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Growth pattern of crossbred Holstein Friesian heifer calves in an organised farm

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Abstract

The data from 27 crossbred Holstein Friesian heifer calves were taken for the study, conducted in the dairy unit maintained in TamilNadu Agricultural University, Coimbatore, India. The calves were maintained as per the routine feeding and management practices of the farm. The average birth weight of Holstein Friesian heifer calves was 28±5.04 Kg. The average body weight at 4, 8, 12, 16, 20, 24 and 28 months were 47 ± 6.76, 78 ± 12.28, 119 ± 16.71, 173 ± 25.95, 221 ± 32.14, 265 ± 35.14, 305 ± 40.58 Kg, respectively. The average daily gain in body weight were 0.24 ± 0.071, 0.31 ± 0.074, 0.38 ± 0.097, 0.43 ± 0.105, 0.41 ± 0.041, 0.33 ± 0.069 and 0.30 ± 0.110 Kg/d, respectively. Correlation studies of heifer calves on age with average body weight (ABW) showed positive correlation ($R^2 = 0.99$) and were significant at $P<0.01$, correlation of age with average daily gain (ADG) in body weight was positive, but not significant. The correlation between the ADG and ABW was positive ($R^2 = 0.41$) but not significant.

Keywords: Average body weight, average daily weight gain, birth weight, crossbred, heifer calves, Holstein Friesian

INTRODUCTION

Production profile of the animals includes both the growth of skeleton as well as muscle which determine the stage and age of maturity, hence growth is regarded as a complex phenomenon (Singh *et al.*, 2003). Growth rate is the major factor affecting economics of raising dairy replacements and lifetime producing ability of heifers (Tozer and Heinrichs, 2001). Heifer rearing is thus an integral part of any dairy herd (Heinrichs, 1993). There is little information on the growth rates of heifers reared. More accurate balancing of diets according to the protein and energy requirements of growing heifers will result in more efficient growth, younger ages at first calving and increased profits for the producer. This may be achieved by changing the diets according to the age of the animal (NRC, 1989).

Monitoring dairy heifer growth and development will ensure that calves are on target to reach the standard weight (Goyache *et al.*, 2002). Charting heifer growth for body weight, skeletal development, and body condition scoring can evaluate performance and spot trends or problems in heifer management (Bakir *et al.*, 2004). The genetic heritability of birth weight is about 45 per cent, with the remaining 55 per cent due to environmental conditions (Marquez *et al.*, 2001). The animal husbandman finds that birth weight is of economic importance and that knowledge of factors influencing gestation length may be of value in planning herd management (Bayram and Aksakal, 2009). Hence in the present study the growth pattern of crossbred Holstein Friesian heifer calves was analyzed.

MATERIALS AND METHODS

The study was conducted at dairy unit of TamilNadu Agricultural University (TNAU), Coimbatore, TamilNadu, India. The growth data of 27 crossbred Holstein Friesian calves born on the farm during period from 2006 to 2008 were taken for this study. Animals were fed with dry fodder like paddy straw, maize straw and chaffed green fodder. One to 2 kg of feed was given for the heifers belonging to different ages. The various measurements were recorded such as date of birth, birth weight (Kg), age of calves. The average daily gain in weight (Kg) was also calculated. The mean, standard error, correlation and one way ANOVA were performed by Graph Pad Prism and SPSS 18.

RESULTS AND DISCUSSION

Birth weight: The average birth weights of crossbred Holstein Friesian are presented in Table1. The average birth weight of Holstein Friesian was found to be 28±5.04 Kg. The birth weights reported by Guarangna *et al.*, (1990) were very close to the present findings in respect to Holstein Friesian heifer calves. The birth weight of crossbred Holstein Friesian calves reported by Singh *et al.*, (2001) was higher than the present results. The R^2 value of the 4, 8, 12, 16, 20, 24 and 28 months

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with respect to birth weight were 0.204, 0.204, 0.247, 0.237, 0.284, 0.316 and 0.335. Topal *et al.*, (2010) reported the average birth weight of calves as 41.03±4.21 kg, which was higher than the present study and Diack *et al.*, (2004) reported a mean birth weight of 17.7 ± 4.1 kg lower than the present study. Kertz *et al.*, (1997) reported a mean birth weight of 40 kg for heifer calves for a US Holstein herd.

Average body weight: The average body weight at 4, 8, 12, 16, 20, 24 and 28 months were 47 ± 6.76, 78 ± 12.28, 119 ± 16.71, 173 ± 25.95, 221 ± 32.14, 265 ± 35.14, 305 ± 40.58 Kg, respectively (Table 1). Diack *et al.*, (2004) reported an average weight of 100.6 ± 29.9 kg for one year for crossbred Friesian calves. Muller and Botha, (2000) reported average body weight of 69 ±1.1 kg at two months of age, lower than the present findings. Singh *et al.*, (2001) reported higher values of body weight for Holstein Friesian heifer calves with respect to present findings. Dunnett's Multiple comparisons Test (One Way ANOVA) was performed with birth weight and the average body weight at 4,8,12,16,20,24 and 28 months. The birth weight was not significant with 4th month but was significant with 8, 12, 16, 20, 24 and 28 months at $P < 0.05$ ($\alpha = 0.05$).

Table 1. Average birth weight, average body weight and gain in weight of heifer calves during different months of growth

Age	Average body weight (ABW) (Kg)	Average daily weight gain (ADG) (Kg/d)
At Birth	28.0 ± 5.04	-
4 months	47.0 ± 6.76	0.24 ± 0.071
8 months	78.0 ± 12.28	0.31 ± 0.074
12 months	119.0 ± 16.71	0.38 ± 0.097
16 months	173.0 ± 25.95	0.43 ± 0.105
20 months	221.0 ± 32.14	0.41 ± 0.041
24 months	265.0 ± 35.14	0.33 ± 0.069
28 months	305.0 ± 40.58	0.30 ± 0.110

*(Correlation of heifer calves on age with average body weight (ABW) showed positive correlation ($R^2 = 0.99$) that were significant at $P<0.01$, n=27)

Average daily gain in weight: The average daily gain in weight calculated on the basis of body weight at different ages. The average daily gain in body weight were 0.24 ± 0.071, 0.31 ± 0.074, 0.38 ± 0.097, 0.43 ± 0.105, 0.41 ± 0.041, 0.33 ± 0.069 and 0.30 ± 0.110 Kg/d, respectively (Table 1), with an R^2 value of 0.99 (Figure 2). The findings of Singh *et al.*, (2001) with respect to average daily body weight gain were less when compared with the present findings.

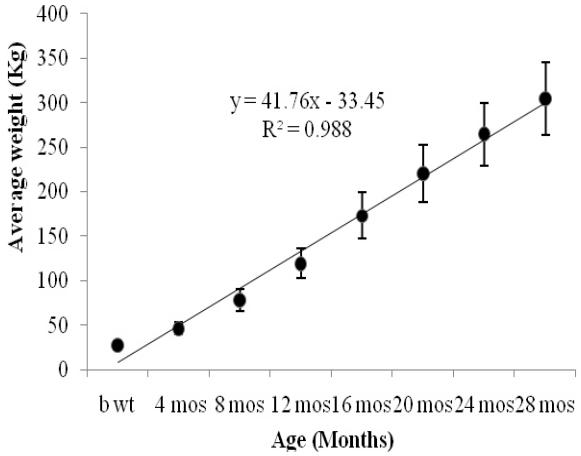

Figure 1. Average weight (Kg) with respect to age (in months). Error bars and plots indicate mean and standard deviation.

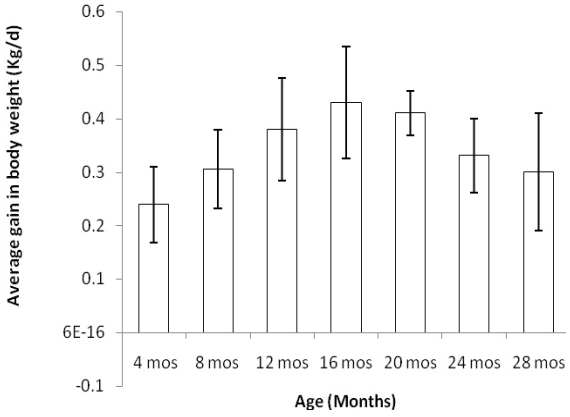

Figure 2. Average daily gain in weight (Kg/d) with respect to age (in months). Error bars and plots indicate mean and standard deviation.

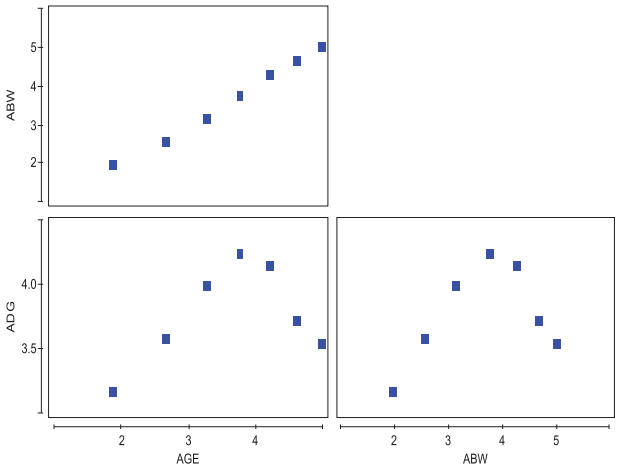

Figure 3. Draftsman plot showing average daily gain (ADG) in weight (Kg) ($R^2 = 0.43$) and average body weight (ABW) (Kg) ($R^2 = 0.99$) with respect to age (months).

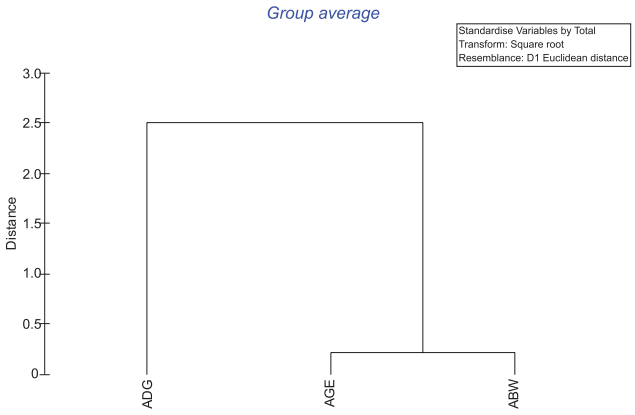

Figure 4. Complete linkage between average daily gain (ADG) in weight (Kg), average body weight (ABW) (Kg) and age (months) of Holstein Friesian heifer calves.

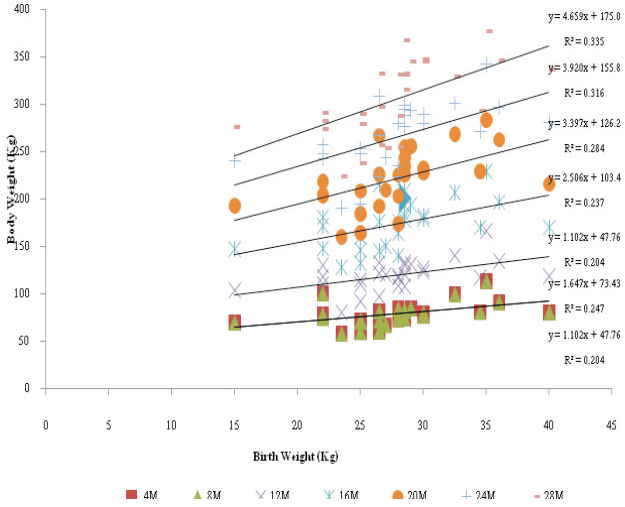

Figure 5. Regression lines for different ages (4, 8, 12, 16, 20, 24 and 28 months) with regard to birth weights of Holstein Friesian heifer calves.

Diack *et al.*, (2004) reported an overall mean daily weight gain (DWG) of 0.220 ± 0.104 kg. Muller and Botha (2000) reported average daily gain of heifers as 0.76, 0.68, 0.64 and 0.68 kg/day, respectively. Vaccaro and Rivero (2010) reported an average gain in weight as 0.84, 0.77, 0.75, 0.79 and 0.78 kg/day at 24, 36, 48 and 72 months respectively for Holstein Friesian heifer calves. The correlations of average body weight, average daily weight gain and age are represented in Figure 3. Correlation of heifer calves on age with average body weight (ABW) showed positive correlation (R^2 = 0.99) and were significant at P<0.01, correlation of age with average daily gain (ADG) in body weight was positive, but not significant which is also shown in Figure 4. The correlation between the ADG and ABW was positive (R^2 = 0.41) but not significant. Stress due to high environmental temperatures and humidity might be the reasons for reduced growth rates (Akbulut *et al.*, 2001).

The significant effect of season of birth on some reproductive traits could be attributed to the changes in climatic conditions and feeding regimes during different seasons (Guaragna *et al.*, 1990).

CONCLUSION

The present study confirms the linearity and positive correlation with age, average body weight and average daily gain in body weight in heifer calves of Holstein Friesian. Further researches need to be taken for the relationships between management factors, animal welfare, nutritive level and dairy heifer growth.

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