Genetic analysis of growth performance of Vrindavani cattle

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Growth from birth to maturity is of great economic significance and at equal production level smaller and lighter cows become more profitable than larger and heavier cows due to reduced feed and housing costs. The birth weight, weight at different periods and growth rate of animal are an expression of its genotype and environmental combination. Heritability estimation of growth traits is an important parameter to estimate the genetic merit of animals constituting population and is required in the design and application of animal breeding programme. Vrindavani cattle are a recently developed synthetic crossbred cattle strain and no information is available about growth traits of this animal. Hence, the objectives of this study were to find out body weight at different ages, determine average daily gains between different ages and to derive estimates for heritability for growth rate.

The data used in this study were collected from growth register of Vrindavani cattle, maintained at cattle and buffalo farm, LPM, Indian Veterinary Research Institute, Izatnagar (UP). The relevant records of body weights on Vrindavani cattle over a period of 8 years (2000–08) were used for this study. Traits included for this study were of birth weight (BWT), body weights at 3 (WT3), 6 (WT6), 12 (WT12), 18 (WT18) and 24 (WT24) months of age and body weights at first Service (WFS), first successful service (WFSS), first calving (WFC) and subsequent calvings. Number of observations for body weights at different ages and average daily gains ranged from 299 (BWFS) to 1344 (BWT). Average daily gains at 3 (ADG1), 6 (ADG2), 12 (ADG3), 18 (ADG4) and 24 (ADG5) months of age were calculated. All these data were classified according to the sex (male and female) of the animal. Year of birth was classified into 3 seasons *i.e.* rainy (July-September), winter (October-February) and summer (March-June). The entire duration of study was classified into 3 periods *i.e.* period 1 (2000–2002), period 2 (2003–2005) and period 3 (2006–2008). Statistical analysis was carried out by using least square mixed model of LSML package (Harvey 1990). The estimates of heritability for body weights and average daily gains were estimated using paternal half sib correlation method (Harvey 1987).

The overall least squares means for body weights at birth (BWT), 3 (WT3), 6 (WT6), 12 (WT12), 18 (WT18), 24 (WT24) months were 22.1±0.1, 46.6±0.3, 82.2±0.7, 149.1±1.4, 229.8±2.9, 280.2±5.3 kg, respectively. For males the BWT, WT3, WT6, WT12, WT18 and WT24 were 22.3±0.1, 47.5±0.5, 83.4±1.2, 155.8±2.5, 248.0±5.5 and 291.9±10.4 kg, whereas in females, these estimates were 21.8±0.1, 45.8±0.3, 80.9±0.6, 142.5±1.0, 211.7±1.6 and 268.5±2.2 kg, respectively. Except for WT24, male and female animals differed significantly for their body weights at different ages. Males were heavier than females at almost all stages. Similar findings were reported by Kayasth *et al.* (2008). Raphaka *et al.* (2009) concluded that heavier body weights of males at different stages than the females may be due to the fact that male calves grow faster than female calves. The body weights at birth was higher in calves born in rainy (22.7±0.2 kg) season than the calves born in winter (21.8±0.1 kg) and summer season (21.8±0.1 kg). It may be due to the fact that dam of the calves born in summer might have experienced heat stress, low quality and quantity of feed and fodder during their advanced pregnant stage. Significant effect of season on birth weight was also observed by Bhat and Singh (1978). The overall least squares' means for WFS, WFSS and WFC were 271.8±2.8, 283.1±3.2 and 326.8±5.0 kg, respectively. Analysis of variance revealed that the effect of season of birth was non-significant on WFS and WFC. Similar finding was reported by Raheja (1994). But, BWFSS differed significantly across the season and it was the highest (292.8±6.3 kg) in rainy season and the lowest (276.8±5.1 kg) in summer. The least square means of WFS, WFSS and WFC were significantly different across the periods. The least squares means for body weight at second, third, fourth and fifth calvings were 372.2±4.3, 401.4±4.8, 417.3±6.6 and 428.2±8.2 kg, respectively.

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The overall least squares means for ADG1, ADG2, ADG3, ADG4 and ADG5 were 267.3±0.02, 566.9±0.05, 379.0±0.01, 467.1±0.04 and 401.1±0.06 g, respectively. The effect of sex on ADG was significant for ADG1, ADG3 and ADG4. The ADG1 for males (259.7±0.02) were lower than females (274.9±0.02 kg) where as ADG3 (403.7±0.02 g) and ADG4 (539.7±0.05 g) of male was significantly higher than ADG3 (354.2±0.01 g) and ADG4 (394.4±0.04 g) of females. The analysis of variance revealed that effect of season was significant on ADG3, ADG4 and ADG5. Shukla (2005) also reported significant effect of season of birth on average daily gains. The analysis of variance revealed that effect of period of birth was significant for average daily gains at almost all stages. Similar findings were reported by Shukla (2005).

The estimates of heritability for BW, W3, W6, W12, W18 and W24 were 0.29±0.10, 0.10±0.05, 0.05±0.05, 0.51±0.17, 0.51±0.17 and 0.63±0.21, respectively. On contrary, Rabeya *et al.* (2009) reported higher estimates of heritability for BW, W3, W6 and W12 in Red Chittagong cattle. The estimates of heritability for ADG1, ADG2, ADG3, ADG4 and ADG5 were 0.47±0.15, 0.81±0.19, 0.18±0.09, 0.38±0.15 and 0.16±0.10, respectively. The high heritability of initial body weight gains (ADG1 and ADG2) may be ascribed due to presence of maternal effect on early body weights gains. However, Akpa *et al.* (2007) reported relatively lower estimates of heritability for these traits while Weller and Ezra (2008) reported comparatively higher estimates of heritability for yearling body weight gain in Holstein cows.

SUMMARY

Genetic analysis of growth performance of Vrindavani Cattle was conducted. The overall least squares means for body weights at birth, 3, 6, 12, 18 and 24 months were 22.1±0.1, 46.6±0.3, 82.2±0.7, 149.1±1.4, 229.8±2.9, 280.2±5.3 kg, respectively. The overall least square means for BWFS, BWFSS and BWFC were 271.8±2.8, 283.1±3.2 and 326.8±5.0 kg, respectively. The overall least squares means for average daily gains between different ages ranged from 267.3±0.02 (up to 3 months) to 566.5±0.09 gm (between 3 to 6 months). The estimates of heritability for body weights at different ages ranged between 0.05±0.05 (W6) and 0.63±0.21 (W24) whereas estimates of heritability for average daily gains ranged between 0.18±0.09 (between 3 to 6 months) and 0.81±0.19 (between 6 to 12 months).

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