**CHAPTER 1: INTRODUCTION**

The world food requirement by the year 2050 will be double that of 2010, a significant part of this requirement will emerge from developing countries (FAO, 2012). At present, Bangladesh is secured by food production. But as the growth of population increases rapidly, government has emphasized on agro based farming regarding food security for the future. Consequently, Dairying is nearly always part of mixed farming system in Bangladesh (Saadullah, 2001). The Government of Bangladesh undertook innumerable attempts to improve the milk production capacity of local breed through crossbreeding with high yielding breed.

In Bangladesh the total cattle population is about 23.4 million of which 11.91 million are males and 11.49 million are females. Included among the cattle population are about 3.53 million milking cows, 2.61 million dry cows (cows without milk), 2.13 million draught cattle, and 4.20 million improved cattle (BBS, 2012).

Since the 1960s, the people of Bangladesh have been rearing three categories of cattle viz pure breed, crossbreed, and local. In Bangladesh the best local cattle are available in some selected areas viz Pabna, Sirajganj, Chittagong, and Munshiganj areas. In Pabna and Sirajganj area medium type cattle are seen, known as Pabna cattle. A Pabna cow can produce 3-5 liters of milk per day. In Chittagong a beautiful red cattle with some distinct characteristics are seen; it is known as Red Chittagong Cattle and may produce about 2 litres milk. In Munshiganj area a type known as White Munshiganj Cattle has also some distinct phenotypic characteristics (BBS, 2012).

To improve the production potentialities of the local cattle, efforts were made to cross breed with different exotic breeds several times in the past. The introduced breeds are Holstein-Friesian, Jersy, Sahiwal, Harians, Sindhi, Australian, Sahiwal-Friesian etc (BBS, 2012). Only 10 per cent of our cows were reported to be crossbred (BBS, 2012). In Bangladesh, a number of exotic pure breeds, their crossbreeds, and up-graded cattle are found in the government dairy farms, commercial dairy farms, milk pocket area and in urban and semi-urban areas. But the major problem with crossbreeding is recording of crosses of the individual animals. This means that record keeping is important for maintaining the percentage of crosses as well as performance.

The cattle of Bangladesh are mostly of indigenous types (*Bos indicus*) with few cross-breeds along with some purebreds. Although, milk production of indigenous cows is not up to the mark but we cannot ignore them as they possess some unique characteristics. Most importantly, indigenous cows have more disease resistance capacity and survive well in threaten level of nutrition as well as adjusted with hot and humid climatic conditions than that of exotic breeds.

In dairy cattle, milk yield is one of the most important quantitative traits that are limited by a common effect of genotype and environmental factors (Topal *et al.*, 2010). The low productivity of a milking cow in the country is due to shortage of feeds and fodder, poor genetic potentiality, and wide spread of diseases. For better performance, suitable breeds of cows have to be developed in our country through selection, crossbreeding and upgrading together with improved management practices. In spite of all these problems recently some people in the rural areas of low income group are very much interested for small scale dairy farming than that of other professions.

The cattle of Bangladesh are mainly an indigenous Zebu Type (*Bos indicus*) and their average milk production is 0.5 to 2.5 litres per day (Ahmed and Islam, 1987 and Hossain *et al.*, 2002). Crosses of Holstein-Friesian, Jersey, Sahiwal and Red-Sindhe with indigenous cattle produce 5 to 10 litres per day (Hossain *et al.*, 2002). The number of dairy farms increased from 2,490 in the year 1990-1991 to 29,600 by the year 1997-1998 (DLS, 2000). Milk production increased from 1.78 million metric tons in 2001-2012 to 3.46 million metric tons in 2011-2012 (DLS, 2012). Better genotype and sound management are the major determinants of profitability of dairying at either farm or individual level (Djemoli and Freeman, 1987; Rahman *et al.*, 1987). The farms situated in Chittagong are varied in feed composition, production performance (Das *et al.*, 2011), management and feeding practice (Khan and Mazumder, 2011). Bangladesh has given the priority on the development of dairying at farmer’s level to increase the supply of milk from small-holder dairy farms. A large number of crossbreds and indigenous dairy cows are raised in the study areas at Chittagong. Moreover, the area is well communicated and the farmers are aware about the dairy farming. The present study was therefore undertaken to investigate the productive and reproductive performances of crossbreds and indigenous dairy cows at Patiya in Chittagong and recommended farmers that were suitable in existing ecological and socio-economical condition.

**The current study was design with the following objectives:**

1. To know the performance of daily milk yield (DMY) of different dairy cows in Patiya, Chittagong.
2. To estimate regression between daily milk yield (DMY) and lactation number of different dairy cows in Patiya, Chittagong.

**CHAPTER 2: MATERIALS AND METHODS**

**2.1 Study area**

The study area was carried out among six dairy farms at Patiya in Chittagong, Bangladesh.

**2.2 Study time**

The study was conducted for two months of internship period from March, 2016 to April, 2016 at different dairy farms in Patiya.

**2.3 Base line survey**

At first, base line survey was done on 06 (six) dairy farms at Patiya. A total of 100 dairy cows of 3 genotype (50% Holstein-Friesian × 50% Local, 75% Holstein-Friesian × 25% Local and 50% Holstein-Friesian × 25% Sahiwal × 25% Local) were studied.

**2.4 Collection of data**

All data were collected through a structured questionnaire (Appendix-I) for the information on dairy cattle production, reproduction and their management at Patiya. Data were collected on various production parameters (live weight, milk yield, lactation length and lactation number) and reproduction parameters (calving interval, gestation length, age at first calving and conception rate). A total of 06 dairy farms (of those farms which have at least 10 dairy cows) surveyed directly. The survey was done by direct farm visit with the help of local personnel. Besides these, additional data were collected on management factors (history of vaccination and anthelmantics), occurrence of various diseases, breeding and feeding.

**2.5 Fitting the Linear Regression**

In the linear regression equation (Y = a + bx, where Y is daily milk yield (DMY), x is Lactation number and a & b are the parameters that define the slope of the curve) the daily milk yield (DMY) was set as dependent and lactation number was set as independent variable. The model was analyzed by Microsoft Office Excel Worksheet to obtain the model parameters (a and b). Along with the fit statistic coefficient of determination (R2) was also obtained.

**2.6 Statistical analysis**

At first, data were collected randomly from the farms of the study areas for regression analysis. After that, collected data were input into Microsoft Office Excel Worksheet as ‘xlsx’ format. Collected data were calculated by means of Microsoft Excel to find out the relationship between daily milk yield (DMY) and lactation number of 50% Holstein-Friesian × 50% Local, 75% Holstein-Friesian × 25% Local and 50% Holstein-Friesian × 25% Sahiwal × 25% Local genotypes of dairy cows at Patiya, Chittagong.

**CHAPTER 3: RESULTS**

**3.1 Mean ± standard error of daily milk yield (DMY) in different dairy cows**

The mean with standard error value of dairy milk yield (DMY) in 50% Holstein-Friesian × 50% Local, 75% Holstein-Friesian × 25% Local and 50% Holstein-Friesian × 25% Sahiwal × 25% Local were shown in Table 1.

For 50% Holstein-Friesian × 50% Local, the highest daily milk yield (DMY) was 9.23 ± 2.89 in lactation number 3 (three) and the lowest daily milk yield (DMY) was 7.50 ± 1.05 in lactation number 1 (one) (Table 1).

For 75% Holstein-Friesian × 25% Local, the highest daily milk yield (DMY) was 7.56 ± 1.30 in lactation number 3 (three) and the lowest daily milk yield (DMY) was 6.11 ± 1.02 in lactation number 1 (one) (Table 1).

For 50% Holstein-Friesian × 25% Sahiwal × 25% Local, the highest daily milk yield (DMY) was 6.01 ± 1.21 in lactation number 3 (three) and the lowest daily milk yield (DMY) was 4.50 ± 0.92 in lactation number 6 (six) (Table 1).

The average daily milk yield (DMY) was higher in 50% Holstein-Friesian × 50% Local than 75% Holstein-Friesian × 25% Local and 50% Holstein-Friesian × 25% Sahiwal × 25% Local. The highest daily milk yield (DMY) was 9.23 ± 2.89 in lactation number 3 of 50% Holstein-Friesian × 50% Local and the lowest daily milk yield (DMY) was 4.50 ± 0.92 in lactation number 6 of 50% Holstein-Friesian × 25% Sahiwal × 25% Local (Table 1).

In comparison to lactation number, the daily milk yield (DMY) was found maximum in 50% Holstein-Friesian × 50% Local and lowest in 50% Holstein-Friesian × 25% Sahiwal × 25% Local while 75% Holstein-Friesian × 25% Local was shown intermediate performance.

**Table 1.** Mean ± standard error of daily milk yield in various genotypes

|  |  |
| --- | --- |
| Lactation Number | **Daily Milk Yield** |
| 50% HF × 50% L | 75% HF × 25% L | 50% HF × 25% S × 25% L |
| 1 | 7.50 ± 1.05 | 6.11 ± 1.02 | 5.11 ± 0.98 |
| 2 | 8.39 ± 2.09 | 6.39 ± 0.95 | 5.78 ± 1.20 |
| 3 | 9.23 ± 2.89 | 7.56 ± 1.30 | 6.01 ± 1.21 |
| 4 | 8.34 ± 1.37 | 7.23 ± 1.20 | 5.89 ± 1.07 |
| 5 | 7.87 ± 1.35 | 6.98 ± 1.05 | 5.37 ± 0.81 |
| 6 | 7.90 ± 1.07 | 6.50 ± 0.99 | 4.50 ± 0.92 |
| Average | 8.21 ± 0.24 | 6.79 ± 0.23 | 5.44 ± 0.23 |

Legends: HF = Holstein-Friesian, L = Local, S = sahiwal

**3.2 Linear regression equation of various genotypes with lactation number**

The value of linear regression equation of various genotypes with lactation number was shown in Table 2. The intercept (a) was highest (8.095) in 50% Holstein-Friesian × 50% Local, while 75% Holstein-Friesian × 25% Local was 6.080 and 50% Holstein-Friesian × 25% Sahiwal × 25% Local was 5.883 (Table 2). In 50% Holstein-Friesian × 50% Local, the slope (b) was 0.069 that was higher than 75% Holstein-Friesian × 25% Local (0.258) and 50% Holstein-Friesian × 25% Sahiwal × 25% Local (-0.125) (Table 2). The slope values were positive in 50% Holstein-Friesian × 50% Local and 75% Holstein-Friesian × 25% Local and the negative value of slope was shown in 50% Holstein-Friesian × 25% Sahiwal × 25% Local. So, the 50% Holstein-Friesian × 50% Local and 75% Holstein-Friesian × 25% Local were positively co-related and 50% Holstein-Friesian × 25% Sahiwal × 25% Local genotype was negatively co-related.

The coefficient of determinant (R2) was highest (0.467) in 75% Holstein-Friesian × 25% Local and lowest (0.028) in 50% Holstein-Friesian × 50% Local while intermediate in 50% Holstein-Friesian × 25% Sahiwal × 25% Local (Table 2).

Highest values of intercept (a), slope (b) and fit statistics (R2) showed that linear regression of daily milk yield (DMY) with lactation number of 75% Holstein-Friesian × 25% Local that fitted more accurately than other genotypes.

**Table 2.** Linear regression equation of various genotypes with lactation number

|  |  |
| --- | --- |
| **Genotype** | **Parameter** |
| **a (intercept)** | **b (slope)** | **R2(Coefficient of determinant)** |
| 50% HF × 50% L | 8.059 | 0.069 | 0.028 |
| 75% HF × 25% L | 6.080 | 0.258 | 0.467 |
| 50% HF × 25% S × 25% L | 5.883 | -0.125 | 0.168 |

Legends: HF = Holstein-Friesian, L = Local, S = sahiwal

The curve shape of daily milk yield (DMY) of various genotypes of dairy cows after fitting linear regression was shown in Figure 1.

|  |
| --- |
|  |
|  |
|  |

**Figure 1.** Curves of the daily milk yield of various genotype obtained from linear regression

**CHAPTER 4: DISCUSSION**

Mainly crossbreed of dairy cattle (Holstein-Friesian, Sahiwal, Jersey) had superior performance in daily milk yield (Mojumder, 2012). The average milk yield (DMY) of Local, Friesian cross and Jersey cross were 2.6, 6.6 and 5.7 litres respectively (Ahmed *et al*., 1992). Moreover the average milk yield (DMY) of crossbreed and indigenous dairy cows were 4.1 and 2.28 litres per day respectively (Ali, 1998). The average daily milk yield (DMY) of cross breed dairy cows was 6.2 ± 0.31, 4.2 ± 0.50 and 5.8 ± 0.36 that was found by the Islam *et al*., (1999), Al-Amin & Nahar (2007) and Miazi *et al*., (2007) respectively. Variation in dairy milk yield (DMY) of different genotype might be due to genetic, feeding environmental and management effect (Mojumder, 2012).

In the current study, the average daily milk yield (DMY) was ranging from 8.21 ± 0.24 to 5.44 ± 0.23 in all three genotypes dairy cow in the farms of studied area. 50% Holstein-Friesian × 50% Local produced highest average daily milk yield. The result (8.21 ± 0.24) was higher than the result of the Bilkis *et al*., (2016) and Bhuiyan *et al*., (1994) where they found that average milk yield of 50% Holstein-Friesian × 50% Local were 7.00 and 5.60 ± 0.20 respectively. The result for same genotype was not in accordance with the result of Majid *et al*., (1996) who reported that the average milk yield for 100 day was 839 ± 50.71 while in this study for 100 days the average milk yield was 821 ± 24. Storage of feed and housing system in different dairy farms could be the reasons for dissimilar results.

In case of 75% Holstein-Friesian × 25% Local, the average milk yield was 6.76 ± 0.23 that slightly differed with the result of Bhuiyan *et al*., (1994) who found 6.50 ± 0.10 for the same genotype. Majid *et al*., (1996) reported that average milk yield for 100 days of the 75% Holstein-Friesian × 25% Local was 731 ± 26.29 which differed from the present study (676 ± 23) for the same genotype. Different quality of feed and management practice might be responsible for variation in milk yield.

The 50% Holstein-Friesian × 25% Sahiwal × 25% Local produced lowest average milk yield (5.44 ± 0.23) in the present study. The result differed from the result of Bilkis *et al*., (2016) and Das *et al*., (2009) where they reported that average milk yield of 50% Holstein-Friesian × 25% Sahiwal × 25% Local were 17.23 ± 1.06 and 6.58 ± 0.59 respectively. Majid *et at*., (1996) found that the average milk yield for 100 days was 578 ± 18.6 which was not similar with this study (544 ± 0.23) for Holstein-Friesian × 25% Sahiwal × 25% Local. Improper and inadequate nutrients availability in the studied area might be responsible for lower milk yield.

After fitting the regression equation with the various genotypes (50% Holstein-Friesian × 50% Local, 75% Holstein-Friesian × 25% Local and 50% Holstein-Friesian × 25% Sahiwal × 25% Local) it was noticed that the intercept value of daily milk yield (DMY) was highest in 50% Holstein-Friesian × 50% Local. The slope of the curve and R2 values of daily milk yield (DMY) for 75% Holstein-Friesian × 25% Local were higher than 50% Holstein-Friesian × 50% Local and 50% Holstein-Friesian × 25% Sahiwal × 25% Local. The higher R2 values of the genotypes indicated the more fitted with the regression line that was with the increases of lactation numbers the values were also increase. In case of polynomial model Khan *et al*., (2012) considered R2 values above 0.80 as superior.

**CHAPTER 5: LIMITATION**

The major limitations of this study were smaller studied population size, time period (only two months of internship period), poor record keeping system of the dairy farms at Patiya, Chittagong.

**CHAPTER 6: CONCLUSION**

From the present study, it may be concluded that the maximum average daily milk yield (8.21 ± 0.24) was found in 50% Holstein-Friesian × 50% Local and the minimum average daily milk yield (5.44 ± 0.23) was found in 50% Holstein-Friesian × 25% Sahiwal × 25% Local. But in regression line 75% Holstein-Friesian × 25% Local fitted more than other genotypes. The owners of dairy farms under the studied area followed traditional rearing system. Good husbandry knowledge of farmers, proper housing system, sufficient numbers of high yielding breeds and availability of feeds or fodders were responsible for increasing the daily milk yield. Proper initiatives have to be taken viz. accurate record keeping system, good management practice, supply of proper nutrition, trained and skilled farm owner about rearing system in field level.

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 **Author**

**BIOGRAPHY**

I am **Sumaiya Tajrin**, daughter of Habibur Rahman Khan and Khadiza Begum. I have passed my Secondary School Certificate (S.S.C) examination in 2008 and Higher Secondary Certificate (H.S.C) examination in 2010. Now I am an intern veterinarian under the Faculty of Veterinary Medicine in Chittagong Veterinary and Animal Sciences University. In future I would like to work in the field of Veterinary Epidemiology and Research.

 Date: \_ \_ \_ \_ \_ \_ \_ \_ \_

**APPENDIX-I**

**Tag No :**

|  |  |
| --- | --- |
| **Name of Farm** |  |
| **Name of Owner** |  |
| **Occupation** |  |

**Address:**

|  |  |
| --- | --- |
| House No  |  |
| Road No  |  |
| Village/Ward  |  |
| Upazilla/Thana  |  |
| District  |  |
| Mobile No  |  |

1. **Animal Information Data**:

Physiological Status : Pubertal Heifer/ Non Pubertal Heifer/ Milch/ Dry Milch/ Recently Calved/

 Pregnant/ Other.

Species : Cattle/ Buffalo/ Sheep/ Goat

Breed : Local ND/ Local/ Red Chittagong/ Cross ( \_ \_ \_ \_ \_ \_ \_ x \_ \_ \_ \_ \_ \_ \_ )/Others

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Age | Sex | Height | Length | Width | Weight | Colour | Shape of Animal | Anatomic Structure |
|  |  |  |  |  |  |  |  | Triangular/ Not |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Gestation Length | Calving Interval | Lactation No. | Lactation Length | Duration of Pregnancy |
|  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Conception Rate | 1st Calving Time | 2nd Calving Time | 3rd Calving Time |
|  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| 4th Calving Time | 5th Calving Time | 6th Calving Time | Milk Yield ( lt./day ) |
|  |  |  |  |

1. **Source of Population:**

Source of Animal : Farm Livestock/ Domestic Livestock/ Family Livestock (1-2 No.)

|  |  |  |  |
| --- | --- | --- | --- |
| Type of Farm |  | Date/Month of Recent Calving |  |
| Size of Farm |  | Feeding Reginen | Grass ( . . . . . . kg/day) |
| Deworming |  | Concentrate ( . . . . kg/day) |
| Day since of Deworming |  | Housing System | Intensive/Semi Intensive |
| Any Recent Illness | Yes/ No | Tethered/Free Range |
| Time of Recent Illness |  | Gazing | Yes/ No |
| Vaccination |  | Type of Gazing | Community/ Individual |
| Day since of Vaccination |  | Hair Coat |  |
| Month of Recent Insemination |  | General Attitude |  |