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A STUDY ON COMPARATIVE EFFECTS OF DIFFERENT FEEDS ON PRODUCTION AND REPRODUCTION OF CROSSBRED HEIFERS IN GANGACHARA UPAZILA, RANGPUR

A THESIS

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Chapter I

INTRODUCTION

Bangladesh is a country of rural based subsistence agricultural farming system. Such this developing country, rural sector plays a vital role because most of the people (79.9 %) of this country live in rural areas. Therefore, the policy makers have recognized rural development as the centerpiece of national development. Livestock is one of the major components of its agricultural output which plays a vital role in national economy. In 2013, the contribution of livestock sub-sector to the GDP was 2.95 %, which was estimated about 17.32 % GDP to agriculture (DLS, 2014). Livestock population in Bangladesh is currently estimated about 25.7 million cattle, 0.83 million buffaloes, 14.8 million goats, 1.9 million sheep, 118.7 million chicken and 34.1 million ducks. The density of livestock population per acre of cultivable land is 7.37 (Banglapedia, 2012). This density has been increasing every year in the country. The relative density of the cattle population is well above the averages found in many other countries of the world. It ranks twelve in cattle populations in the world and third among Asian countries (Alam et al., 2008). Despite such a high density of cattle population, the country suffers from an acute shortage of livestock products like milk, meat and eggs. The shortage accounts for 85.9%, 88.1% and 70.7% for milk, meat and eggs, respectively (Banglapedia, 2012). These short falls are encouraging due to lack of optimum level of nutrition, disease control, proper housing management practices, and efficient reproductive performance and well thought systematic breeding programmed etc. These animals are kept mainly in the stall with limited grazing on the roadside; embankment slopes, fallow land etc. and paddy straw are the stable food.

In rural areas, in addition to crop production, dairy is practiced as a subsidiary enterprise. Dairy farming got an impetus with support price by the government and well developed infrastructure for milk marketing (Shivalingaiah and Veerabhadraiah, 1996). Several dairy management practices including feeding straw, green forage and water, breeding practices including artificial insemination, health care including cleaning and sanitation activity, milk production including processing, storing and marketing are being done directly by rural people. The degrees of participation vary due to the various type of working activity. Dairy enterprise provide additional income and gainful employment to the members of the family throughout the year are being practiced by many rural youth.

However, the productivity of cattle is low because of poor fertility, nutrition, herd health and management. Khan *et al.* (1999) reported that the cattle population of Bangladesh are mostly of the indigenous type (Bos indicus) with high amount of Holstein-Friesian, Sindhi, Sahiwal, and Jersey crossbreeds. Indigenous cattle posses late maturity, short lactation length, long calving interval and poor production of milk and draught power but are more disease resistant and capable of thriving in harsh conditions (Majid et al., 1992). Exotic breeds often lack resistance to local diseases and climatic conditions, produce poorly and lack persistency without considerable high quality feed and management. Although milk production of non-descript cattle is low, it shows very high adoption to agro climate condition of the respective region (Khirari et al., 2014). Further, it serves as source of variation for selection and improvement for milk production (Yadav and Rathi, 1991). Efforts are being made to improve the production performance of non-descript cattle through cross breeding with exotic dairy cattle (Rehaman et al., 1998).

Cattle are the main source of animal protein as they give meat, milk and also source of draft power, hides etc. (Anon 2008). The Government of Bangladesh has recently given priority in cattle rearing that encouraged the rural people to consider livestock keeping as commercial

enterprise. But in Bangladesh there are many constrains in cattle production, among them malnutrition and parasitism are the major limiting factors (Jabber and Green 1983). Poor nutrition delays puberty, reduces conception rate and increases pregnancy losses in heifers (Short and Bellows, 1971; Milagres *et al*, 1979; Fleck et al, 1980; Lemenager *et al*, 1980). Wiltbank *et al* (1966) referred to a critical age-to-weight ratio which must be reached before heifers attain puberty. All heifers attained puberty at different ages. Reid *et al* (1964) also found that heifers reared on a very high level of nutrition had more breeding problems subsequently than those fed moderately.

Farmers are very poor; most of them pass their day hand to mouth by hard working. They are not able to supply sufficient feed to their cattle. As a result, the productive and reproductive performance of their cattle is very poor due to malnutrition. The reproductive performance of the postpartum cow is related to nutritional status (Dunn *et al*, 1969). Cows fed a high energy diet after calving conceives sooner than those with a lower energy intake (Wiltbank *et al*, 1962, 1964; Dunn *et al*, 1969; Hill *et al*, 1970). Although protein is generally regarded as less important than energy for reproduction, low protein intake can also cause infertility. However, it may be difficult to differentiate the effects of low protein intake from concurrent low energy intake, because protein deficiency usually leads to decreased appetite. Cattle in the tropics are usually depended on natural pastures and crop by-products for feed.

However, there is a paucity of information about productive and reproductive performance of dairy cattle in Bangladesh. Comprehensive reports on productive potentials of indigenous Zebu cattle (*Desi)* and crossbred cattle under various management conditions in Bangladesh are lacking (Khan *et al*., 2001; Sarder, 2004; Rahman and Rahman, 2006).

To remove these problems from rural areas of Bangladesh, different non-government organization (NGO) working intensely. Rangpur Dinajpur Rural Services (RDRS), a NGO

established for implementing and developing projects, skills, awareness, capacities and technologies designed to raise the living standards of the rural poor in north-west part of Bangladesh. The RDRS is a local development organization operated by the Lutheran World Federation based in Geneva, Switzerland.

As a member of Milk Market Development Project (MMDP) of Chars Livelihoods Programme (CLP) implemented by RDRS Bangladesh, I have worked with the following objectives:

i. To evaluate the comparative effects of different feeds on productive performance of cross bred heifer.

ii. To evaluate the comparative effects of different feeds on reproductive performance of cross bred cows.

Chapter II

REVIEW OF LITERATURE

Many research works have been done in different countries of the world on productive and reproductive performances of different type of dairy heifers and cows. In Bangladesh limited numbers of research works have been carried out to monitor existing productive and reproductive performance of cross bred cows under traditional feeding system vs. improved feeding system. In this section is to provide a selective review of research and past research works which are related to this study. Some of related findings of research carried out in this country or elsewhere are reviewed in this section.

To make it easy and clear the review is divided into several sections:

i. Age at first heat in months
ii. Services per conception
iii. Gestation length in days
iv. Age at first calving in months
v. Daily milk yield in litres
vi. Lactation period in days
vii. Post-partum heat period in days
viii. Calving interval in days

2.1. Age at first heat in months

First calving marks the beginning of a cow's productive life. Age at first calving is closely related to generation interval and therefore, influences response to selection. Under controlled breeding, heifers are usually mated when they are mature enough to withstand the stress of parturition and lactation. This increases the likelihood of early conception after parturition. In traditional production systems, however, breeding is often uncontrolled and heifers are bred at the first opportunity. This frequently results in longer.

Rahman *et al.* (1987) investigated the age at first heat of local cows and found it was 42.8 months.

Ashraf (1998) concluded that age at first heat of indigenous cows was 31.0 months.

Khan and Khatun (1998) shown the ages at first heat of Sahiwal × Pabna cross and Holstein Friesian × Pabna cross cows were 37.29, 33.57 months, respectively.

Sultana *et al.* (2001) recorded the ages at first heat of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 25.2, 21.4 and 24.4 months, respectively.

Sarder *et al.* (2006) studied on comparative reproductive performance of cross bred dairy cows at greater Rajshahi District. They observed average value of age at first heat in Local × Holstein Friesian ×Sahiwal cross and Local × Shindhi × Sahiwal cross were 26.6±4, 31.5±5.1 months, respectively.

Al-Amin *et al.* (2007) studied on reproductive performance of North Bengal Grey cow. They found that the age at first heat was 29.0 months in North Bengal Grey cow.

Bhuiyan *et al*. (2007) observed different age at first heat for Red Chittagong and Pabna cattle (40.5 and 15.6 months, respectively).

Alam *et al.* (2008) found in their Productive and reproductive performance of dairy cattle in *Char* areas of Bangladesh. The average value of the ages at first heat of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 27.4, 23.9 and 26.2 months, respectively.

Uzzaman *et al.* (2010) found 33.8 months age at first heat in Munshiganj cattle.

2.2. Services per conception

The number of services per conception (NSC) depends largely on the breeding system used. It is higher under uncontrolled natural breeding and low where hand-mating or artificial insemination is used.

Halim (1992) found that the average service per conception rate of local and crossbred cows 77.65 and 74.47 percent, respectively, and service per conception were 1.31 and 1.39, respectively.

Bhuiyan and Sultana (1994) analyze the number of service per conception on 540 cows of different exotic breeds and their crosses at Saver Dairy and Cattle Improvement Farm in Bangladesh found that the highest value in ½ Holstein Friesian × ½ Sahiwal was 2.05 and lowest was in Sahiwal was 1.12.

Ghosh (1995) stated that the number of service per conception were in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.56±0.16, 1.69± 0.18 respectively. The service require for conception were not significant among the crosses.

Sarder *et al.* (1997) studied on 284 cows and 29 heifers from 53 mini dairy farms in Nator District of Bangladesh from December 1993 to November 1994. They found that the fertility were better in local non-descript cows than in Holstein Friesian (L×HF) cross bred cows. They

also found that the service per conception of non-descript cows was 1.4±0.7 and Holstein Friesian (L×HF) cross bred cows was 1.8± 0.6.

Uddin *et al.* (2004) found the services per conception in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.71 and 1.6, respectively.

Mondal *et al*. (2005) found in Dairy Genotypes Reared in Bangladesh, that the average service per conception was 1.63±0.64, 1.60±0.59 and 1.67±0.62 for Sahiwal cross, Sindhi cross and Red- Chittagong cows, respectively.

Rahman and Rahman (2006) recorded services per conception in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.75 and 1.65, respectively.

Sarder *et al.* (2007) stated the services per pregnancy in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.6 and 1.68, respectively.

Alam *et al* (2008) found their study on Productive and reproductive performance of dairy cattle in *Char* areas of Bangladesh that services per conception of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.3, 1.7 and 1.6, respectively.

Kabir and Islam (2009) reported the services per pregnancy in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.6 ± 0.74 and 2.0± 0.92, respectively.

Rokonuzzaman *et al*. (2009) observed in Productive and reproductive performance of dairy cows that the service per conception was 1.84 ±0.80 and 1.32±0.48 respectively, in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows.

Uzzaman *et al.* (2010) observed services per conception in Red Chittagong cattle (1.25); North Bengal Grey cow (1.40) and Munshiganj cattle (1.30).

2.3. Age at first calving in months

Kamrul *et al* (1997) analyzed the collected data on 986 cross bred cows at the Indian Veterinarian Research Institute, Izathnagar from 1970 to 1991 and found that the overall age at first calving was (average) 1037.93±5.95 days.

Sarder (2006) reported in comparative study on reproductive performance of cross breed dairy cows in greater Rajshahi District that the age at first calving of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross were 35.8 and 39.1 months, respectively.

Kabir and Islam (2009) reported in comparative study on productive and reproductive performance of local and different crossbred dairy cows at Daulatpur, Khulna, Bangladesh that the age at first calving in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 35 and 38 months, respectively.

Rokonuzzaman *et al* (2009) recorded in Productive and reproductive performance of dairy cows that the age at first calving Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 34.12 and 36.64 months, respectively.

2.4. Gestation length in days

Gestation length was calculated as interval from conceived to parturition. The duration of gestation was expressed in terms of days.

Majid *et al.* (1995) observed the average gestation length of different genetic groups ranged from 270 to 280 days.

Mondal *et al*. (2005) found in Dairy genotypes reared in Bangladesh, that the average gestation length of different dairy cows Sahiwal cross and Holstein cross were 276±4.26 days and 275±3.95 days respectively.

Rahman and Rahman (2006) observed the average gestation length of different genetic groups ranged from 270 to 284 days.

Sarder (2006) studied on comparative reproductive performance of cross bred dairy cows at greater Rajshahi District that the average gestation period in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 278± 4.9 and 278.7± 4 days, respectively.

Sarder *et al.* (2007) found that gestation period of Local, Local x Friesian and Local x Sahiwal cows were 279.7, 278.2 and 278.8 days, respectively.

Al-Amin *et al.* (2007) observed the gestation length in North Bengal Grey cows was 281.0 days.

Alam *et al.* (2008) recorded in Productive and reproductive performance of dairy cattle in *Char* areas of Bangladesh that gestation length of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 278.3 and 278.3 days, respectively.

Kabir and Islam (2009) found the gestation periodof Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 282.6 and 282.4 days, respectively.

Rokonuzzaman *et al.* (2009) recorded gestation periodof Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 276.2 and 277.4 days, respectively.

Uzzaman *et al*. (2010) found the gestation length in Munshiganj cattle was 309 days.

Koirala *et al*. (2011) recorded the gestation length of indigenous cows of Sylhet region was 299.2 days.

The gestation length was no significant, because it is the species characteristics which is fixed genetically and variation may occur due to maternal and fetal and as well as seasonal influence, Sarder (2006).

2.5. Daily milk yield in litre

Milk yield is an important for economic return of lactating cow. It is the essential criteria to choose a dairy cow. Profitable dairy business is dependent on milk yield. Some relevant reviews are given below:

Nahar *et al.* (1992) collective data on productive and reproductive performance of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows under rural condition of Bangladesh and reported that average milk yield per day were 5.5±0.1 and 2.9±0.1 kg, respectively. They concluded that Local × Holstein Friesian (L×HF) cross cow performed better in rural condition of Bangladesh.

Sultana *et al.* (2001) observed daily milk production of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 2.6, 7.2 and 4.9 litres, respectively.

Mondal *et al*. (2005) found that the average milk yield of different dairy cows Sahiwal cross and Holstein cross were 2.84±0.61 litres and 3.20±0.40 litres respectively.

Al-Amin *et al.* (2007) and Bhuiyan *et al.* (1992) found almost similar daily milk yield in North Bengal Gray cattle and local cow (3.0 liters).

Alam *et al.* (2008) reported that average daily milk production of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.7, 6.3 and 5.1 litres, respectively.

Rokonuzzaman *et al.* (2009) recorded the average daily milk production of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 8.36 and 4.53litres, respectively.

Kabir and Islam (2009) found in the comparative study on productive and reproductive performance of local and different crossbred dairy cows that the average milk production of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 12.03±3.37 and 5.16± 0.81 litres, respectively.

Koirala *et al.* (2011) recorded the milk yield per day was 1.33 liter in native cattle of Sylhet.

Khirari *et al.* (2014) found that the daily milk yield was 1.62 liters in non-descriptive cattle.

2.6. Lactation period in days

Halim (1992) observed that average length of lactation period for local and cross bred dairy cows were 228 and 259 days, respectively.

Nahar *et al.* (1992) found the average lactation length of Friesian × Desi cows were 330.5 days.

Khan et al. (2001) who found that lactation period of Local and Local × Friesian were 221 and 281 days, respectively.

Sultana *et al.* (2001) recorded that the lactation length of Local, Local × Friesian cross and Local ×Sahiwal cows were 221, 287.5 and 254 days, respectively.

Mondal *et al.* (2005) stated on Dairy genotypes reared in Bangladesh that the average lactation length of Sahiwal cross and Holstein cross were 245±106 days and 250±38.6 days respectively.

Al-Amin *et al.* (2007) observed that the lactation length of North Bengal Grey cattle of Bangladesh was 219.0 days.

Alam *et al.*(2008) recorded the average lactation period of Local, Local × Friesian cross and Local ×Sahiwal cows were 217.9, 253.8 and 240.8 days, respectively.

Zafar *et al.* (2008) observed that the lactation length was 267.0 days in case of Pakistani Sahiwal cows.

Kabir and Islam (2009) found the average lactation period of Local × Friesian cross and Local × Sahiwal cows were 295 and 280.6 days, respectively.

Rokonuzzaman *et al.* (2009) recorded the average lactation period of Local × Friesian cross and Local × Sahiwal cows were 270.25 and 250.06 days, respectively.

Uzzaman *et al.* (2010) found almost the lactation length was 253.5 days in Munshiganj cattle.

Koirala *et al.* (2011) observed the lactation length of native cows in Sylhet region was 187.9 days.

Khirari *et al.* (2014) studied the lactation length in non-descriptive cattle were 200.5 days.

2.7. Post-partum heat period in days

Post partum heat period is defined as the interval date of calving and the date of first insemination. It is the number of days from calving to the first subsequent service of a cow (Dairy Herd Fertility, 1984). Hafez (1974) defined post partum involution as a process of return of the uterus to its normal non pregnant size.

Uddin *et al.* (2004) stated that post-partum heat of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 182.2 and 171.8 days, respectively.

Sarder *et al.* (2007) who found the time to post partum oestrus of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows was 170.2 and 166.6 days, respectively.

Al-Amin *et al*. (2007) observed the postpartum heat period was 110 days in North Bengal Grey cows.

Bhuiyan *et al.* (2007) observed different post partum heat period for Red Chittagong and Pabna cattle were 57 and 160.7 days, respectively.

Alam *et al. (*2008) recorded the average post-partum heat period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 166.8 and 170.5 days, respectively.

Rokonuzzaman *et al* (2009) found the average post-partum heat period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 94.48 and 120.06 days, respectively.

Uzzaman *et al.* (2010) recorded the post partum heat period was 70.2 days in Munshiganj cattle.

2.8. Calving interval in days

Calving interval is defined as the interval between two successive intervals of the same cow. It is the number of days from one calving to the next for the same cow. Calving interval can be divided into three periods (shown in figure): gestation, postpartum anoestrus (from calving to first oestrus) and the service period (first postpartum oestrus to conception).

Calving interval has been probably the best index of a cattle herd's reproductive efficiency. Resumption of ovarian activity in the postpartum period does not necessarily lead to conception and methods of stimulating oestrus must be considered in relation to their effect on conception (Holness *et al,* 1980) and, indirectly, calving intervals.

Sultana *et al.* (2001) observed their comparative study on productive and reproductive performance of different cross-bred and indigenous dairy cows under small scale dairy farm condition that the calving intervals of Sahiwal × Desi cows were 453.7 days.

Habib *et a*l. (2003) and Uzzaman *et al*. (2010) found that the calving interval of Red Chittagong cows (410.0 days) and Munshiganj cows (399.0 days).

Uddin *et al.* (2004) found in Reproductive performance of different genetic groups of dairy cows under ideal management condition that the calving intervals of Local and Local × Friesian cross cows were 484.1 and 489.2 days, respectively.

Sarder (2006) studied on comparative reproductive performance of cross bred dairy cows at greater Rajshahi District that the calving interval of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 137± 48 and 145± 51 days, respectively.

Al-Amin *et al*. (2007) found the Calving interval of North Bengal Grey cows was 442.0 days.

Bhuiyan *et al*. (2007) observed different calving interval in Red Chittagong and Pabna cows were 430.9 and 485.0 days, respectively.

Alam *et al.* (2008) recorded in their Productive and reproductive performance of dairy cattle in *Char* areas of Bangladesh that the average calving intervals of Local, Local × Friesian cross and Local ×Sahiwal cross cows were 494.8, 487.5 and 493.3 days, respectively.

Zafar *et al*. (2008) found that the calving interval of Sahiwal cows in Pakistan was 429.0 days.

Kabir and Islam (2009) found in the comparative study on productive and reproductive performance of local and different crossbred dairy cows that the average calving intervals of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 447.7 and 417.5 days, respectively.

Khirari *et al.*, (2014) found the calving interval of non-descriptive cattle in Ratnagiri District of Konkan Region, India, was 381.2 days.

Chapter III

MATERIALS AND METHODS

The present study was conducted from January to June 2014, in Gangachara Upazila of Rangpur District. A sample of 60 cross-bred dairy cows: Local × Holstein Friesian (L×HF) = 30 and Local × Sahiwal (L×Sh) = 30 were selected for this study. Various methods, tools and techniques were used during different stages of work for collection and compilation of data. An interview schedule having both closed and open-ended questions were used to collected information. Methods and procedures followed in conducting this piece of research are discussed in this chapter.

3.1. Location and climate of study area

Gangachara upazila of Rangpur District was selected as the research area where most of RDRS activities are concentrated. Gangachara upazila is located in Northern part of Bangladesh. It is located between 25°48' and 25°57' north latitudes and in between 89°05' and 89°21' east longitudes. The area is within the annual average highest temperatures of 33.5°C and average lowest temperature of 10.5°C with annual rainfall 2,931 mm. The average height of Gangachara upazila from the sea level is 38 m.

Table 1. The area, population and literacy rate of different unions of Gangachara upazila

Name of Union	Area (acre)	Population		Literacy rate (%)
		Male	Female	
Alam Biditar	7820	16035	14948	28.19
Kolkanda	8558	12738	11677	32.61
Khaleya	5936	12213	11536	34.89
Gangachara	6160	17301	15896	45.99
Gajaghanta	4761	14495	13523	37.07
Nohali	7667	11324	10104	25.04
Barabil	8543	17004	15442	35.65
Betgari	6029	11980	11085	31.11
Marania	5106	13247	11929	20.78
Lakshmitari	6703	89.48	8431	30.66

Source: Bangladesh Population Census 2011, Bangladesh Bureau of Statistics.

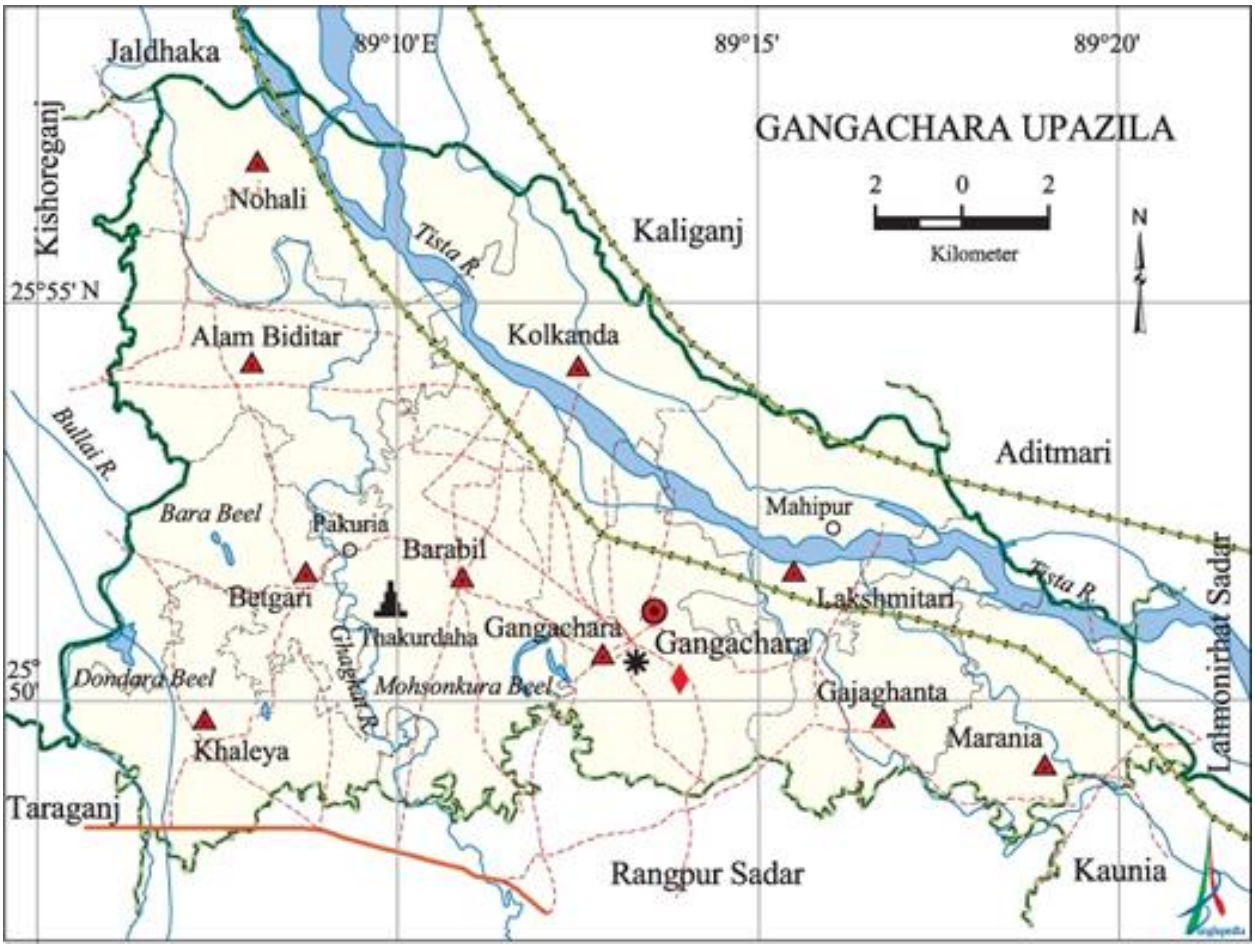

Photo 1. Map of Gangachara upazila of Rangpur District

(Available at http://en.banglapedia.org/index.php?title=Gangachara_Upazila)

The reasons for selecting the areas for the present study are noted below:

a) The availability of local and crossbred milch cows in the area
b) The area was well communicated for the researcher which helped in free movement and data collection
c) It was expected that co-operation from the farmers in the area would be high so that data required for the study could be obtained

3.2. Questionnaire development

Most easy, simple and direct questions were used to obtain information from the respondent farmers. The questionnaire was pre-tested in order to judge its suitability for the respondents then finalized and necessary modifications have been made. It was carefully designed keeping the purposes of the study in mind. It contained both open and closed form questions. Simple and direct questions were included in the questionnaire for the purposes of collecting information relating to the farmers such as age, education, occupation, farm size and for information relating to the cattle such as feeding management, production potential, reproductive characteristics, disease incidence, control measures and management of cattle. In general, most farmers are not used to keeping any written information (records) on their livestock, so the researchers had to depend on the memory of the respondent for obtaining information.

3.3. Sampling technique

Data for this study were collected from a sample rather than the whole population. In this connection, proportionate random sampling method was followed in order to select the representatives. The Core Participants House Hold (CPHHs) of RDRS, Gangachara upazila, who received asset/money from the organization, were considered as the owner of the population of the study.

3.4. Breed selection and management system

A total of 30 Local × Holstein Friesian and 30 Local × Shahiwal cross bred heifer were selected for the present study. There were three types of feeding was practiced. In type-I feeding system animals were provided with 5 kg straw and 5 kg sweet jamboo grass per cattle with no concentrate feed. In type-II feeding system animals were provided with 5 kg straw, 5 kg sweet jamboo grass and additionally given @1kg/day/heifer JDF feed (Jomjom Dairy feed- Jomjom Agro Industries Ltd.). In type-III feeding system animals were provided with 5 kg straw, 5 kg sweet jamboo grass and additionally supplied ready feed @1kg/day/heifer formulated by ACI (Advance Chemical Industry - Godrej feed company). Other management practices were uniform throughout the experimental period for all the animals. All cows and heifers access to *ad libitum* fresh drinking water with iodized salt.

Table 2. Comparative nutritive analysis of different feed

Ingredients	**Sweet Jamboo grass**	**Jomjom Agro Industries Ltd.**	**ACI (Advance Chemical Industry)**
Crude protein	12.7%	19.2%	21%
Crude fat	-	3-4%	4–4.5%
Crude fiber	-	11-12%	9–10%
Total Digestible Nutrient (TDN)	-	77%	64%
Calcium	-	1.1%	1.5%
Phosphorus	-	0.8%	0.65%
Dry matter	42.1%	10%	-
Hemicellulose	24.7	-	-

Cellulose	27.2	-	-
Ash	9.5%	-	-

(Source: Sweet jamboo grass: Tauqir *et al.,* 2009; Jomjom Agro Industries Ltd.; Advance Chemical Industry - Godrej feed company).

3.5. Insemination and medication

In heated heifers and cows were inseminated by artificial insemination (AI) through trained AI technicians. The farmers were treated all heifers and cows with deworming tablets and injection, alternately contained tetramisole hydrochloride (2.0g) and oxyclozanide (1.2g) per 100-150 kg body weight in every four month interval. All the animals which were in this study received vaccination against infectious diseases like Foot and Mouth Disease (FMD), Anthrax, Hemorrhagic Septicemia and Black Quarter etc.

3.6. Data collection

Data was collected from July 2013 to June 2014. A formatted data sheet was supplied to each farmer and Suggestions were given to the farmers on importance of data record and how to put data in data sheet, in order to obtain reliable data several visits were made by researcher. Sometime data was collected by farmer's response process from focus group discussion and informal interview. For the collection of information, a format was used for kept the data recorded. The format contained following information:

i. Name and address of farmer
ii. Breed and age of heifer
iii. Age at first heat of heifer
iv. Date and time of AI
v. Number of service per pregnancy
vi. Pregnancy diagnosis
vii. Gestation period
viii. Age at first calving
ix. Milk yield / Day
x. Lactation period
xi. Post partum heat period
xii. Calving interval etc.

3.7. Processing, Tabulation and Analysis of data

Collected data were classified, tabulated and analyzed in terms of the objectives set for the study. Both tabular and statistical techniques were used to find important relationship among the relevant variables. The following techniques were used for analyzing data:

a) Tabular Analysis and
b) Statistical Analysis

3.7.1. Tabular analysis

Every crossbred heifer was considered as the unit for analysis. Collected data were compiled, classified, tabulated and analyzed to find out the crude association of variables. In this study, tabular technique was used to illustrate the whole picture of analysis.

3.7.2. Statistical analysis

The collected data in this study was analyzed and presented using simple statistical techniques. The raw data were entered and sorted into MS Excel spread sheet then the data was transferred to analytical software SPSS (version 16.0) for descriptive analysis. Compare means pair sample T- test to know the reproductive performance considering different factors. All data are expressed as mean ± SEM. Differences were considered significant at the level of ($P<0.05$).

Photo 2: Milking of Local × Holstein Friesian cow

Photo 3: Sweet jamboo grass provided to the Cattle

Photo 4: Packet of Jomjom and ACI feeds

Photo 5: New-borne calf with Local × Holstein Friesian cow

Photo 6: Calf with Local × Shahiwal Friesian cow

Chapter IV

RESULTS AND DISCUSSION

4.1. Age at first heat

Effect of different feeding systems on the age at first heat is shown in Figure 1. The present result revealed the average age at first heat of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 26.32 and 28.18 months respectively in type-I (Sweet jamboo grass) feeding system, 23.12 and 25.51 months respectively in type-II (Jomjom Dairy feed) feeding system, where it was 20.10 and 22.61 months respectively in type-III (Advance Chemical Industry) feeding system. The age at first heat of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) reduced by type-III feeding system compare with the type-I and type-II feeding system (Figure 1). The present results are agreed with the result of other researchers. Sultana *et al.* (2001) recorded the ages at first heat of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 25.2, 21.4 and 24.4 months, respectively. Sarder (2006) found the ages at first heat of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 27.7 and 30.5 months, respectively. Alam *et al.* (2008) found the ages at first heat of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 27.4, 23.9 and 26.2 months, respectively.

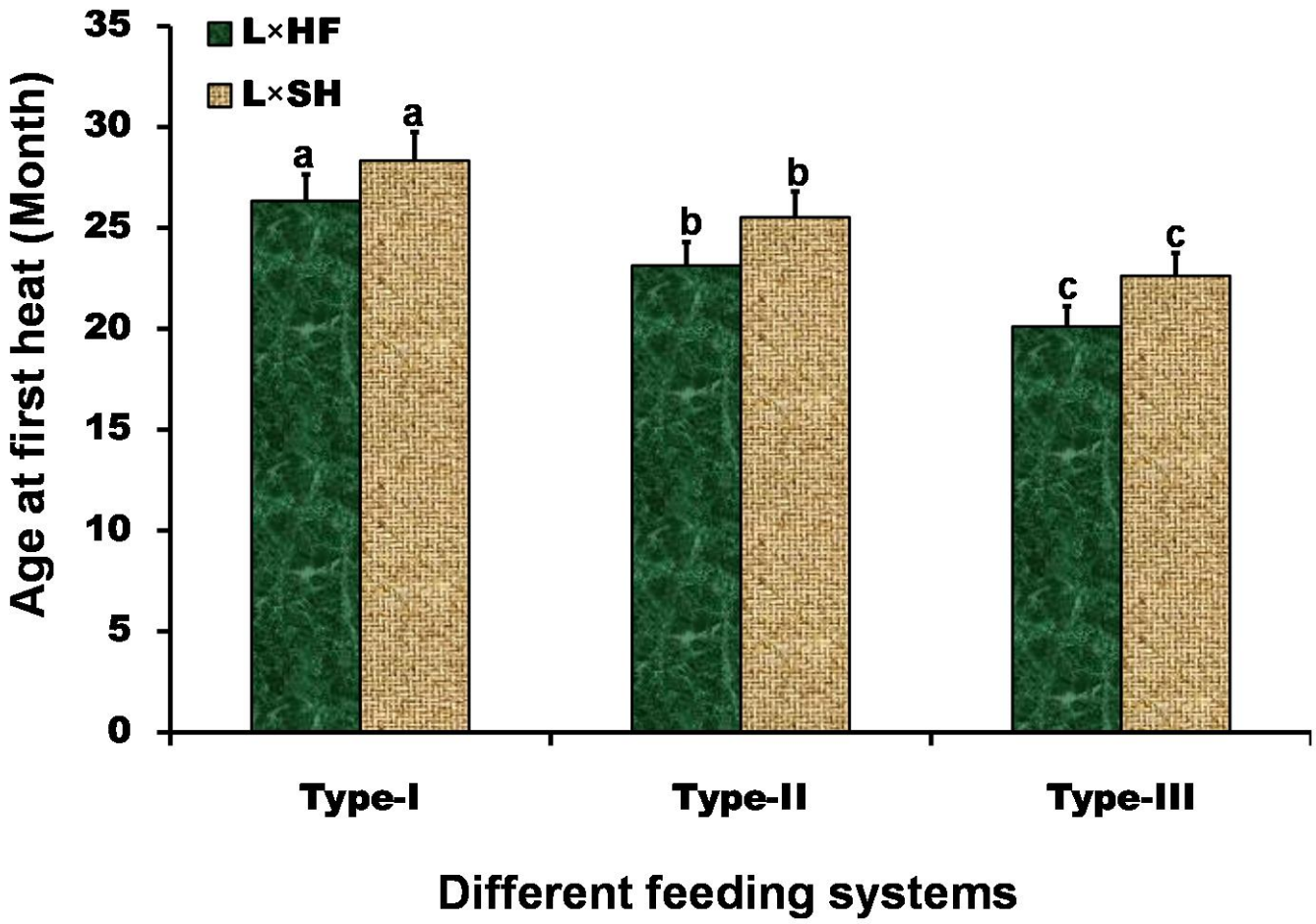

Figure 1. Effect of different feeding systems on age at first heat of cross bred (L×HF) and (L×SH) heifers. Each bar with error bar represents Mean ± SEM value. Without a common lowercase letter on error bars indicate significant differences ($P<0.05$) between the treatment groups.

4.2. Services per conception

The present result showed that the average services per conception of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.9 and 1.7 respectively in type-I (Sweet jamboo grass) feeding system, 1.7 and 1.45 respectively in type-II (Jomjom Dairy feed) feeding system while 1.30 and 1.41 respectively in type-III (Advance Chemical Industry) feeding system. Effect of different feeding systems on service per conception is presented in Figure 2. The services per conception of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) reduced by type-III feeding system compare with the type-I and type-II feeding system (Figure 2). Uddin *et al.* (2004) found the services per conception in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.71 and 1.6, respectively. Rahman and Rahman (2006) recorded services per conception in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.75 and 1.65, respectively. Sarder *et al.* (2007) stated the services per pregnancy in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.6 and 1.68, respectively. Alam *et al* (2008) found that services per conception of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.3, 1.7 and 1.6, respectively. Rokonuzzaman *et al*. (2009) observed in Productive and reproductive performance of dairy cows that the service per conception was 1.84 ±0.80, 1.32±0.48 respectively, in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows. Kabir and Islam (2009) reported the services per pregnancy in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.6 ± 0.74 and 2.0± 0.92, respectively.

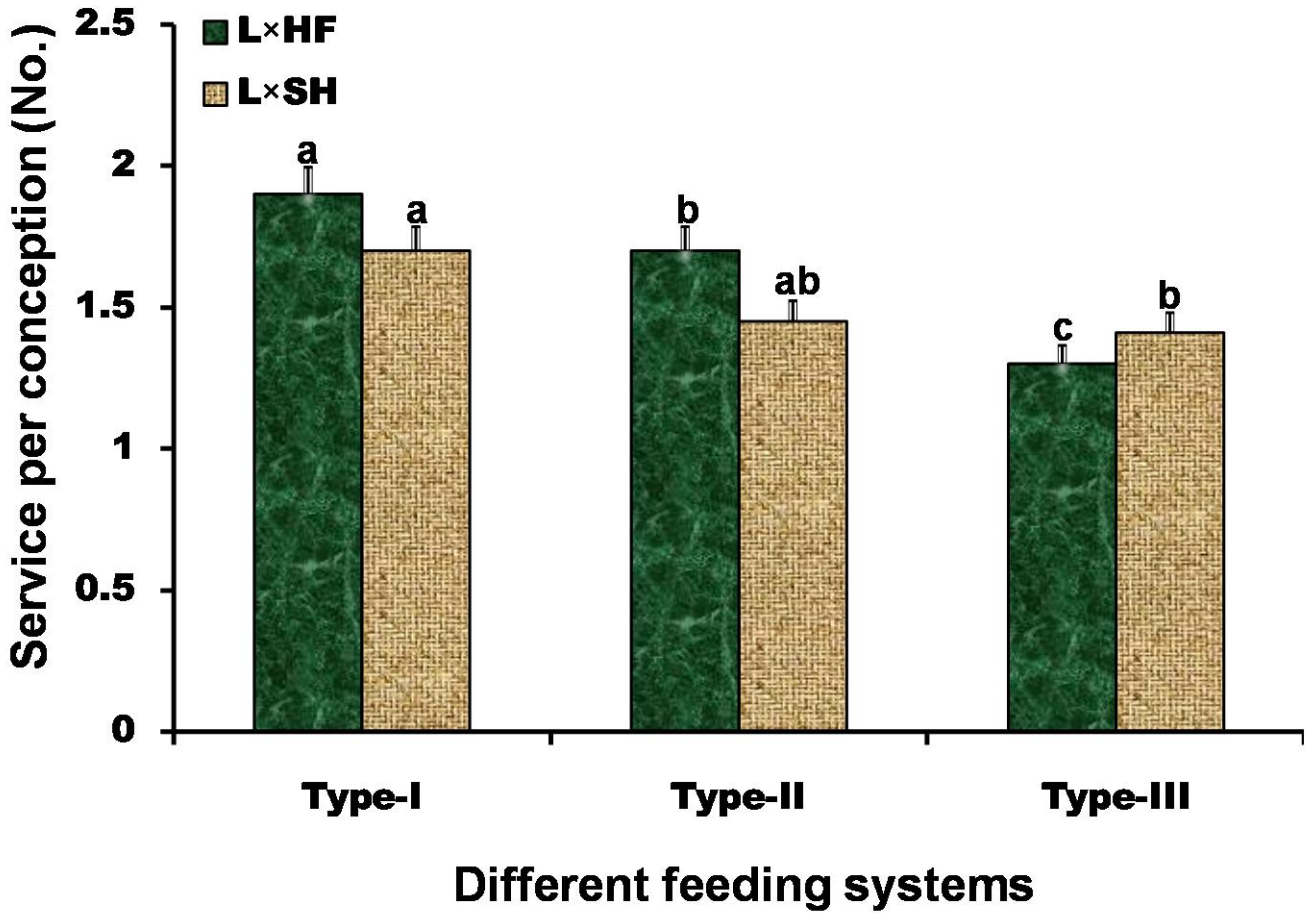

Figure 2. Effect of different feeding systems on service per conception of cross bred (L×HF) and (L×SH) heifers. Each bar with error bar represents Mean ± SEM value. Without a common lowercase letter on error bars indicate significant differences ($P<0.05$) between the treatment groups.

4.3. Age at first calving

Effect of different feeding systems on age at first calving is made known in Figure 3. The present result revealed the average age at first calving of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 34.35 and 35.13 months respectively in type-I (Sweet jamboo grass) feeding system, 32.20 and 36.31 months respectively in type-II (Jomjom Dairy feed) feeding system, where it was 31.20 and 33.71 months respectively in type-III (Advance Chemical Industry) feeding system. The age at first calving of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) reduced by type-III feeding system compare with the type-I and type-II feeding system (Figure 3).

The present result agreed with the result of other authors. Sarder (2006) reported the age at first calving of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross were 35.8 and 39.1 months respectively. Kabir and Islam (2009) reported the age at first calving in Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 35 and 38 months, respectively. Rokonuzzaman *et al* (2009) recorded age at first calving Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 34.12 and 36.64 months respectively.

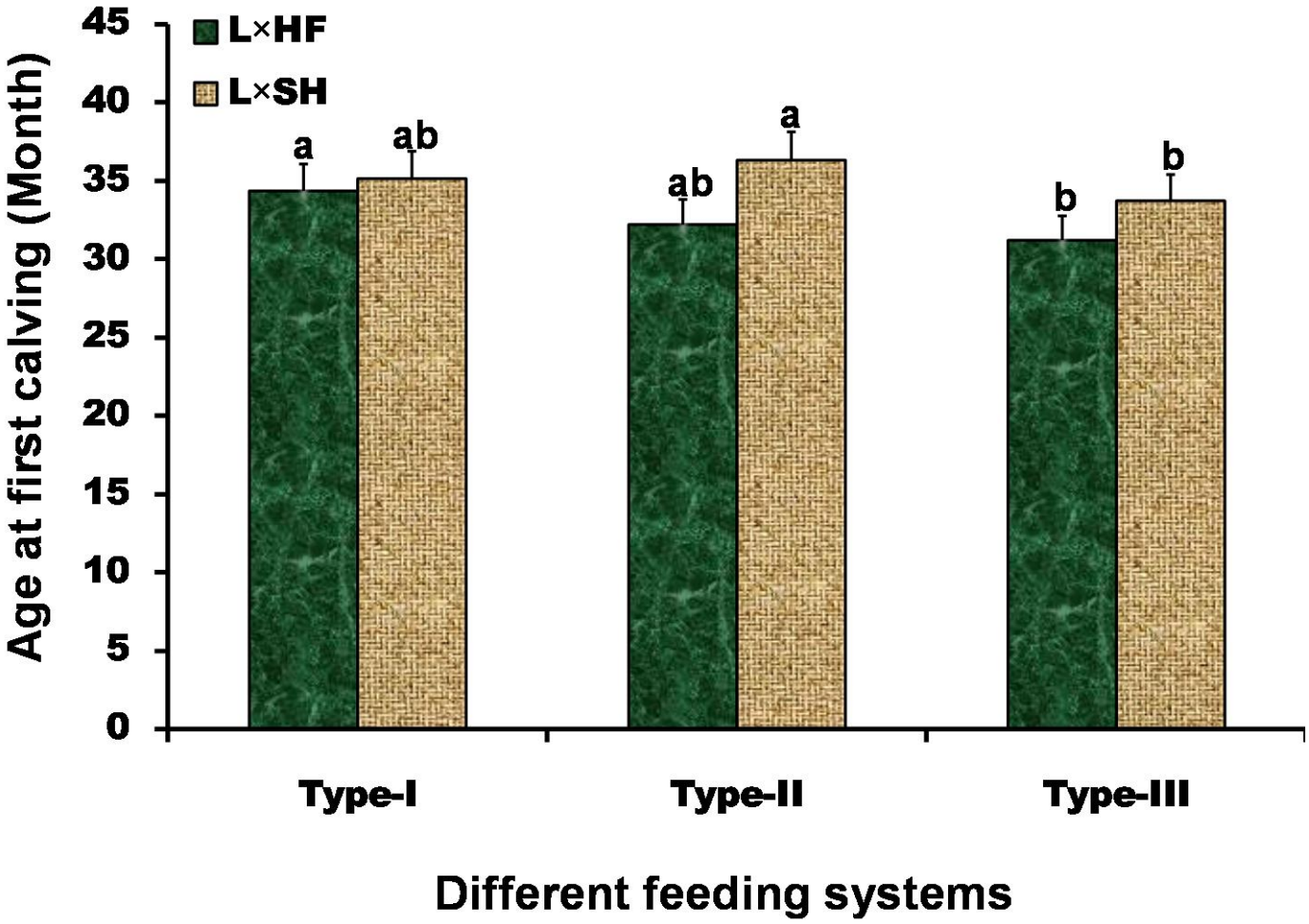

Figure 3. Effect of different feeding systems on age at first calving of crossbred (L×HF) and (L×SH) heifers. Each bar with error bar represents Mean ± SEM value. Without a common lower case letter on error bars indicate significant differences ($P<0.05$) between the treatment groups.

4.4. Gestation Period

Effect of different feeding systems on the gestation period is shown in Figure 4. The average gestation period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 283.21 and 285.15 days respectively in type-I (Sweet jamboo grass) feeding system, 281.01 and 280.30 days, respectively in type-II (Jomjom Dairy feed) feeding system, where it was 282.23 and 280.11 days respectively in type-III (Advance Chemical Industry) feeding system. There were no significant difference ($p>0.05$) between the groups of cows reared under the different feeding systems (Figure 4).

Different authors {Nahar *et al.* (1992); Majid *et al.* (1995); Bhuiyan (1997); Khan and Khatun (1998). Islam and Uddin *et al.* (2004); Rahman and Rahman (2006); Sarder (2006)} found that the gestation length of different genetic groups ranged from 270 to 284 days. Sarder *et al.* (2007) who found that gestation period of Local, Local x Friesian and Local x Sahiwal cows were 279.7, 278.2 and 278.8 days respectively. Alam *et al.* (2008) recorded gestation period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 278.3 and 278.3 days respectively. Rokonuzzaman *et al.* (2009) recorded gestation period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 276.2 and 277.4 days respectively. Kabir and Islam (2009) found the gestation period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 282.6 and 282.4 days respectively.

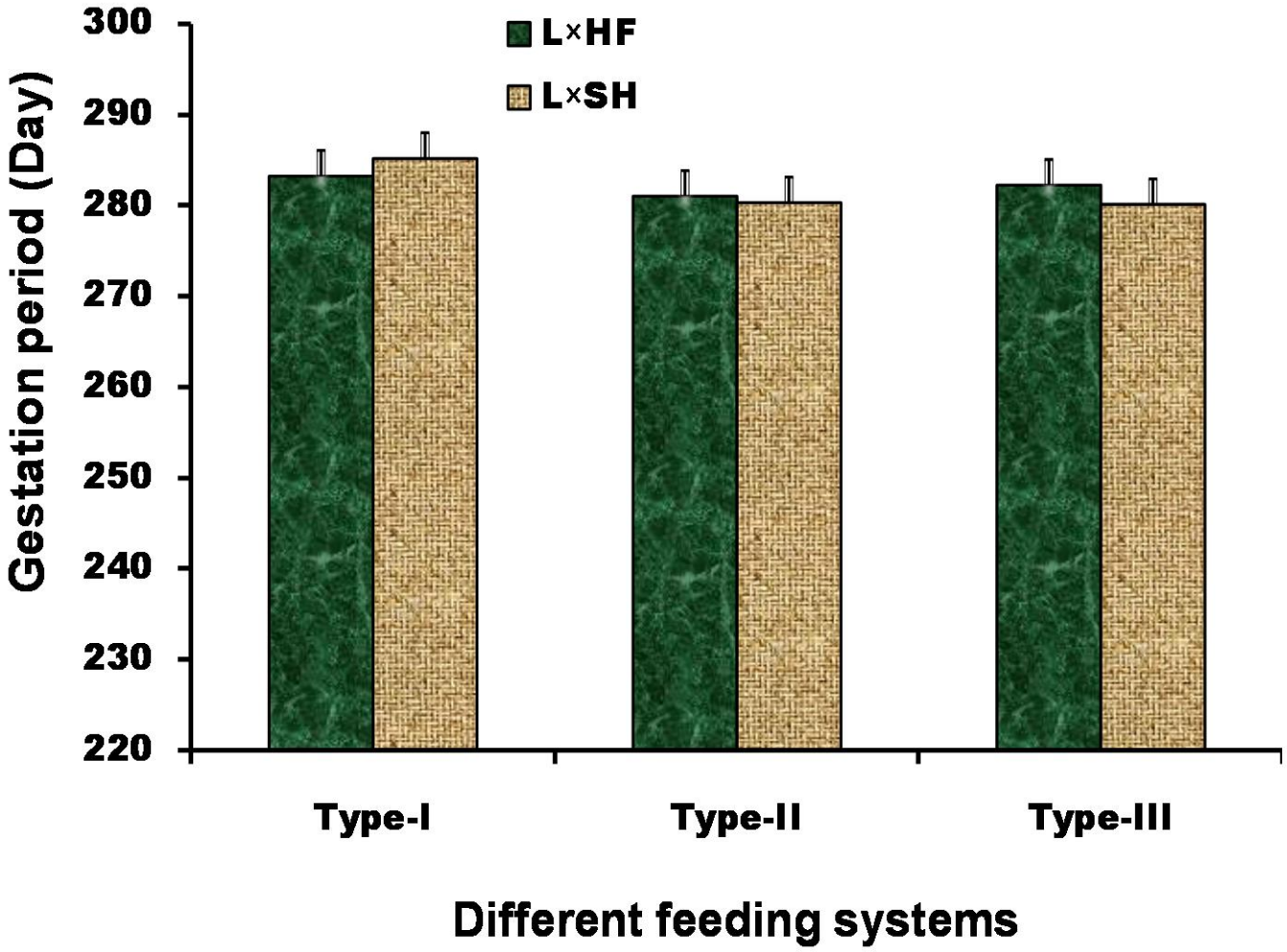

Figure 4. Effect of different feeding systems on gestation period of cross bred (L×HF) and (L×SH) heifers. The values have no significant differences (P>0.05) among the group of cross bred cows reared under the two feeding system.

4.5. Daily milk yield

Effect of different feeding systems on daily milk yield is shown in Figure 5. The present result revealed the average daily milk production of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 5.6 and 4.3 litres respectively in type-I (Sweet jamboo grass) feeding system, 6.8 and 5.2 litres respectively in type-II (Jomjom Dairy feed) feeding system, but it was 9.51 and 7.12 litres respectively in type-III (Advance Chemical Industry) feeding system. The daily milk yield of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) increased by type-III feeding system compare with the type-I and type-II feeding system (Figure 5).

Sultana *et al.* (2001) found daily milk production of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 2.6, 7.2 and 4.9 litres respectively. Alam *et al.* (2008) found average daily milk production of Local, Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 1.7, 6.3 and 5.1 litres respectively. Rokonuzzaman *et al.* (2009) recorded the average daily milk production of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 8.36 and 4.53 litres respectively. Milk yield is highly heritable, as cows produce more milk either by using ingested food or by mobilizing body fat (Schei *et al.*, 2005). Management and nutrition are important for milk production and fertility (Windig *et al.*, 2005; 2006).

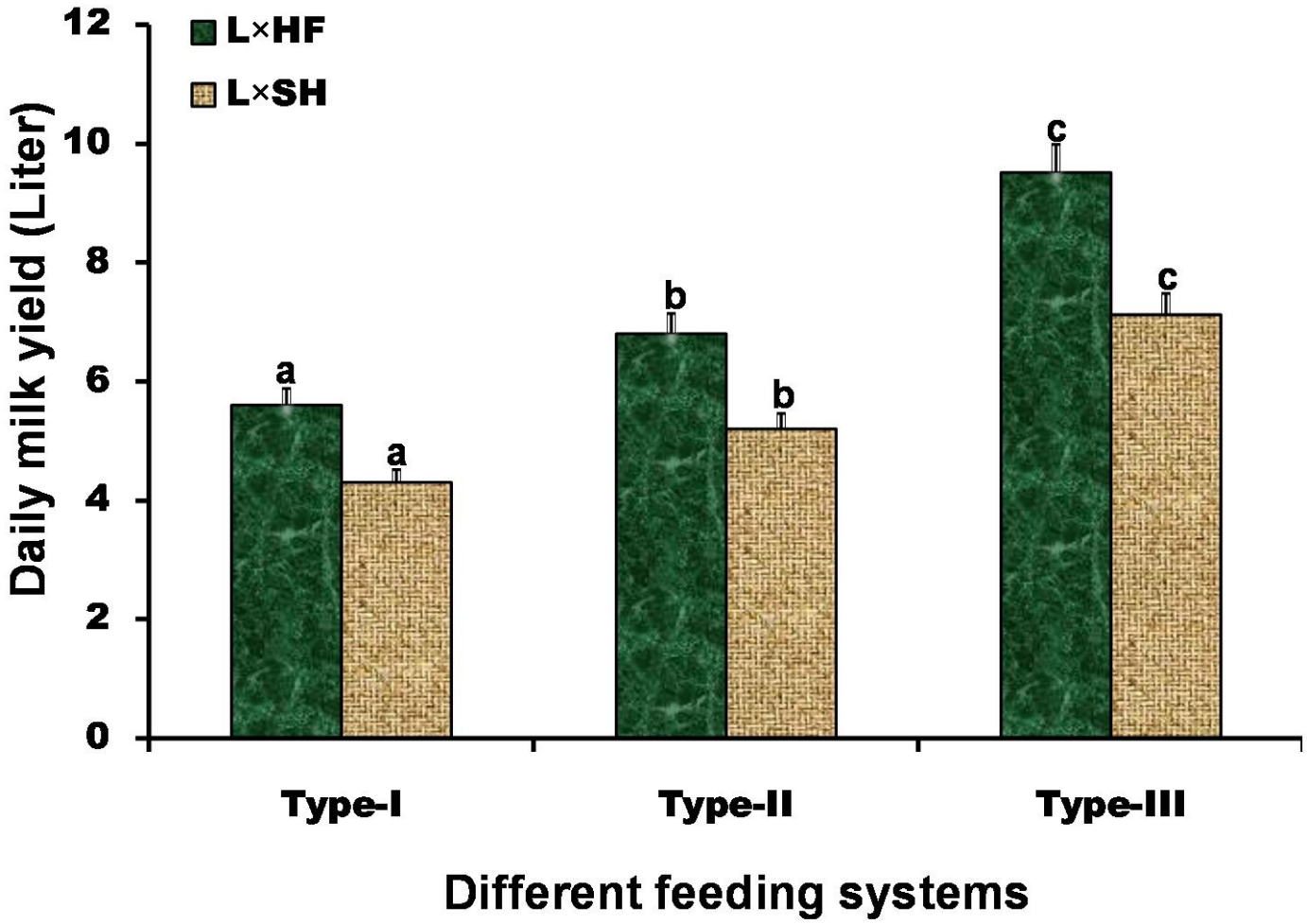

Figure 5. Effect of different feeding systems on milk yield of crossbred (L×HF) and (L×SH) cows. Each bar with error bar represents Mean ± SEM value. Without a common lower case letter on error bars indicate significant differences ($P<0.05$) between the treatment groups.

4.6. Lactation period

The present result showed that the average lactation period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 283.46 and 247.5 days respectively in type-I (Sweet jamboo grass) feeding system, 281.5 and 243.81 days respectively in type-II (Jomjom Dairy feed) feeding system, where it was 295.70 and 267.38 days respectively in type-III (Advance Chemical Industry) feeding system. Effect of different feeding systems on lactation period is presented in Figure 6. The present result of lactation period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) increased by type-III feeding system compare with the type-I and type-II feeding system (Figure 6). Many authors worked with crossbreed cattle {Ahmed and Islam (1987); Mondal (1998), Uddin *et al.* (2004); Rahman and Rahman (2006); Sarder (2001; 2006); Sarder *et al.* (2007)}. Khan et al. (2001) who found that lactation period of Local and Local × Friesian were 221 and 281 days, respectively. Sultana *et al.* (2001) found that the lactation length of Local, Local × Friesian cross and Local × Sahiwal cows were 221, 287.5 and 254 days, respectively. Alam *et al.*(2008) recorded the average lactation period of Local, Local × Friesian cross and Local ×Sahiwal cows were 217.9, 253.8 and 240.8 days, respectively. Rokonuzzaman *et al.* (2009) recorded the average lactation period of Local × Friesian cross and Local × Sahiwal cows were 270.25 and 250.06 days, respectively. kabir and Islam (2009) founded the average lactation period of Local × Friesian cross and Local ×Sahiwal cows were 295 and 280.6 days, respectively which is not agreed with the present study. But the results differ from those of Nahar *et al.* (1992) who found the average lactation length of Friesian × Local cows were 330.5 days.

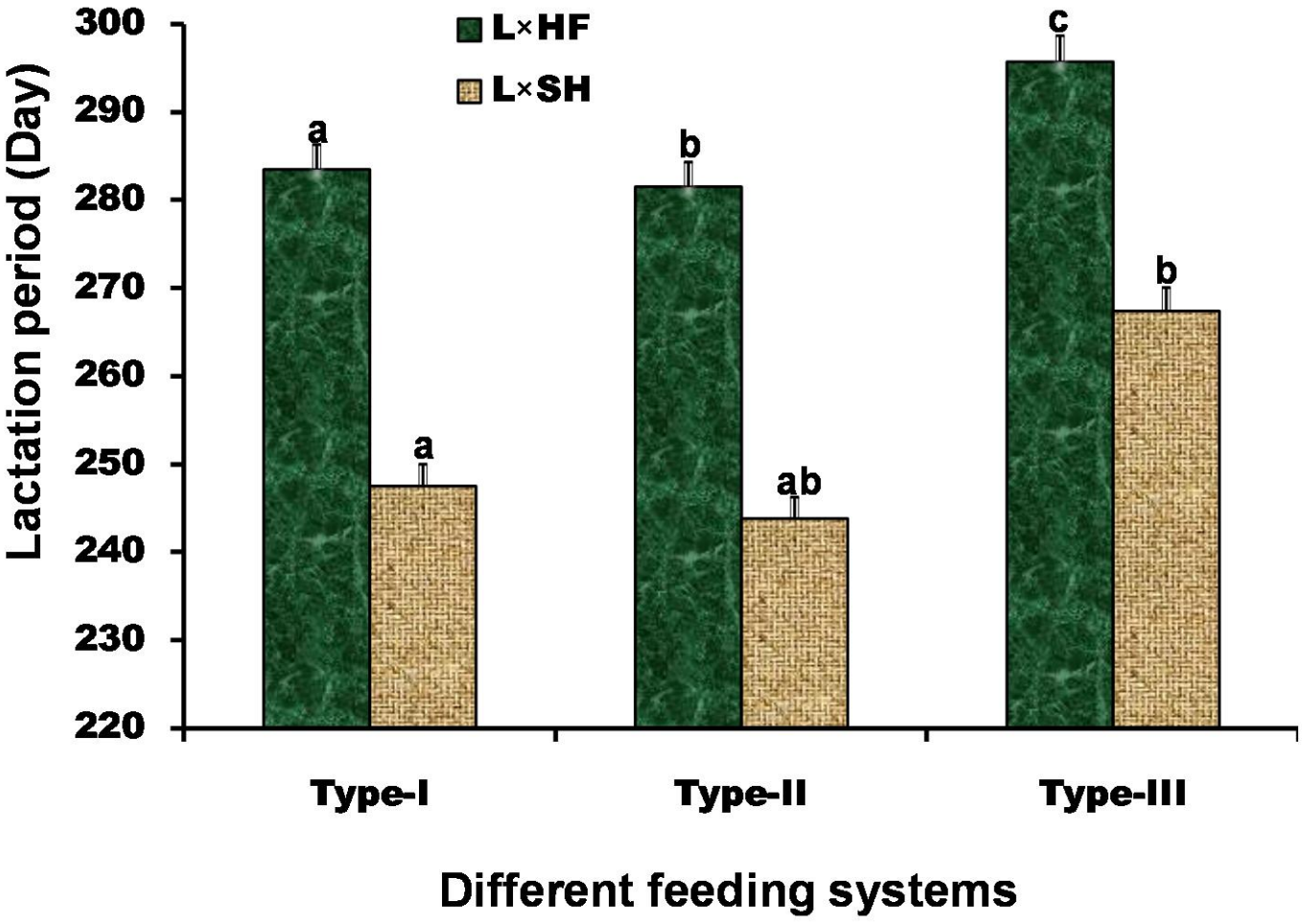

Figure 6. Effect of different feeding systems on lactation period of crossbred (L×HF) and (L×SH) cows. Each bar with error bar represents Mean ± SEM value. Without a common lowercase letter on error bars indicate significant differences ($P<0.05$) between the treatment groups.

4.7. Post-partum heat period

Effect of different feeding systems on post partum heat period is presented in Figure 7. The present result revealed the average post-partum heat period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 170.32 and 164.40 days respectively in type-I (Sweet jamboo grass) feeding system, 166.30 and 163.80 days respectively in type-II (Jomjom Dairy feed) feeding system, but 123.30 and 140.60 days respectively in type-III (Advance Chemical Industry) feeding system. The post-partum heat period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) reduced by type-III feeding system compare with the type-I and type-II feeding system (Figure 7). Uddin *et al.* (2004) stated that post-partum heat of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 182.2 and 171.8 days, respectively. Sarder *et al.* (2007) who found the time to post partum oestrus was 170.2 and 166.6 days, respectively. Alam *et al. (*2008) recorded the average post-partum heat period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 166.8 and 170.5 days, respectively. Rokonuzzaman *et al* (2009) found the average post-partum heat period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 94.48 and 120.06 days, respectively.

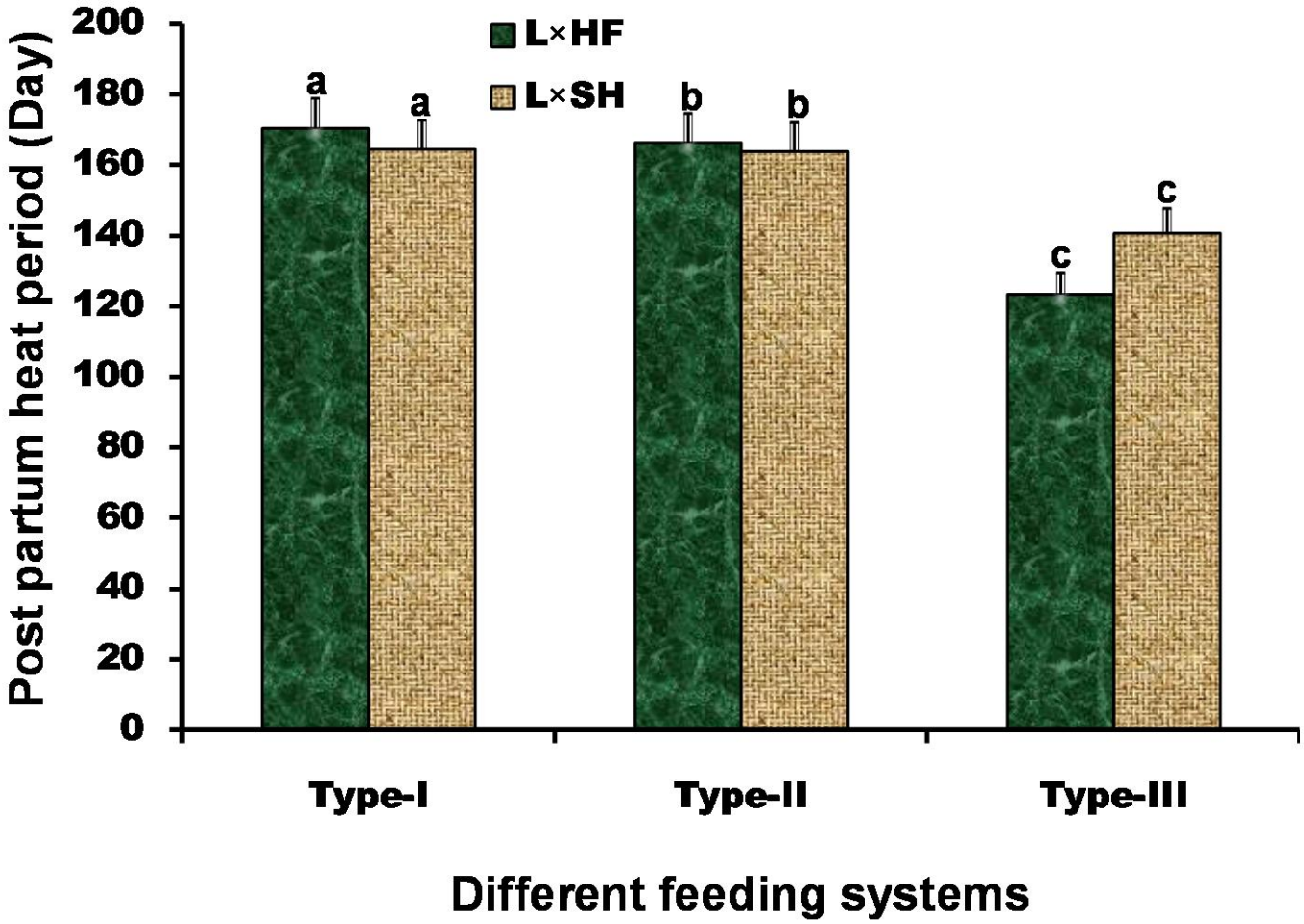

Figure 7. Effect of different feeding systems on post partum heat period of crossbred (L×HF) and (L×SH) cows. Each bar with error bar represents Mean ± SEM value. Without a common lowercase letter on error bars indicate significant differences ($P<0.05$) between the treatment groups.

4.8. Calving interval

The present result expressed that the average calving intervals of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 451.6 and 432.2 days respectively in type-I (Sweet jamboo grass) feeding system, 460.7 and 453.20 days respectively in type-II (Jomjom Dairy feed) feeding system, where it was 413.3 and 430.31 days respectively in type-III (Advance Chemical Industry) feeding system. Effect of different feeding systems on lactation period is presented in Figure 8. The present result of calving intervals of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) reduced by type-III feeding system compare with the type-I and type-II feeding system (Figure 8).

Some other authors worked with crossbreed cattle {Rahman and Rahman (2006); Sarder (2006); Sarder *et al.* (2007); Majid *et al.* (1995)}. Sultana *et al.* (2001) found that the calving interval of Sahiwal × Local cows were 453.7 days. Uddin *et al.* (2004) found that calving intervals of Local and Local × Friesian cross cows were 484.1 and 489.2 days respectively. Alam *et al.* (2008) recorded the average calving intervals of Local, Local × Friesian cross and Local ×Sahiwal cross cows were 494.8, 487.5 and 493.3 days respectively. Kabir and Islam (2009) recorded average calving intervals of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were 447.7 and 417.5 days respectively.

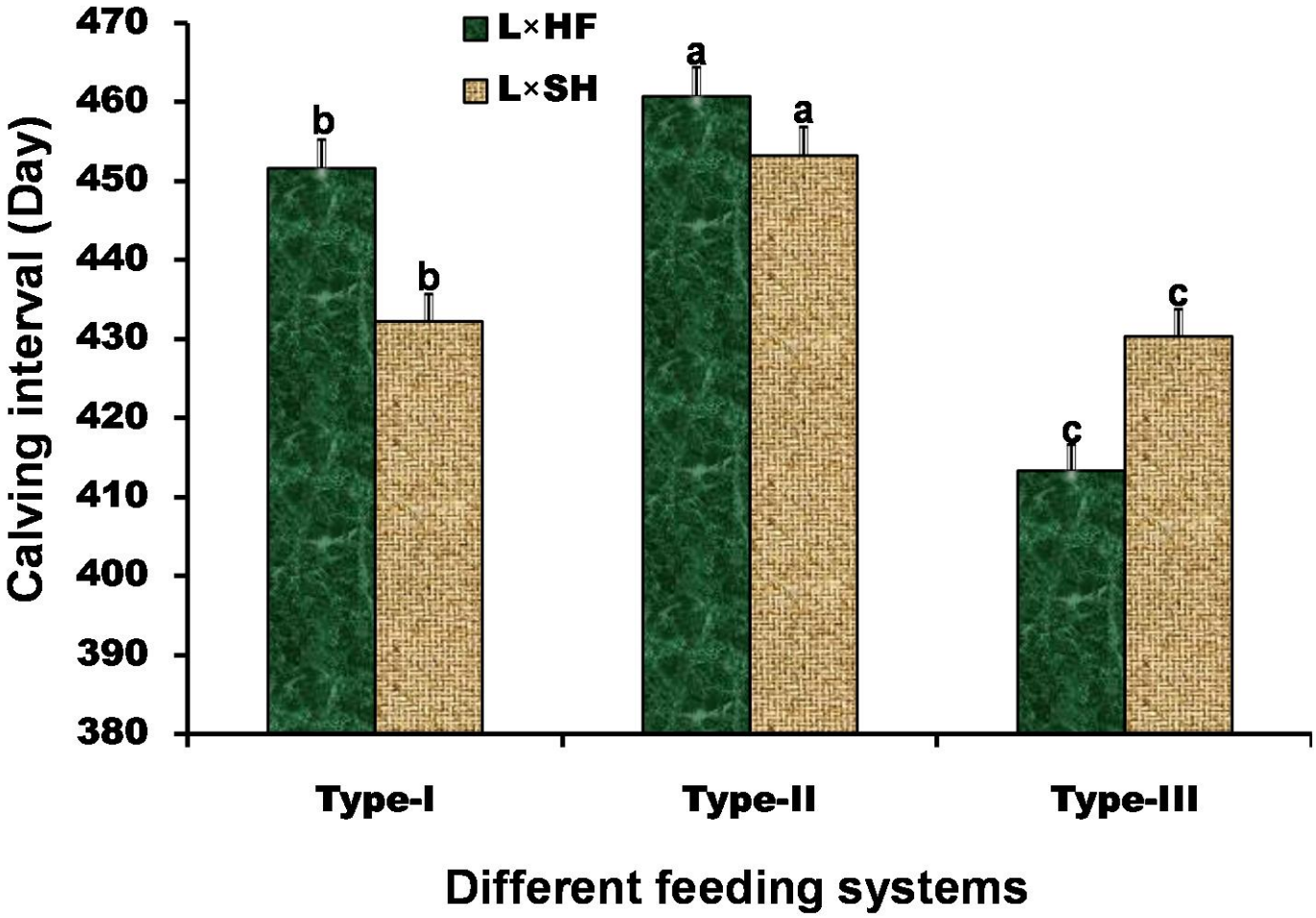

Figure 8. Effect of different feeding systems on calving interval of cross bred (L×HF) and (L×SH) cows. Each bar with error bar represents Mean ± SEM value. Without a common lowercase letter on error bars indicate significant differences ($P<0.05$) between the treatment groups.

Chapter V

SUMMERY AND CONCLUSION

The present study was conducted for a period of 6 months in Gangachara Upazila of Rangpur District. A sample of 60 cross-bred dairy cows Local × Holstein Friesian (L×HF) = 30 and Local × Sahiwal (L×Sh) = 30 were selected for in depth study. The collected data were compiled, decoded and analyzed statistically.

As regards determination of reproductive performance of L×HF and L×Sh cross dairy cows, we found that the average age at first heat of L×HF and L×Sh cows were 26.32 and 28.18 months, respectively in type-I (Sweet jamboo grass) feeding system, 23.12 and 25.51 months, respectively in type-II (Jomjom Dairy feed) feeding system, where it was 20.10 and 22.61 months, respectively in type-III (Advance Chemical Industry) feeding system. The average services per conception of L×HF and L×Sh cows were 1.9 and 1.7, respectively in type-I feeding system, 1.7 and 1.45, respectively in type-II feeding system, but 1.30 and 1.41, respectively in type-III feeding system. The services per conception of L×HF and L×Sh cows were significantly ($p<0.05$) reduced by improved feeding system than traditional feeding system. The middling age at first calving of L×HF and L×Sh cows were 34.35 and 35.13 months, respectively in type-I feeding system, 32.20 and 36.31 months, respectively in type-II feeding system, where it was 31.20 and 33.71 months, respectively in type-III feeding system. The average gestation period of L×HL and L×Sh cows were 283.21 and 285.15 days, respectively in type-I feeding system, 281.01 and 280.30 days, respectively in type-II feeding system, where it was 282.23 and 280.11 days, respectively in type-III feeding system. The usual post-partum heat period of L×HF and L×Sh cows were 170.32 and 164.40 days, respectively in type-I, 166.30 and 163.80 days, respectively in type-II where 123.30 and 140.60 days, respectively in type-III feeding system. The average calving intervals of L×HF and L×Sh cows were 451.6 and 432.2 days, respectively

in type-I feeding system, 460.7 and 453.20 days, respectively in type-II feeding system, where it was 413.3 and 430.31 days, respectively in type-III feeding system. As regards determination of productive performance of cross-bred Local × Holstein Friesian (L×HF) and Local × Sahiwal (L×Sh) dairy cows, we found that the average milk of L×HL and L×Sh cows were 5.6 and 4.3 litres, respectively in type-I (Sweet jamboo grass) feeding system, 6.8 and 5.2 litres, respectively in type-II (Jomjom Dairy feed) feeding system, but it was 9.51 and 7.12 litres, respectively in type-III (Advance Chemical Industry) feeding system. The average lactation period of L×HF and L×Sh cows were 283.46 and 247.5 days, respectively in type-I feeding system, 281.5 and 243.81 days, respectively in type-II feeding system, where it was 295.70 and 267.38 days, respectively in type-III feeding system. The present result of lactation period of Local × Holstein Friesian (L×HF) cross and Local × Sahiwal (L×Sh) cross cows were significantly ($p<0.05$) increased by type-III feeding system compare with the type-I and type-II feeding system.

In the socio–economic aspects of Bangladesh we are to improve the productive and reproductive performance of cross bred dairy cows in order to have an aid from this sector to national economy. In the result of the present study the productive and reproductive performance of cross bred dairy cows is higher in type-III feeding system compare with other feeding systems. So it may be suggested that the farmers of Rangpur District should be provided type-III feeding to their cross- bred heifers and cows.

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