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EFFECT OF GENETIC AND NON-GENETIC FACTORS ON MILK PRODUCTION PERFORMANCE OF HOLSTEIN-FRIESIAN × LOCAL CROSSBREDS AT THE VILLAGES OF NOAKHALI DISTRICT IN BANGLADESH

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ABSTRACT

A total of 210 Holstein Friesian (HF) × Local crossbred cattle were examined to collect data like, test day milk production (MT), peak milk production (PM), lactation period (LD), green grass used the day before test milk production (GG), cost involved to feed the cow with concentrate feed on the day before test milk production (CP), age, body weight of cows (BW) and ancestry of test cows to define the grade. The data were collected using a pre-structured questionnaire at the villages of Noakhali district in Bangladesh during October to November 2016.The effect of grades, age, body weight, concentrate feed and green grass on milk production were evaluated. To study the effects, Duncan's Multiple Range Test and Pearson's correlation coefficient were performed using the Statistical Package for the Social Sciences. Positive correlation of MT with CP (0.794) and GG (0.453) were estimated. Ages of cows did not affect MT, PM and LD significantly. In grade two, the highest, MT (18.75±2.62 liter/cow/day) and PM (20.75±2.62 liter/cow/day) were reported for body weight group 3 while, the longest LD (219.88±0.47) was reported under body weight group 2. However, under grade three in body weight group 3, MT, PM and LD were 15.57±0.78 liter/cow/day, 18.00±0.78 liter/cow/day and 218.79±0.80 days/cow, respectively. Present study might be suggested that body weight group 3 under grade three was better for MT and PM while, body weight group 2 was better for LD but to come up with final decisions in this regard, further study addressing more numbers of crossbred cows with defined exotic blood percentages under different grades, seasons of calving, parity, feed and water management, housing, healthcare and farmers socio-economic status would be advisable. Finally, it might be indicated that grades, bodyweight groups, CP and GG affected milk production at the villages of Noakhali district in Bangladesh.

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INTRODUCTION

Huge gap between production and requirements of milk, influencing the importer to import milk in various forms from abroad though, Bangladesh has the greatest potentiality to increase milk production with proper utilization of its huge man power. It is a matter of hope for the nation that over the decades dairy sector has made tremendous improvements in the field of establishment of some crossbred dairy cattle genotypes and selected some improved local verities for milk production purpose and private entrepreneurs are involving in this promising sector day by day. Livestock is a vital component of agriculture and this is contributing more than 6% of total foreign exchange earnings and about 3.10% to gross domestic products (GDP) in Bangladesh (BER, 2015). In Bangladesh, per capita availability of meat and milk are 102 gm/day and 120 ml/day, respectively but per capita meat and milk requirement are 120 gm/day and 250 ml/day, respectively (BER, 2013), while, here in Bangladesh total annual requirement is 13.32 million tons (MT) of milk but annual production of milk is 3.46 million tons only (BER, 2012). In Bangladesh, improved varieties like: Pabna Cattle, Red Chittagong, Munshiganj Cattle, North Bengal Grey Cattle and introduced exotic breeds like Holstein-Friesian, Jersy, Sahiwal, Hariana, Sindhi, Australian, Sahiwal-Friesian, etc are available. Out of total cattle population (23.4 million) in Bangladesh, 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 were reported (Banglapedia, 2014). Digestibility of organic matter and crude protein were improved and the milk yield also increased by increasing the concentrate ratio in the diet from 30 to 45 percent but there was no effect on milk composition (Tuan, 2000). Feed intake, nutrient digestibility and live weight gain of indigenous cattle were improved through supplementation of straw-based diets with vigna hay, in Bangladesh (Hossain *et al.,* 2015). Friesian x Local crossbred cows's milk production performance under Bangladesh condition considerably improved over the decades (Bhuiyan, 2011) and this crossbred animals contributes about 24% of the 6.9 million breedable cows and heifers (Huque *et al.,* 2011). Among the various mating systems crossbreeding of local non-descript cattle with exotic breeds of high genetic potential, to improve genetic merit of the dairy animals, is considered to be a rapid and effective method (Usman *et al*., 2012). To add proven bull in dairy cattle industry, progeny tested bulls for dairy development in the country are in progress (Bhuiyan *et al*., 2015).Many research works have been carried out using Holstein Friesian and other exotic hi-yielding breeding bull through crossbreeding with local cattle to improve milk production but published data of systematic research works with specific grade number of Friesian X local crossbred cattle, assessments of the optimum amount of concentrate feed and green grass for maximum milk production at the rural villages in Bangladesh for this crossbred dairy cows is scanty. So, the present study was designed and conducted to explore knowledge about the milk production performances of Friesian X local crossbred cattle under different grades and to know the present status and relationship of concentrate feed and green grass use with milk production parameters at rural village condition in Bangladesh.

MATERIALS AND METHODS

Data like test day milk production (MT), peak milk production in a whole lactation period (PM), lactation period (LD) in days, green grass used the day before test milk production in kg per cow (GG), cost involved to feed the cow with concentrate feed on the day before test milk production per cow in Bangladeshi taka (CP), age of enumerated cows, body weight of cows (BW) and ancestry(dam and sire identity) of test cows to define the grade of the enumerated cows were collected. Door to door visits were performed to collect the said data using a pre-structured questionnaire from a total of 210 Holstein-Friesian X Local crossbred dairy cows at the villages of Sonaimuri, Senbagh, Suborno char and Noakhali sadar upazilas under the district of Noakhali in Bangladesh during October to November 2016. Numbers of Crossbred dairy cows of grade one, two and three were 5, 158 and 44, respectively. Experimental cows were divided into three body weight groups like below:

Body weight group one (BWG1): Body weight per cow under this group was in a range of 200 kg to below 300 kg.
Body weight group two (BWG2): Body weight per cow under this group was in a range of 300 kg to below 400 kg.
Body weight group three (BWG3): Body weight per cow under this group was in a range of 400 kg to 570 kg.

Grades were defined as follows:

Grade one: Progeny produced after successful mating between Local female and upgraded Friesian male (progeny produced after successful mating between upgraded Holstein-Friesian male and upgraded local female cattle).

Grade two: Progeny produced after successful mating between female of grade one and upgraded Friesian male.

Grade three: Progeny produced after successful mating between female of grade two and upgraded Friesian male.

All cows were inseminated artificially and all male calves were kept for meat purpose to sale. The following formulae were used to calculate **CPC** and **GGC**:

$$CPC = \frac{\text{Total concentrate feed cost spent per cow for test day milk production in BDT}}{Total\ milk\ production\ on\ test\ day\ per\ cow\ in\ liter}$$

$$GGC = \frac{\text{Total green grass supplied per cow for test day milk production in kg}}{Total\ milk\ production\ on\ test\ day\ per\ cow\ in\ liter}$$

The observation numbers of different traits were unequal and the design of the study was unbalanced factorial in nature. The recorded data were stored on to the excel spread sheet and edited for further analyses. Then data were analyzed for having means through compare means menu, to obtain the relationship among the traits like MT, CP and GG, Pearson's correlation coefficient were used through correlate menu, and Duncan's Multiple Range Test (DMRT) were used for performing mean comparisons using the Statistical Package for the Social Sciences version 14.0 (SPSS, 2005).

RESULTS

Correlation of MT with CP and GG

The correlations between different traits are presented in Table 1. Strong positive correlation (0.794) between MT and CP was observed in present study. Similarly, positive correlation (0.453) between MT and GG was also documented.

Effect of grades on MT, CPC and GGC

Table 2 shows the effect of grades on MT, CPC and GGC. Test day milk production was significantly varied among the grades of crossbred cows. The highest amount of MT was recorded for grade three (14.75±0.70 liter/cow) and this was followed by grade two and one. The lowest amount of CPC was found in grade three (9.99±0.70 BDT/liter), while the highest was noted in grade one. However, the highest GGC was reported in grade one (0.82±2.00 kg/liter/cow) and the lowest were in grade three.

Effect of grades on PM and LD

The effects of different grades on PM and LD are summarized in Table 3. The PD and LD were affected by grades significantly. The highest peak milk productions were recorded for grade three (17.11±0.70 liter/cow/day) and the lowest were reported for grade one (6.60±2.00 liter /cow/day). On the contrary, the LD between grades two and three did not vary significantly though the highest LD was recorded for grade three (217.98±0.72 days).

Effect of age groups of cow on MT, PM and LD

Table 5 briefs the effects of ages of cows under study on MT, PM and LD. Though the higher MT were reported for age group 3 (cows include in this group were of above 6 years to 10 years of old) than age group 1 (cows include in this group were of 2.5 years to 4 years of old) and age group 2 (cows include in this group were of above 4 years to 6 years of old). Similarly, the higher PM was reported for age group 3 than age group 1 and age group 2. On the contrary, LD was higher in age group 2 than 1, though the same were higher in age group 3 than 2. However, the effect of age group on MT, PM and LD was not significant.

Table 1. Correlations between MT and CP; MT and GG

Traits	MT
CP	0.794** (210)
GG	0.453** (209)

Note: CP-Concentrate feed cost in Bangladeshi Taka (BDT) to feed the cow for the test day milk production, GG-green grass in kg supplied per cow to produce milk on test day, MT-test day milk production in liter/cow, ** correlation is significant at the 0.01 level (2 tailed)

Table 2. Effect of grades on test day milk production and feed cost of Holstein-Friesian X Local crossbred dairy cattle genotypes

Parameter	Grade 1	Grade 2	Grade 3	F
MT	6.00^{c}±2.00 (5)	11.75^{b}±0.38 (158)	14.75^{a}±0.70 (44)	18.289
CPC	12.00^{c}±2.00 (5)	10.13^{b}±0.38 (158)	9.99^{a}±0.70 (44)	1.827
GGC	0.82^{c}±2.00 (5)	0.38^{a}±0.38 (158)	0.47^{b}±0.70 (44)	15.187

Note: MT-test day milk production in liter, CPC- cost in Bangladeshi Taka (BDT) to feed the cow for concentrate feed for per liter of milk production on test day, GGC-green grass in kg supplied to the cow to produce one liter of milk on test day, F-F value in one way ANOVA during post-hoc analysis for DMRT and ^{abc}Means with the different superscripts differed significantly within the column ($P<0.05$)

Table 3. Effect of grades on peak milk production and lactation period of Holstein-Friesian X Local crossbred dairy cattle genotypes

Parameter	Grade 1	Grade 2	Grade 3	F
PM	6.60^{c}±2.00 (5)	13.70^{b}±0.38 (157)	17.11^{a}±0.70 (44)	22.953
LD	190.00^{b}±2.00 (5)	217.58^{a}±0.39 (153)	217.98^{a}±0.72 (42)	7.197

Note: PM-peak milk production per day in liter, LD-lactation period in one calving. F-F value in one way ANOVA during post-hoc analysis for DMRT and ^{abc}Means with the different superscripts differed significantly within the column ($P<0.05$)

Table 4. Effect of age of cow on milk production performances of Holstein-Friesian X Local crossbred dairy cattle genotypes

Parameter	(AG1) 2.5 to 4 years	(AG2) above 4 to 6 years	(AG3) above 6 to 10 years	F
MT	12.37±0.69 (46)	11.81±0.47 (102)	12.93±0.61 (60)	1.489
PM	14.28±0.70 (45)	13.77±0.47 (102)	15.14±0.61 (60)	1.944
LD	214.29±0.70 (45)	216.69±0.48 (99)	219.74±0.62 (57)	1.392

Note: MT-test day milk production in liter, PM-peak milk production per day in liter, LD-lactation period in one calving. F-F value in one way ANOVA during post-hoc analysis for DMRT, AG1-age group 1, AG2-age group 2 and AG3-age group 3

Effect of body weight groups (BWG) on milk production performances under different grades

Grade one

Table 5 states the milk production performances of crossbred cattle under grade 1. All cattle were with a body weight range like 200 kg to below 300 kg/cow under grade one crossbred cattle. Test day milk production and peak milk production per cow were 6.00±2.00 liter/cow/day and 6.60±2.00 liter/cow/day, respectively. Mean lactation period in days were 190.00±2.00/cow.

Grade two

Effects of BWG on MT, PM and LD in grade two are presented in Table 6. In grade two, MT, PM and LD were affected by body weight groups significantly. The higher MT (18.75±2.62 liter/cow/day) and PM (20.75±2.62 liter/cow/day) were reported for BWG3 than BWG2 and BWG1. But very interestingly, LD was reported higher under BWG2 than BWG1 and BWG3.

Grade three

Effects of BWG on MT, PM and LD in grade three are presented in Table 7.In grade three, MT, PM and LD were not affected by body weight groups significantly. MT, PM and LD were reported for BWG3 under grade three, 15.57±0.78 liter/cow/day, 18.00±0.78 liter/cow/day and 218.79±0.80 days/cow, respectively.

Table 5. Effect of body weight of cow in grade one on milk production performances of Holstein-Friesian X Local crossbred dairy cattle genotypes

Parameter	BWG1 (200 to below 300 kg/cow)	BWG2 (300 to below 400kg/cow)	BWG3 (400 to 570kg/cow)	F
MT	6.00±2.00 (5)	-	-	-
PM	6.60±2.00 (5)	-	-	-
LD	190.00±2.00 (5)	-	-	-

Note: MT-test day milk production in liter, PM-peak milk production per day in liter, LD-lactation period in one calving

Table 6. Effect of body weight of cow in grade two on milk production performances of Holstein-Friesian X Local crossbred dairy cattle genotypes

Parameter	BWG1 (200 to below 300 kg/cow)	BWG2 (300 to below 400kg/cow)	BWG3 (400 to 570kg/cow)	F
MT	8.91^{c}±0.69 (46)	12.69^{b}±0.46 (108)	18.75^{a}±2.62 (4)	46.455
PM	10.71^{c}±0.69 (46)	14.73^{b}±0.46 (107)	20.75^{a}±2.62 (4)	41.276
LD	213.82^{b}±0.70 (45)	219.88^{a}±0.47 (104)	200^{c} (4)	4.159

Note: MT-test day milk production in liter, PM-peak milk production per day in liter, LD-lactation period in days in one calving. F-F value in one way ANOVA during post-hoc analysis for DMRT and ^{abc}Means with the different superscripts differed significantly within the column (P<0.05)

Table 7. Effect of body weight of cow in grade three on milk production performances of Holstein-Friesian X Local crossbred dairy cattle genotypes

Parameter	BWG1 (200 to below 300 kg/cow)	BWG2 (300 to below 400kg/cow)	BWG3 (400 to 570kg/cow)	F
MT	12.00 (4)	11.43±1.69 (7)	15.57±0.78 (35)	3.256
PM	13.50 (4)	13.71±1.69 (7)	18.00±0.78 (35)	4.155
LD	210.00 (4)	216.43±1.69 (7)	218.79±0.80 (33)	0.628

Note: MT-test day milk production in liter, PM-peak milk production per day in liter, LD-lactation period in one calving. F-F value in one way ANOVA during post-hoc analysis for DMRT

DISCUSSION

Correlation of MT with CP and GG

Strong positive correlation (0.794) between MT and CP reported. Similarly, positive correlation (0.453) between MT and GG was also documented. However, Body weight gain, milk yield and milk protein were increased as the ratio of concentrate feed was increased in the diet but milk fat was decreased (Sanh *et al*., 2002). Positive and significantly correlated traits might be suggested that, increase for one trait will affect the other positively. So, above discussion might be indicative that increase of CP and GG will affect the MT positively.

Effect of grades on MT, CPC and GGC

MT significantly varied among the grades and the highest MT was recorded for grade three and this was followed by grade two and one. However, present findings was similar to Bhuiyan *et al.* (2015), who reported 1473±35.3 liter of milk / cow/100days of lactation of the first calving daughters of Holstein Friesian crossbred bull in Bangladesh condition. On the other hand, the lowest amount of CPC was observed in grade three (9.99±0.70 BDT/liter), while the highest was noted in grade one. However, the highest amount of GGC was documented in grade one (0.82±2.00 kg/liter/cow) and the lowest were in grade three. Daily 7.14±0.72 kg concentrate feed supplied to the Friesian X local crossbred cow to produce 15.90±0.72 liter milk a day (Hossain *et al.,* 2016). The above discussions might be suggested that grade three contributed more to increase MT and decrease CPC and GGC than grades two and one.

Effect of grades on PM and LD

PM and LD were affected by grades significantly and the highest amount of PM were recorded for grade three and the lowest were reported for grade one. On the contrary LD varied non-significantly between grades two and three but, the higher LD was recorded for grade three than two and one. On the other hand, Sarder *et al*. (2007), found longer lactation length of Holstein Friesian × Local crossbred cows (285±47days) than the present observation. The above discussions might be pointed that grade three contributed more to increase PM and LD than grades two and one.

Effect of age groups of cow on MT, PM and LD

Higher MT and PM were reported for age group 3 than age group 1 and 2. On the contrary, LD was higher in age group 2 than 1, though the same were higher in age group 3 than 2.However, Milk production performances for cows in 4^{th} and more lactations were no longer better than that of their 3^{rd} lactation and this might be due to more numbers of secretory cells after third lactations, were dieing as the cows becoming older and older (Epaphras *et al.,* 2004).These non-significant variations among age groups might be suggested that age group 3 was better than 1 and age group 1 was better than 2 for MT and PM and higher MT and PM under age group 1 than 2, might be to the variation of body weight, genetic merit for milk production of experimental cows or it might be due to the variation of management. But apparently, age group 3 was better than 2 and age group 2 was better than 1 for LD.

Effect of body BWG on milk production performances under different grades

Grade one

All cattle were with a body weight range like 200 kg to below 300 kg/cow under grade one crossbred cattle, mean lactation period in were lower than that of other grades and these lower body weights and LD might be due to the effect body weight and LD of dam (local cattle) of the experimental cows under this grade. Test day milk production and peak milk production per cow were close to the findings of Hossain*et al.* (2016), who observed, daily milk yield was higher in crossbred (15.90±0.72 liter/cow) than pabna (5.73±1.21 liter/cow) cattle at northern region of Bangladesh.

Grade two

In grade two, MT, PM and LD were affected by body weight groups significantly. The higher MT (18.75±2.62 liter/cow/day) and PM (20.75±2.62 liter/cow/day) were reported for BWG3 than BWG2 and BWG1. In a different study, Sarder *et al*. (2007) in Bangladesh found lower amount (11.63±2.90 liter/day/cow) of peak milk than the present findings for Friesian ×local crossbred cattle. But very interestingly, LD was reported higher in BWG2 and this was followed by BWG1 and BWG3 under the same grade. The above discussions might be indicative that BWG3 were superior for MT and PM but BWG2 was better for LD.

Grade three

In grade three, MT, PM and LD were not affected by body weight groups significantly but higher MT, PM and LD were reported for BWG3 under grade three. The above discussions might indicative that the higher the body weight the higher the MT, PM and LD could be found under grade three.

CONCLUSION

Increase of concentrate feed cost per cow (CP) and use of green grass per cow (GG) before test day milk production (GG) will increase the test day milk production (MT). Body weight group three under grade two was better for test day milk production per cow and peak milk production per cow (PM) but body weight group two was better for lactation period in days in one calving per cow (LD). Grades, body weight groups, CP and GG affected MT, PM, LD.

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REFERENCES

1. Banglapedia, 2014. Banglapedia, National Encyclopedia of Bangladesh. http://en.banglapedia.org/index.php?title=Cattle
2. BER, 2012. Bangladesh Economic Review (BER), Economic Division, Ministry of Finance. The Government of the People's Republic of Bangladesh, from http://www.mof.gov.bd
3. BER, 2013. Bangladesh Economic Review (BER), Economic Division, Ministry of Finance. The Government of the People's Republic of Bangladesh, from http://www.mof.gov.bd
4. BER, 2015. Bangladesh Economic Review (BER), Economic Division, Ministry of Finance. The Government of the People's Republic of Bangladesh, from http://www.mof.gov.bd
5. Bhuiyan AKFH, Rashid MM, Khan RA, Habib MA, Bhuiyan MSA, Faiz MA, 2015. Progeny tested bull production for dairy cattle development in Bangladesh. Bangladesh Journal of Animal Science, 44: 106-112.
6. Bhuiyan AKFH, 2011. Progeny Tested Seed Bull Production: Progress towards National Dairy Development. Keynote paper presented at the 3rd National Seminar of Breed Up-gradation through Progeny Test Project held on 15 June 2011 at BIAM, Dhaka.
7. Hossain MS, Islam F, Rashid MHO, Leena SA, Sarker SC, 2016. Productive and Reproductive Performances of Holstein Friesian ×Local Crossbred and Pabna × Pabna Cattle Genotypes. International Journal of Business, Social and Scientific Research, 4: 261-266.
8. Epaphras A, Karimuribo ED and Msellem SN, 2004. Effect of season and parity on lactation of crossbred Ayrshire cows reared under coastal tropical climate in Tanzania. Livestock Research for Rural Development, 16 (2).

9. Hossain MS, Miah MY, Khandaker ZH, Islam F, 2015.Effect of different levels of matikalai (*Vignamungo*) hay supplementation to straw-based diets on feed intake, digestibility and growth rate of indigenous cattle.Livestock Research for Rural Development, 27 (2).
10. Huque KS, Dev GK, Jalil MA, 2011. High yielding dairy breed development in Bangladesh- limitations and opportunities. Paper presented in international workshop on “High yielding dairy breed development in Bangladesh” held at Bangladesh Livestock Research Institute, Dhaka from 28-29 September.
11. Sanh MV, Wiktorsson H, Ly LV, 2002. Effects of Natural Grass Forage to Concentrate Ratios and Feeding Principles on Milk Production and Performance of Crossbred Lactating Cows. Asian-Australasian Journal of Animal Science, 15: 650-657.
12. Sarder MJU, Rahman MM, Ahmed S., Sultana MR, Alam MM, Rashid MM, 2007. Consequence of dam genotypes on productive and reproductive performance of dairy cows under the rural condition in Bangladesh. Pakistan Journal of Biological Sciences 10: 3341-3349.
13. SPSS, 2005. Windows for version-14.0. Release on 27.10.2005. (Microsoft Corp. 1998). Trends SPSS Inc., Michigan Avenue, Chicago, IL. 19-182.
14. Tuan BQ, 2000. Effects of Protein and concentrate levels on rumen digestion and milk production of crossbed dairy cattle in Hanoi. PhD Thesis. University of Agriculture, Hanoi, Vietnam.
15. Usman T, Guo G, Suhail SM, Ahmed S, Qiaoxiang L, Qureshi MS and Wang Y,2012. Performance traits study of Holstein Friesian cattle under subtropical conditions. The Journal of Animal and Plant Sciences, 22: 92-95.