A STUDY ON BODY WEIGHTS AND MEASUREMENTS AT VARIOUS AGES IN HOLSTEIN X GIR AND JERSEY X GIR CROSSES[1]

EIN STUDIUM DES KOERPERGEWICHTES UND MASSEN UM VERSCHIEDENE ALTERSSTUFEN IN HOLSTEIN X GIR UND JERSEY X GIR KREUZUNGEN

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Several genetic and non-genetic sources like sex, sire, breed, age of dam, year and season of calving and parity number have been reported as factors influencing body weights and measurements (Katpatal, 1970; Taneja and Bhat, 1972; Rathi and Balaine, 1975; Chauhan et al., 1975; Pandey and Desai, 1976; and Parekh et al., 1976). Evaluation of average influence of indentifiable non-genetic sources of variation and adjusting the data for them, removes the average effect of factors and thus increases the accuracy with which real differences between the population exists. It also helps in getting the precise estimates of genetic parameters which are to be used for future breeding.

MATERIAL AND METHODS

Under the All-India Coordinated Research Project on Cattle Breeding, which aims to evolve the dairy breed for the area with an average of 3200 kg milk in a lactation, the crossbreeding was undertaken. The first generation two halfbreds, one with Holstein (H) and the other with Jersey (J) sires, were generated from 313 randomly purchased Gir (G) cows. The data on body weight (BW), heart girth (HG), wither height (WH) and body length (BL) was taken at birth, 1,2,3,6,9,12 and 15 months of age on 202, 1/2H 1/2G and 97, 1/2J1/2G females. These measurements were obtained over a period of 5 years (1973 to 1978). The body weights and measurements data were analysed by least squares analysis for unequal subclass number (Harvey, 1960) for different genetic and non-genetic sources.

The fixed model including effect of breed group, year and season of birth and the different sires used was fitted. The significant difference between least squares constants was tested by modified Duncan's multiple range test (Kramer, 1957).

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1 A part of Ph.D. Thesis in Animal Breeding and Genetics (1978) submitted by senior author to J.N. Agricultural University, Jabalpur-482 004 (M.P.), India.

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As per the climograph given in Fig.1, the year was divided into four seasons viz., Summer (April to June) i.e., very hot and humid; Rainy (July to Sept.) i.e., hot and high humid; Winter (October to Jan.) i.e., cold and moderate humid and Spring (Feb. to March) i.e., comfortable temperature with low humidity. The growth curve was fitted by regressing the body weights/body measurements on age in months, using quadratic function. The growth rate per day at different age interval was calculated for the different age intervals and the breed differences were tested by 't' test (Steel and Torrie, 1960).

RESULTS AND DISCUSSION

Analysis of Variance Results

Body weights : The analysis of variance revealed highly significant ($P < 0.01$) breed group differences at all age groups. Similar significant effect of year of birth was recorded indicating in managemental variation creeping in at different age intervals. The between sire differences were also significant indicating genetic variance available at all age groups. The R^2 value for the model fitted accounted for 50% to 95% of total variation with a minimum at 2 months of age and maximum at 12 months of age. The season of birth exhibited significant difference at 3,9,12 and 15 months of age only.

Body measurements : Highly significant difference between breed groups for all body measurements (HG, WH and BL) were recorded at all ages. Similar significant effect for year of birth was noticed almost at all age groups for all the body measurements. The sire effect at almost all ages was recorded for different body measurements. The season effect for different body measurements was not revealed at earlier age. However, almost consistently significant effect from 6 month onward for different body measurements was observed. The R^2 values for the body measurements at different ages were consistently lower than R^2 value for body weights indicating larger experimental error involved in body measurement recording. The R^2 value ranged from 27% to 88% for HG with lowest at birth and maximum at 12 months. In case of WH similar lowest contribution by model at birth (20%) and maximum at 12 months (59%) was observed. However, in case of BL the lowest R^2 recorded was at 2 months (28%) with maximum at 12 months (64%).

Least Squares Constant and Effects of Different Factors

Body weights : The least squares mean of body weights at 0,1, 2,3,6,9,12 and 15 months of age for halfbreds were 21.40$\pm$0.18, 28.5$\pm$0.22, 38.2$\pm$0.34, 50.1$\pm$0.43, 90.4$\pm$0.79, 118.5$\pm$0.55, 152.3$\pm$0.50 and 182.2$\pm$1.26, respectively. As the calves were weaned at 2 months of age and as the analysis results showed maximum contribution by model at 12 months of age, the body weights and body measurements least squares mean and the constant at 0,2 and 12 months of age for different factors except sires, are presented in Table 1. The deviation of different sires constants from least squares mean is shown in Fig.2.

The analysis of variance results indicate that Holstein crosses were superior to Jersey crosses at all ages. A consistent increase in superiority was observed as age advanced. Although effect of season on body weights could not be observed at birth and during early age of life, its effect was reflected later at 9 months of age where all the seasons were significantly different from each other. Similar effect of season as observed at birth was noticed at nine months of age. The highest weight was noticed for Rainy calvers, followed by Winter, Summer and Spring calvers. This indicates that the longer duration of comfortable climate, like Winter and Spring following weaning (Rainy) resulted in maximum growth.

The year constant was maximum during early years indicating that the calves born in later years had a stress of overcrowding, space and fodder availability.

A wide variation in respect of both Holstein and Jersey sires responsible for growth in the calves was noticed. Out of the total 17 sires, there were five sires which showed lower body weight than population mean at twelve months of age. While there were only three Jersey sires which showed significantly higher body weights than population mean at 12 months of age (Fig.2).

Body measurements : The least squares means for body measurements viz., HG, WH, BL; were 65.4±0.20, 65.8±0.20, 61.0±0.22; 72.3±0.21, 70.8±1.19, 67.8±0.21; 80.7±0.27, 76.1±0.22, 74.4±0.24; 88.4±0.29, 80.7±0.22, 79.6±0.26; 108.9±0.32, 92.6±0.25, 95.7±0.34; 118.8±0.30, 98.0±0.25, 103.7±0.28; 128.2±0.22, 104.0±0.27, 115.5±0.33; and 135.1±1.38, 109.8±0.30, 119.2±0.64, respectively at 0,1,2,3,6,9,12 and 15 months of age. Similar trends in respect of different body measurements as that for body weight was recorded for almost all the effects indicating body weights has close association with body measurements.

<u>Growth Curve</u>

The growth curve for 1/2H1/2G and 1/2J1/2G crossbreds for body weight is shown in Fig.3, which is almost linear upto the age of 18 months. However, quadratic function fitted accounted for 91.4 and 90.5 per cent of total variation, respectively. The growth curve for HG, WH and BL showed a downward curvilinearity from sixth month onward which is shown in Fig.4,5 and 6, respectively.

The growth rate per day for 1/2H1/2G and 1/2J1/2G crossbreds for different intervals are presented in Table 2. From the result it is apparent that the growth rate was slow upto 3 months of age in both the genetic groups. This slow growth rate might be due to weaning at 2 months of age resulting to poor growth due to adoptation time taken for calf starter feeding. A significant breed difference for growth rate was noticed only upto the age of 9 months. Later growth in both crosses was almost similar.

Table 1

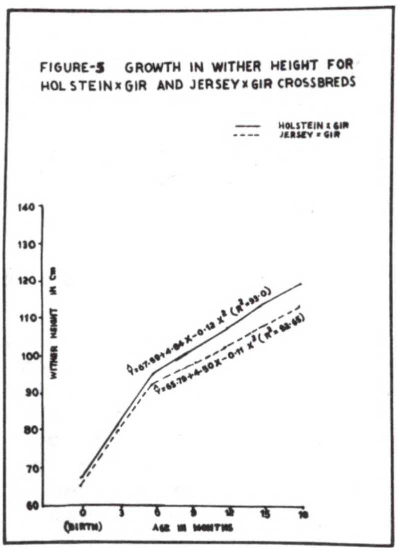
Least squares mean and constant for the fixed effect for the body weight at 0,2 and 12 months of age

	BW_0	BW_2	BW_{12}	HG_0	HG_2	HG_{12}	WH_0	WH_2	WH_{12}	BL_0	BL_2	BL_{12}
u	21.4± 0.18	38.23± 0.34	152.30± 0.50	65.42± 0.20	80.67± 0.27	128.24± 0.22	65.83± 0.20	76.13± 0.22	104.01± 0.27	61.01± 0.22	74.37± 0.24	111.48± 0.33
Breed group:												
H x G	1.50**	2.71**	5.64**	1.26**	1.96**	1.58**	0.87**	1.06**	1.90**	1.14**	1.08**	2.30**
J x G	-1.50**	-2.71**	-5.64**	-1.26**	-1.96**	-1.58**	-0.87**	-1.06**	-1.90**	-1.14**	-1.08**	-2.30**
Season of birth												
Summer	-1.13*	1.07	17.25**	0.14	-0.85	0.88	-0.24	0.26	-0.55	0.38	-0.78	0.91
Rainy	0.33	-0.96	7.83**	-0.31	-0.12	2.37**	-0.24	-0.09	1.24**	-0.93*	-0.63	0.37
Winter	-0.05	0.62	-2.50**	0.40	0.85*	0.71*	0.43	0.24	0.50	0.70*	0.75	0.81
Spring	0.85*	-0.73	-22.58**	-0.23	0.11	-3.97**	0.06	0.11	-1.19*	-0.15	0.65	-2.09**
Year of birth												
1973	-1.45	1.98*	36.68**	-0.92	-0.23	9.63**	0.10	0.62	3.19**	-2.74**	-1.58*	3.89**
1974	-0.50	-1.00	0.64	0.16	-1.13	1.54**	-0.79	-1.37	-0.68	0.03	-1.58*	1.48*
1975	2.71	-0.90	-20.61**	-0.50	-1.87**	-4.70**	-0.31	-1.47	-1.04*	0.46	-0.40	-4.64**
1976	-0.57	-1.61	-16.71**	-0.09	-0.51	-6.47**	-0.73	-0.67	-1.46*	0.98	0.09	0.72
1977	-0.19	1.52		1.36	3.75		1.73	2.90		1.27	3.47[a]	

Table 2

Growth rate in halfbreds at different age interval

Age intervals in months	Gain in body weight (g)		't' value
	Holstein x Gir	Jersey x Gir	
Birth to 3	346	296	4.31**
3 to 6	480	426	2.68**
6 to 9	358	297	2.80**
9 to 12	368	338	1.19
12 to 15	404	382	0.66
15 to 18	407	366	0.83



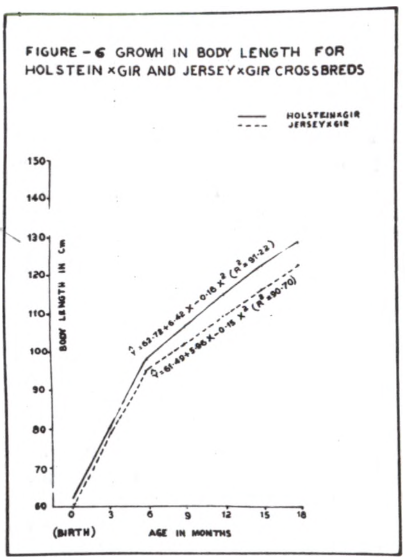


FIGURE 2 LEAST SQUARES CONSTANTS FOR SIRES FOR BODY WEIGHTS AT VARIOUS AGES FROM BIRTH TO 15 MONTHS IN HOLSTEIN×GIR AND JERSEY×GIR CROSSBREDS

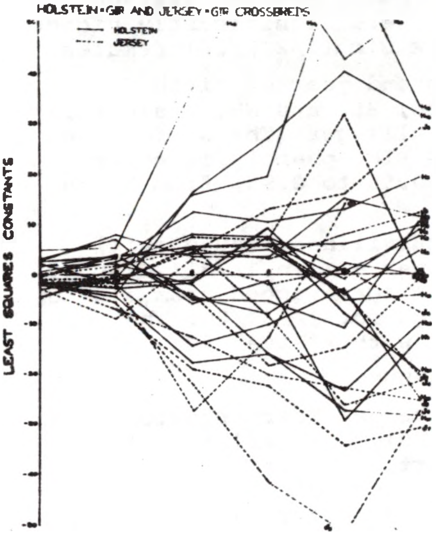


FIGURE 1 CLIMOGRAPH OF JABALPUR FOR THE PERIOD 1973-77

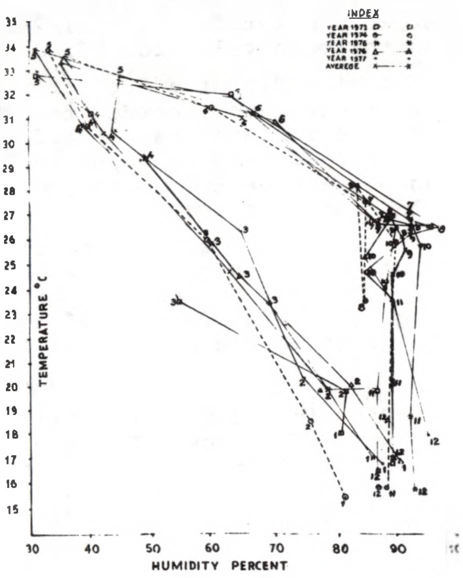


FIGURE-3 GROWTH IN BODY WEIGHT FOR HOLSTEIN×GIR AND JERSEY×GIR CROSSBREDS

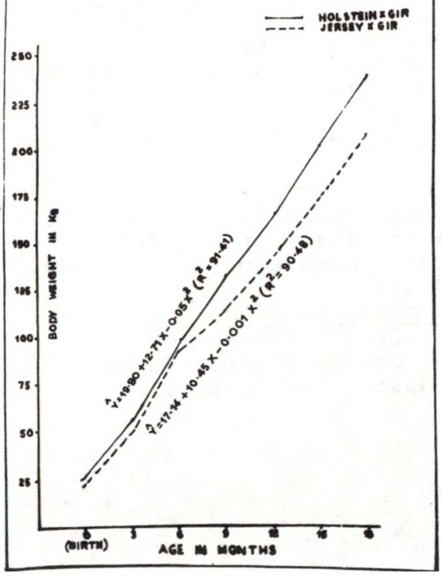
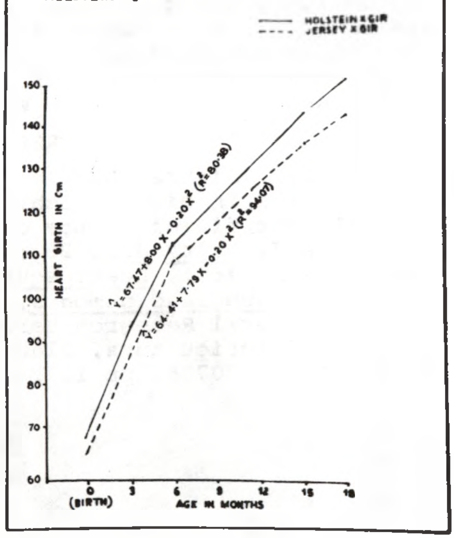


FIGURE-4 GROWTH IN HEART GIRTH FOR HOLSTEIN×GIR AND JERSEY×GIR CROSSBREDS



SUMMARY

The least squares means of body weights (BW) and measurements like; heart girth (HG), body length (BL), and wither height (WH) at birth, 1,2,3,6,9,12 and 15 months, averaged over 202, Holstein x Gir (1/2H1/2G) were significantly higher than the mean value for 97, Jersey x Gir (1/2J1/2G) females.

A significant effect of season and year of birth from 6 month onward was recorded for BW, HG, BL, and WH. A significant sire variance was recorded at all ages. The R^2 for the model ranged between 40.6% to 94.5%. The phenotypic correlation between BW and HG ranged from 0.55 to 0.95, from birth to 12 months of age.

The monthly growth curve was curvilinear (quadratic) for all body measurements with R^2 over 90% in 1/2H1/2G and 1/2 J1/2G. The per day gain at different ages ranged from 346 to 407 g. for 1/2H1/2G and 296 to 426 g. for 1/2J1/2G. The monthly growth curve for BW was linear with R^2 over 90%.

ZUSAMMENFASSUNG

Die mindest Quadrate Mittelwerte des Koerpergewichts (BW) und Massen sowie Herzguerten (HG), Koerperlaenge (BL) und Widerristhoehe (WH) um die Geburt, 1,2,3,6,9,12 und 15 Monaten war hoeher im Falle der 202, Holstein x Gir (1/2H 1/2G) im Vergleich zu den Mittlrernwerten der 97, Jersey x Gir (1/2J1/2G) Tiere des weiblichen Geschlechts.

Einnklares Einflusz der Jahreszeit und das Geburtjahr von 6 Monat anwaerts war registeriert fuer BW, HG, BL, und WH. Eine klare Veraenderung des maennlichen Stammtleres wurde in alle Altersstufen regiseriert. Die R^2 fuer das Modell erstreckte sich zwischen 40.6% und 94.5%. Das sichtbares Korelation zwischen BW und HG erstreckte sich zwischen 0.55 und 0.95 von Geburt bis zum 12 monatigem Alter. Die monatliche Wachstumskurve war Krummling (Quadratisch) fuer alle Koerpermassen mit R^2 ueber 90% in 1/2H1/2G und 1/2J1/2G. Die taegliche Gewichtszunahme um verschiedene Altersstufen war 346 bis 407 gm in 1/2H1/2G und 296 bis gm in 1/2J1/2G. Die monatliche waestumskurve fuer BW war linear mit R^2 ueber 90%.

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