is lower than this study. He showed that litter size of does affected by parity of dam and season of birth. The present result is almost similar with the findings of Hossain *et al*. (2004), Chowdhury *et al*. (2002), Abdul Jalil *et al*. (2016) and Halim *et al*. (2011). The mean of litter size of Black Bengal goat under semi-intensive and scavenging system were 2.00±0.00 and 2.33±0.33 respectively founded by Islam *et al*. (2009) which is higher than the present study.
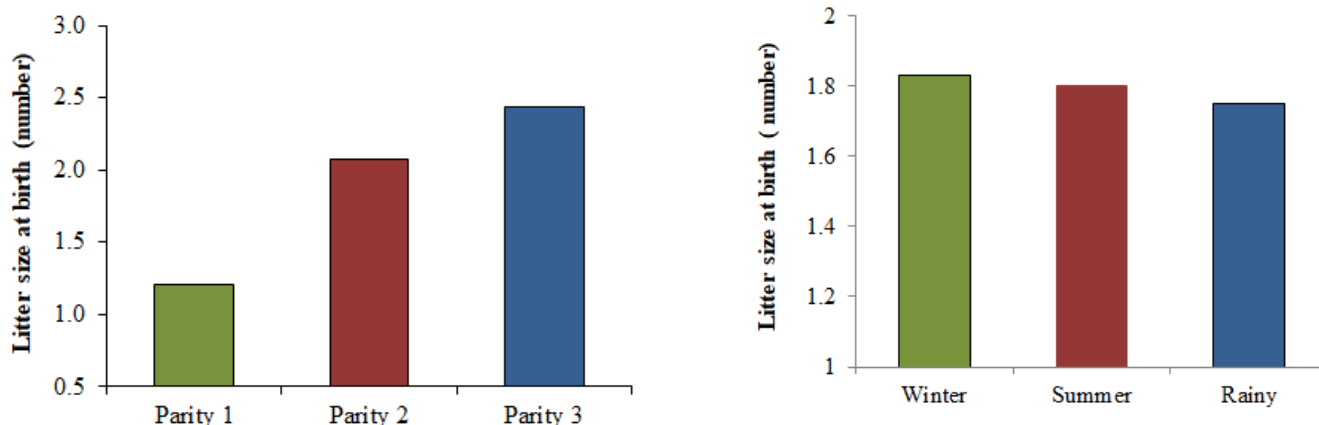
**Figure 4: Effect of parity and season on litter size at birth**

### 4.3.2 Litter size at weaning

Average litter size at weaning period of Black Bengal goat at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were 1.18±0.05, 1.56±0.06 and 1.91±0.12 respectively. Effect of different factors i.e. parity of dam and season of kidding in litter size at weaning is presented in Table 4. There are highly significant ($p<0.01$) effect of parity in litter size of Black Bengal goat at weaning age. Highest litter size of Black Bengal goat at weaning is found at third parity and lowest in second parity than third parity of dam. There are significant difference between $1^{st}$ parity and $2^{nd}$ parity of litter size at weaning. There are also significant difference of litter size of weaning between $1^{st}$ parity and $3^{rd}$ parity. Average litter size at weaning significantly different between $2^{nd}$ parity and $3^{rd}$ parity. Kid mortality response to reduce the litter size at weaning period. Kid mortality rate increase due to disease breakdown such as PPR, diarrhea, poor management, poor nutrient and environmental distress etc. The mean of litter size at weaning of Black Bengal goat at winter, summer and rainy season are 1.60±0.08, 1.40±0.07 and 1.30±0.08 respectively. There are statistically significant ($p<0.05$) different in litter size at weaning for season of Black Bengal goat. In winter season highest litter size and lowest litter size came during rainy season of Black Bengal goat which is found in this study. Disease breakdown and agro-climate condition is the major reason for highest kid mortality.

**Table 4: Effect of different factors on litter size at weaning of Black Bengal goat**

| Factors | Litter size at weaning (no.) | |
|---|---|---|
| | No. of observation | LSM±SE |
| Parity of dam | | |
| First | 66 | $1.18^c \pm 0.05$ |
| Second | 73 | $1.56^b \pm 0.06$ |
| Third | 44 | $1.91^a \pm 0.12$ |
| Level of significance | | ** |
| Season of kidding | | |
| Winter | 77 | $1.60^a \pm 0.08$ |
| Summer | 66 | $1.40^{ab} \pm 0.07$ |
| Rainy | 32 | $1.30^{bc} \pm 0.08$ |
| Level of significance | | * |

Means with different superscripts within each column and trait differ significantly *, ($p< 0.05$), **, ($p<0.01$), No: number, LSM: Least-squares means, SE: Standard error.

Mia *et al.* (2013) showed that the litter size at weaning of Black Bengal goat in 1st, 2nd and 3rd parity were 1.04±0.09, 1.12±0.12 and 1.21±0.17 respectively which is lower than this study. This variation occurs due to genetic and environmental factors. This variation also occurs due to nutrient level, genetic and environmental factors etc. He also showed that the litter size at weaning for winter, summer and rainy season were 1.27±0.19, 1.04±0.16 and 0.80±0.23 respectively which is slightly lower than this study. He reported that the highest litter size found in winter season and lowest in rainy season which is in agreement with the present study. The litter size at weaning affected by parity and season is presented in Figure 5.

Hamed *et al.* (2009) showed that the litter size at weaning period at 1st, 2nd and 3rd parity were 1.39±0.03, 1.64±0.03 and 1.75±0.03 respectively which is slightly higher than the present study. He also showed that the litter size at weaning period at March and October were 1.61±0.02 and 1.67±0.03 respectively which is also slightly higher than the present study. The increase of productive performance with parity indicates improvement of reproductive traits as does early

maturity. Variation on litter size at birth and weaning due to parity, season management, feeding, age and environment etc.
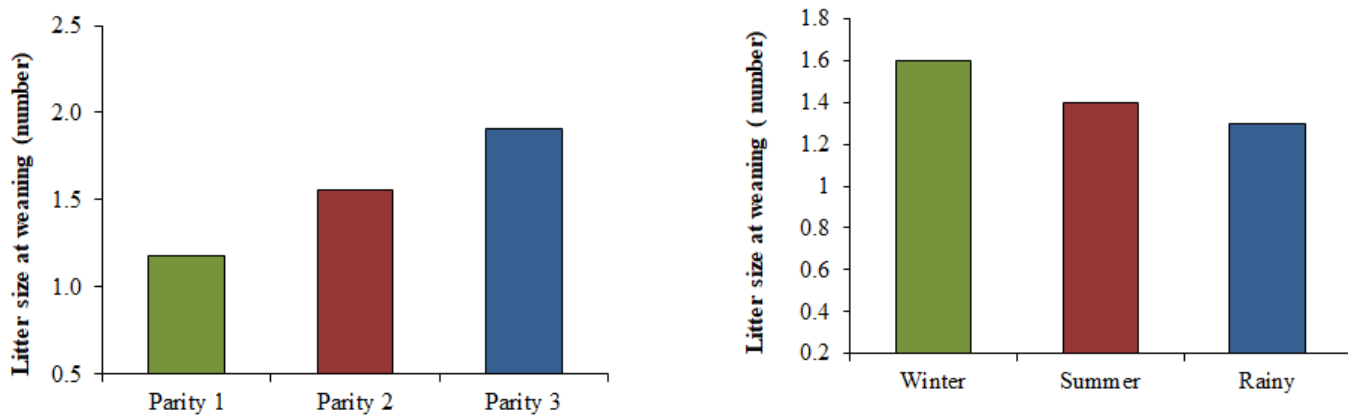


**Figure 5: Effect of parity and season on litter size at weaning**

## 4.4 Gestation period

The average gestation period in the present study was 144.1±0.43, 143.5±0.40 and 144.1±0.48 days at 1st, 2nd and 3rd parity respectively. At winter, summer and rainy season the gestation length was 143.9±0.37, 143.9±0.41 and 143.6±0.59 days respectively. The average gestation period at parity and season were presented in Table 5.

Faruque *et al*. (2010) showed the average gestation period of Black Bengal goat was 143.0±1.71 and 142.8±1.4 days respectively which are almost similar results with the present findings. Mia *et al*. (2013) reported the average gestation period of Black Bengal goat 144.71 days which also similar with this findings. Chowdhury *et al*. (2002) found the gestation period at low and high feeding system respectively 144.0±1.75 and 146.0±2.53 days. Among the result which is found for low feeding system the gestation period (144) is similar with this study but in high feeding system showed higher value (146). Haque *et al*. (2013) showed the average gestation period 145.34 days which are almost similar with the present study. Bhowmik *et al*. (2014) reported that the gestation length of Jamunapari, Black Bengal goat and cross breed were 151.71±8.19, 146.72±7.61 and 147.85±7.74 days respectively which are also higher than the present findings. The results of this study also slightly higher than those results which are reported by Kabirul *et*

*al*. (2013), Hoque *et al*. (2002), Hossain *et al*. (2004) and Halim *et al*. (2011). Jalil *et al*. (2016) showed that the average gestation length 142.45±0.31 days which are lower than this study. Shorten or lengthen gestation period occurs due to nutritional factors, foetal development during pregnancy, litter size etc. but the variation due to this factor was only 1.5 days (Riera. 1982). Shortened gestation period approximately by one days was for does carrying twins compared to singles reported by Shelton (1960), Peaker (1978) and Amoah and Bryant (1983). Chowdhury *et al*. (2002) showed that the gestation length at 1$^{st}$, 2$^{nd}$, 3$^{rd}$ and 4$^{th}$ parity was respectively 146, 147, 142 and 146 days in which there is no effect on parity. This result slightly higher than present findings. Devendra and Burns (1983) reported that although gestation period of goat is fairly constant at about 146 days yet it may be affected by factors such as sire, season, year (Gupta *et al*. 1964) kid birth weight and weight of dam at mating (Mishra *et al*., 1979). Those of factors did not effect on gestation period of goat in the present study. Faruque *et al*. (2002) was found the gestation period of three genetic groups i.e. Jamunapari ×Black Bengal goat, selected Black Bengal male× selected Black Bengal female and random Black Bengal goat respectively 142.06±0.32, 143.10±0.24 and 143.22±0.24 days which were almost similar to the present findings.

**Table 5: Effect of different factors on gestation period of Black Bengal goat**

| Factors | Gestation period (days) | |
|---|---|---|
| | No. of observation | LSM±SE |
| Parity of dam | | |
| First | 66 | 144.1±0.43 |
| Second | 73 | 143.5±0.40 |
| Third | 44 | 144.1±0.48 |
| Level of significance | | NS |
| Season of kidding | | |
| Winter | 74 | 143.9±0.37 |
| Summer | 76 | 143.9±0.41 |
| Rainy | 33 | 143.6±0.59 |
| Level of significance | | NS |

Means with different superscripts within each column and trait differ significantly, NS: non-significant, No: number, LSM: Least-squares means, SE: Standard error.

The present study indicated that season and parity had no influence on gestation period. The average gestation period of Black Bengal goat at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity was 144.1, 143.5 and 144.1 days and at winter, summer and rainy season was 143.9, 143.9 and 143.6 days respectively. The effect of parity and season on gestation period was found to be non-significant in this study. There is no significant difference on gestation length for parity and season which is showed in Figure 6.
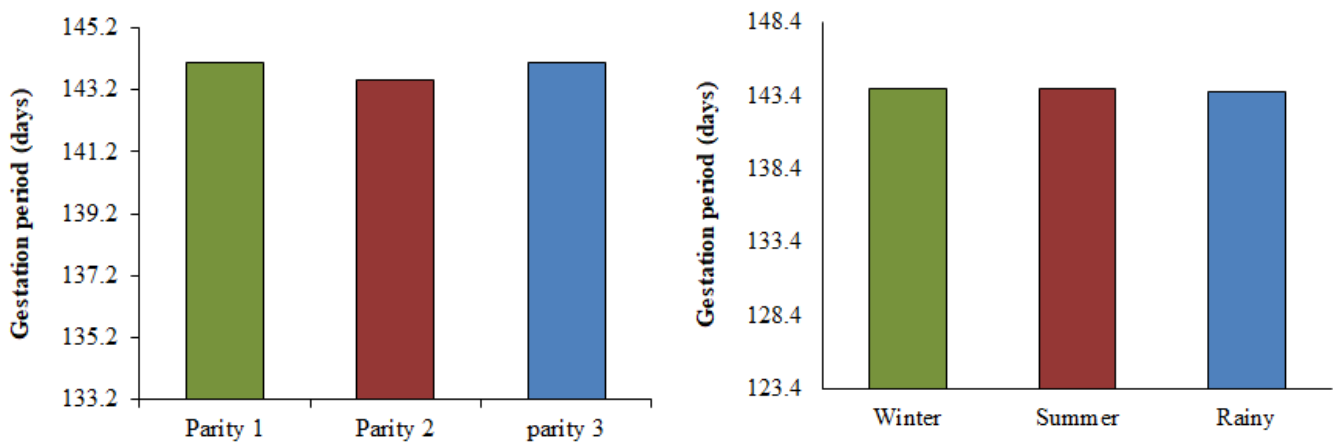


**Figure 6: Effect of parity and season on gestation period**

**CHAPTER 5**

**SUMMARY AND CONCLUSION**

The study was conducted to compile reproductive parameters of Black Bengal goat in different villages at Savar Upazilla under Dhaka district. Source of data of this research came out from the research activities of the project entitled "Performance traits Study of Black Bengal goat in Savar Upazilla in Dhaka District." The objectives of this present study is the reproductive performance of Black Bengal goat in village condition based on different factors such as parity of dam and season of birth under extensive rearing system. The reproductive traits considered for this study were body weight at birth and weaning, litter size at birth and weaning and gestation period based on different factors like parity and season in village condition at Savar Upazilla.

In the present study in terms of reproductive traits, birth weight at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were $0.92\pm0.01$, $0.99\pm0.01$ and $0.97\pm0.01$ kg respectively. The body weight at birth for winter, summer and rainy season $0.92\pm0.01$, $0.99\pm0.01$ and $0.97\pm0.01$ kg respectively. There are effect of parity and season on birth weight of Black Bengal goat. Parity of dam and season has significant ($p<0.05$) effect on body weight at birth. The body weight at weaning at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were $5.12\pm0.06$, $5.03\pm0.05$ and $4.97\pm0.06$ kg respectively and at winter, summer and rainy season were $4.89\pm0.05$, $5.27\pm0.05$ and $4.93\pm0.09$ kg respectively. There are non-significant effect of parity of dam on body weight at weaning but season has significant ($p<0.05$) effect on body weight at weaning of Black Bengal goat. Highest birth weight (0.99 kg) found in second parity and in summer season (0.99 kg) at birth due to available of feed, agro-climate conditions etc. Highest body weight at weaning (5.12 kg) found in first parity and in summer season (5.27 kg). Effect of parity of dam has highly significant ($p<0.01$) effect in litter size at birth. The litter size at birth of Black Bengal goat at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were $1.21\pm0.06$, $2.07\pm0.08$ and $2.43\pm0.12$ respectively. In this study concluded that highest litter size (2.43) found in third parity. Gradually increased parity of dam improved prolificacy ability of Black Bengal goat. There is no trend of the effect of season on litter size at birth. The litter size at birth of Black Bengal goat for winter, summer and rainy season were $1.83\pm0.09$, $1.80\pm0.09$ and $1.75\pm0.14$ respectively. The litter size at weaning period of Black Bengal goat at $1^{st}$, $2^{nd}$ and $3^{rd}$ parity were respectively $1.81\pm0.05$, $1.56\pm0.06$ and $1.91\pm0.12$. The effect of parity of dam has highly

significant (p<0.01) at litter size during weaning period. We can say that from this study highest litter size (1.91) at weaning found in third parity of dam. The litter size at weaning for winter, summer and rainy season were 1.60±0.08, 1.40±0.07 and 1.30±0.08 respectively. Litter size during weaning period at winter season (1.60) came highest and smallest in rainy season (1.30) in this study. Significantly (p<0.05) effect of season on litter size at weaning period. The gestation period of Black Bengal goat at 1st, 2nd and 3rd parity were 144.1±0.43. 143.5±0.40 and 144.1±0.48 days respectively. There is no significant effect of parity on gestation period. The gestation length of Black Bengal goat at winter, summer and rainy season were 143.9±0.37, 143.9±0.41 and 143.6±0.59 days respectively. The present study indicated that the parity and season had no influenced on the gestation period in Black Bengal goat.

In this study concluded that third parity of dam and summer season give better performance than others. This study revealed that under extensive rearing condition, Black Bengal goat give better reproductive performances. In rural area, Black Bengal goat more preferable due to higher prolificacy and fertility, lower maturity age, non-seasonality and relatively shorter kidding interval and higher adaptability at our adverse agro-climate conditions. Although improvement in reproductive traits through selection may be limited but through breeding program, better feeding and management practices may help in improvement of reproductive performance of Black Bengal goat. It is also essential to improve this genetic resource for lifetime productivity. If we want to improve productive performance, we must be improve reproductive performance of Black Bengal goat and it will be possible through proper management. So, it can be concluded that considering the socio-economic and agro-climate condition of Bangladesh, rearing of Black Bengal goat under extensive system in village, would be more profitable than other livestock which may help in alleviating poverty.

**Recommendation:**

From the findings and conclusions of this study, the following recommendations were made:

This study investigated the effect of parity of dam and season on reproductive performance of black Bengal goat. By providing proper management and breeding program the reproductive performance will be increased which finally increased lifetime productivity of Black Bengal goat.

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**Appendix 1:**

Questionnaire on performance traits study of Black Bengal goat in Dhaka district

| | | | | | | |
|---|---|---|---|---|---|---|
| Name of the owner | | | | | | |
| Name of the area/ village | | | | | | |
| Occupation | | | | | | |
| Types and source of breed | | Black Bengal | | Cross | | |
| Number of goat | | Doe : | | Buck : | | |
| | | | | Scrotum length: | | |
| | | | | Scrotum circumference: | | |
| Rearing system | | Intensive | Semi-intensive | | Others | |
| Age at puberty | | | | | | |
| Types of service | | Natural | | Artificial | | |
| No. of service per conception | | | | | | |

| Parity number | Season of kidding | Body weight at birth | Litter size at birth | Body weight at weaning(kg) | Litter size at weaning | Body weight at 365 days |
|---|---|---|---|---|---|---|
| First | Winter | | | | | |
| | Summer | | | | | |
| | Rainy | | | | | |
| Second | Winter | | | | | |
| | Summer | | | | | |
| | Rainy | | | | | |
| Third | Winter | | | | | |
| | Summer | | | | | |
| | Rainy | | | | | |

| Types of birth | Season | Dairy milk yield | |
|---|---|---|---|
| Single | Winter | | |
| | Summer | | |
| | Rainy | | |
| Twins | Winter | | Others |
| | Summer | | |
| | Rainy | | |
| Triplet | Winter | | |
| | Summer | | |
| | Rainy | | |

| | | |
|---|---|---|
| Sex of kid | Male | Female |
| Lactation length | | |
| Post-partum heat period | | |
| Kidding interval(days) | | |
| Dry period | | |
| Age at first kidding | | |
| Gestation length | | |
| Hearth girth length | | |
| Body length | | |

Date :

**Appendix 2:** ANOVA showing the effect of parity on birth weight of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 0.2398 | 2 | 0.1199 | |
| Residual (within columns) | 1.189 | 180 | 0.006608 | 18.15 |
| Total | 1.429 | 182 | | |

**Appendix 3:** ANOVA showing the effect of parity on body weight at weaning of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 0.6174 | 2 | 0.3087 | |
| Residual (within columns) | 39.82 | 180 | 0.2212 | 1.40 |
| Total | 40.44 | 182 | | |

**Appendix 4:** ANOVA showing the effect of parity on litter size at birth of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 45.23 | 2 | 22.62 | |
| Residual (within columns) | 78.48 | 180 | 0.436 | 51.87 |
| Total | 123.7 | 182 | | |

**Appendix 5:** ANOVA showing the effect of parity on litter size at weaning of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 14.31 | 2 | 7.155 | |
| Residual (within columns) | 55.43 | 180 | 0.3099 | 23.24 |
| Total | 69.74 | 182 | | |

**Appendix 6:** ANOVA showing the effect of parity on gestation period of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 15.68 | 2 | 7.84 | |
| Residual (within columns) | 2083 | 180 | 11.57 | 0.68 |
| Total | 2099 | 182 | | |

**Appendix 7:** ANOVA showing the effect of season on body weight at birth of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 0.2382 | 2 | 0.1191 | |
| Residual (within columns) | 1.189 | 179 | 0.0066 | 17.92 |
| Total | 1.428 | 181 | | |

**Appendix 8:** ANOVA showing the effect of season on body weight at weaning of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 6.294 | 2 | 3.147 | |
| Residual (within columns) | 34.08 | 179 | 0.1904 | 16.53 |
| Total | 40.37 | 181 | | |

**Appendix 9:** ANOVA showing the effect of season on litter size at birth of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 0.1124 | 2 | 0.05622 | |
| Residual (within columns) | 116.2 | 179 | 0.6489 | 0.087 |
| Total | 116.3 | 181 | | |

**Appendix 10:** ANOVA showing the effect of season on litter size at weaning of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 2.79 | 2 | 1.395 | |
| Residual (within columns) | 62.29 | 178 | 0.35 | 3.98 |
| Total | 65.08 | 180 | | |

**Appendix 11:** ANOVA showing the effect of season on gestation period of Black Bengal goat

| ANOVA Table | SS | df | MS | F value |
|---|---|---|---|---|
| Treatment (between columns) | 2.188 | 2 | 1.094 | |
| Residual (within columns) | 20.97 | 180 | 11.65 | 0.09 |
| Total | 2099 | 182 | | |