DR-1688
[1-5]

RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume Issue : ()

Morphological and Morphometrical Studies on the Crossbred Cows under Temperate Climatic Condition of Kashmir Valley

H. Hamadani, A.A. Khan, I.U. Sheikh, M.R. Fazili,
H.M. Khan, Z. Haq, G. Saipriya, S.A. Wani

10.18805/ajdfr.DR-1688

ABSTRACT

Background: Kashmir Valley, one of the temperate regions of India, has experienced an exponential increase in the milk-production over the last decades. This may be mainly attributed to massive cross-breeding of 'Local Cattle of Kashmir Valley' with the world-class dairy breeds like Jersey and Holstein-Friesian (HF), popularly known as Jersey-Crossbreds (JCB) and Holstein-Friesian Crossbreds (HFCB), respectively. However, no specific guidelines on their breed characteristics is available, which is crucial for their establishment, recognition and management. Precise and standardized morphological details are a primary requisite for application of advanced technologies like automation, Internet of Things (IoT) and robotics. Therefore, the present study aimed to characterize the HFCB and JCB cows.

Methods: Morphologic and morphometric traits of 600 and 447 cows respectively, reared in the Srinagar district of Kashmir, were studied in detatil as per the standard methods. The null-hypothesis set was that the two crossbreds do not differ from each other.

Result: It was observed that two crossbreds differed significantly ($p<0.05$) with each other in respect of the morphological and morphometrical traits like body size and weight. The study generated a baseline data on these two crossbreds, which is critical not only for their recognition, welfare and scientific management, but shall also act as a reference for global researchers to assess the results of crossbreeding superior dairy breeds in improving the genetic-merit of other breeds worldwide.

Key words: Characterization, Crossbreds, Holstein-friesian, Jersey, Morphometry.

INTRODUCTION

India, the world's largest milk producer, has seen a tremendous growth in the dairy sector over the last few decades. Implementation of various crossbreeding programmes and popularization of artificial insemination, led to an increased conversion of indigenous non-descript cattle to crossbreds over the years across the country, which in turn helped in increasing the milk production. The Kashmir Valley, one of the temperate regions of India have seen a similar trend. The climate of the Valley being similar to that of the European countries, makes it suitable for rearing the world-class dairy breeds like Holstein Friesian and Jersey.

Both the breeds have been used extensively for the upgradation of local nondescript germplasm and their crossbreds *viz* Holstein Friesian crossbreds and Jersey crossbreds, gained popularity to the extent that at present around 50 per cent of the total cattle population in Jammu and Kashmir (J and K) has been upgraded into these high yielding crossbreds (Anonymous, 2017). The percentage share of exotic/ and crossbred cattle to the total cattle has increased over the last inter-census periods, while indigenous cattle has shown a declining trend (Anonymous, 2019), indicating preference of people towards the crossbred cattle over the indigenous cattle in J and K. The district Srinagar has seen the highest impact of this, with 99.26 per cent of the total cattle population being crossbred/ and exotic as per the latest livestock census of India (Anonymous, 2019), where cows are reared mostly in an intensive system with closed housing.

Division of Livestock Production and Management, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama, Alusteng, Srinagar-190 006, Jammu and Kashmir, India.

Corresponding Author: H. Hamadani, Division of Livestock Production and Management, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama, Alusteng, Srinagar-190 006, Jammu and Kashmir, India.
Email: endolf123@gmail.com

How to cite this article: Hamadani, H., Khan, A.A., Sheikh, I.U., Fazili, M.R., Khan, H.M., Haq, Z., Saipriya, G. and Wani, S.A. (2021). Morphological and Morphometrical Studies on the Crossbred Cows under Temperate Climatic Condition of Kashmir Valley. Asian Journal of Dairy and Food Research. DOI: 10.18805/ajdfr.DR-1688.

Submitted: 19-04-2021 **Accepted:** 11-08-2021 **Online:**13-09-2021

Despite this, they still are not well-recognized, posing obstacles towards their scientific management as well as further research. Although it is well-known that they are the crosses of 'Jersey' or 'Holstein-Friesian' sires with the 'Local Cows of Kashmir Valley', they have not yet been studied for their phenotypic (morphological) characteristics, which is crucial for their establishment and recognition. The crosses with the 'Local Cows of Kashmir Valley' (present only in the Valley) makes these crossbreds unique and different from any other crossbreds of Jersey or Holstein-Friesian in the world. No such study has been conducted for either 'Local

Cattle of Kashmir Valley' or their crossbreds produced thereof. Therefore, the present study being the first baseline study on these crossbreds is novel and critical for their scientific appraisal and will act as the foundation for further research. The significance of anatomical differences between the breeds influences their welfare, housing requirements, managemental practices, transportation, handling, ration formulation, drug dosage, breeding and also further research. Association of morphometric characteristics with the milk yield has also been reported by various authors (Dahiya and Rathi, 2002; Okan and Ozdal, 2016, Rao *et al.,* 2020). Therefore, characterization of these crossbred cows was considered as essential. Keeping in view the above facts, the present study was planned with the objectives of characterizing these dairy crossbred cows on the basis of morphology and morphometry.

MATERIALS AND METHODS

The investigation was conducted on the Holstein Friesian crossbred (HFCB) and Jersey crossbred (JCB) cows being reared by the farmers in the Srinagar district of Kashmir Valley, India during 2014-2017 and the data obtained was studied and analyzed at F.V.Sc. and A.H., SKUAST-Kashmir. The Jersey crossbreds (JCB) are the crossbreds of 'Jersey' sires and cows of the 'Local Cows of Kashmir Valley', whereas the Holstein-Friesian crossbreds (HFCB) are the crossbreds of 'Holstein-Friesian' sires and cows of 'Local Cows of Kashmir Valley'. The null hypothesis set was that the two crossbreds do not differ from each other.

Morphological study

Various morphologic traits of 600 (277 HFCB and 323 JCB) healthy adult dairy cows were studied which included presence/absence of horns, horn symmetry and shape, horn tip type, orientation of ears, placement, attachment and colour of udder, shape, size and symmetry of teats and prominence of milk vein. Udder placement and attachment was judged as per Prasad (2012). Teat shape was characterized as per Rasby (2011).

Morphometric study

The morphometric traits of the 447 (206 HFCB and 241 JCB) healthy adult dairy cows were recorded which included height at withers, height at back, height at rump, height at pin, height at elbow joint, height at knee joint, height at hock, neck length, back length, rump length, top line, body length, tail length, pelvic width, inter-pin distance, pelvic length, paunch girth, abdomen girth, chest girth, face length, face width, ear pinna length, horn length, horn circumference and inter-horn distance. Various parameters were derived from the above morphometric measurements which include body weight and body surface area. Body weight was estimated by using the Agarwal's formula (Prasad, 2012) and body surface area was estimated by Brody's formula (Brody, 1945).

Statistical analysis

The data obtained was tabulated, classified and analyzed statistically by drawing percentages and averages. Percentage data was subjected to the test of proportion and the means between the groups were compared by using Student's t-test (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

Horn morphology

Majority of HFCB cows (91.34%) as well as JCB cows (78.02%) were horned, whereas 8.66 HFCB cows and 21.98 per cent JCB cows were polled. However, significantly ($p<0.05$) more proportion of HFCB cows had horns as compared to JCB cows.The increased frequency of homozygous recessive trait might have indicated greater possibilities of inbreeding in the studied population (Tomar, 2004).

Horns present in both types were mainly symetrical, curved and pointed. Majority of the HFCB cows (84.19%) and JCB cows (87.30) had symmetrical horns, whereas only a small proportion of HFCB cows (15.81%) and JCB cows (12.70%) had asymmetrical horns. Although there was statistically no significant difference in the proportion of cows with symmetrical horns, between the two types of cows, but numerically slightly more proportion of JCB cows had symmetrical horns than HFCB cows.

Curved horns were seen in 85.77 per cent HFCB cows and 80.16 per cent JCB cows, whereas only 14.23 per cent HFCB and 19.84 per cent JCB cows had straight horns. Numerically, greater proportion of JCB cows had straight horns compared to HFCB cows while greater proportion of HFCB cows had curved horns compared to JCB cows, but statistically there was no significant difference.

Horn tip was pointed in 76.28 per cent HFCB cows and 82.54 per cent JCB cows, whereas the same was blunt in 23.72 per cent HFCB cows and 17.46 per cent JCB cows. Although there was statistically no significant difference, but numerically more proportion of JCB cows had pointed horn tips than HFCB cows and more proportion of HFCB cows had blunt horn tips than JCB cows.

Horns had also been reported to be curved with pointed tips in Siri cattle (Pundir *et al.,* 2016) and Sudanese Kenana cattle (Aamir *et al.,* 2010) and with variable curls in Achai cattle (Khan *et al.,*2015).

Ear orientation

All the HFCB cows and JCB cows observed in the present study had horizontally placed ears as was also reported in indigenous hill cattle of Himachal Pradesh (Verma *et al.,* 2015).

Udder morphology

Majority of the HFCB cows (81.95%) and JCB cows (85.14%) had normally placed udder, followed by 16.25 per cent HFCB cows and 13.62 per cent JCB cows with tilted forward udder and lastly by 1.81 per cent HFCB cows and 1.24 per cent JCB cows with pendulous udder. Although statistically the difference was non-significant, but numerically higher proportion of JCB cows had normal udder placement than HFCB cows, whereas higher proportion of HFCB cows had tilted forward and pendulous udders.

Udder attachment of 48.72 per cent HFCB cows and 60.99 per cent JCB cows was observed to be strong, followed by 37.18 per cent HFCB cows and 24.15 per cent JCB cows with moderate udder attachment and then by 14.08 per cent HFCB cows and 14.89 per cent JCB cows with weak udder attachment. Significantly (P<0.05) higher proportion of JCB cows had strong udder attachment than HFCB cows, whereas significantly higher proportion of HFCB had moderate udder attachment than JCB cows. However, almost equal proportion of HFCB and JCB cows had weak udder attachment and there was no significant difference. Well developed, strong fixed and pendulous udders in Sudanese Kenana cattle (Aamir *et al.*, 2010), well attached udder in Achai cattle (Khan *et al.,* 2015) and not well developed udder in Siri cattle (Pundir *et al.,* 2016) was reported in various other studies.

White was the predominant udder colour in both HFCB cows (77.62%) as well as JCB cows (71.83%). Black udder colour was found in 3.61 per cent HFCB cows and 11.76 per cent JCB cows. Around 3.97 per cent HFCB cows and 4.97 per cent JCB cows had black udder with white markings, whereas 3.61 per cent HFCB cows and 1.55 per cent JCB cows had brown coloured udder. Although statistically non-significant, but numerically more proportion of JCB cows had black and black with white markings type of udder colour than HFCB cows and numerically more proportion of HFCB cows had brown and white coloured udder than JCB cows. White udder with black markings was present only in HFCB cows (11.19%) and none of the JCB cows, whereas white udder with brown markings was present only in JCB cows (9.91%) and none of the HFCB cows. Variations in the udder colour may be ascribed to breed differences and cross breeding.

Teat morphology

Cylindrical, funnel-shaped and cone-shaped teats were present in 75.09 15.88 and 9.03 per cent HFCB cows and 81.42, 7.43 and 11.15 per cent JCB cows respectively. Although statistically non-significant but numerically cylindrical and cone shaped teats were found in higher frequency in JCB cows than HFCB cows. Funnel shaped teats were found in significantly (P<0.05) higher frequency in HFB cows than JCB cows. Teat tip were found to be either flattened or rounded in shape. Funnel shaped teats have also been reported in Siri cows (Pundir *et al.,* 2016).

Teat size was symmetrical in significantly (P<0.05) higher proportion of JCB cows (57.28%) than HFCB cows (29.24%), whereas the teat size was asymmetrical in significantly (P<0.05) higher proportion of HFCB cows (70.76%) than JCB cows (42.72%). Asymmetry in the teat lengths was also reported by Aamir *et al.* (2010) in Sudanese Kenana cattle.

Majority of the cows (62.09% HFCB and 81.11% JCB) had symmetrical teat colour, whereas few cows (37.91% HFCB and 18.89% JCB) had asymmetrical teat colour. Significantly (P<0.05) higher proportion of JCB cows had symmetrical teat colour that HFCB cows, whereas significantly (P<0.05) higher proportion of HFCB cows had asymmetrical teat colour.

Teat colour was black, black with white marking, brown, grey, orange, pink with black markings, pink with brown markings, pink and cream in 18.77, 3.97, 3.61, 5.78, 0, 30.32, 0, 26.35 and 11.19 per cent HFCB cows and 22.60, 8.05, 6.50, 0, 27.55, 6.50, 3.10, 24.15 and 1.55 per cent JCB cows respectively. Black and brown teat colour was numerically but not statistically and black with white markings, pink with brown markings and orange teat colour was significantly (P<0.05) more predominant in JCB cows than HFCB cows. However, grey, pink with black markings and cream teat colour was significantly (P<0.05) and pink teat colour was numerically but not statistically more predominant colour HFCB cows than JCB cows. Variations and gradations in the teat colour may be attributed to the breed differences and crossbreeding.

Milk vein

Milk vein was significantly prominent in more proportion of HFCB cows (71.48%) than JCB cows (33.44%), where as it was not prominent in more proportion of JCB cows (66.56%) than HFCB cows (12.27%). Non-prominent milk veins were reported in Siri cattle in a study carried out by Pundir *et al.* (2016). In a separate study on the perfomance of these crosses it was found that HFCB cows significantly produce more milk than JCB cows (Hamadani *et al.,* 2020) and the prominance of milk vein in the former may be an indicative of that.

Morphometric studies

Most of the morphometric parameters were higher in HFCB cows than JCB cows (Table 1), with the exception of tail length, which was numerically more in JCB cows than HFCB cows. The higher morphometric measurements of crossbreds with Holstein Friesian cows as compared to the crossbreds with Jersey cows might have attributed to the fact that Holstein Friesian is the largest and Jersey is the smallest exotic dairy breed (Thomas *et al*., 2012).

Height at withers, height at rump, height at elbow joint, back length, pelvic width, inter-pin distance, paunch girth, abdomen girth and face length of JCB in the present study were more but face width and rump length were lower than the purebred Jersey as well as Sindhi-Jersey crossbred cows as reported by McDowell *et al.* (1954).

The average height at withers, height at back, height at rump, height at pin, rump length, body length, pelvic width, inter-pin distance, face length, face width in the present study was observed to be lesser than the purebred Holstein-Friesian cows as recorded by Cerqueira *et al.* (2013) in their respective study.

Table 1: Comaparative morphometric parameters in HFCB and JCB cows.

Parameter	HFCB (N=206)	JCB (N=241)	P value
Height at withers (cm)	123.40±0.43[b]	113.79±0.41[a]	<0.001
Height at back (cm)	122.25±0.59[b]	113.21±0.41[a]	<0.001
Height at rump (cm)	128.42±0.44[b]	118.35±0.42[a]	<0.001
Height at pin (cm)	122.17±1.00[b]	110.85±0.42[a]	<0.001
Height at elbow joint (cm)	70.74±0.27[b]	64.05±0.40[a]	<0.001
Height at knee joint (cm)	37.80±0.23	36.47±0.37	0.309
Height at hock (cm)	48.34±0.22[b]	46.44±0.22[a]	0.034
Neck length (cm)	70.24±0.87[b]	59.00±0.57[a]	<0.001
Back length (cm)	97.00±0.62[b]	85.71±0.67[a]	<0.001
Rump length (cm)	21.80±0.33	20.13±0.27	0.166
Top line (cm)	189.04±1.19[b]	164.84±1.12[a]	<0.001
Body length (cm)	146.32±0.89[b]	136.41±1.02[a]	0.016
Tail length (cm)	100.36±.073	101.90±0.72	0.601
Pelvic width (cm)	35.08±0.34[b]	28.13±0.36[a]	<0.001
Inter-pin distance (cm)	17.16±0.19[b]	13.94±0.18[a]	<0.001
Pelvic length (cm)	35.57±0.14[b]	31.14±0.09[a]	<0.001
Paunch girth (cm)	196.00±1.17[b]	174.52±1.08[a]	<0.001
Abdomen girth (cm)	210.20±1.05[b]	193.42±1.39[a]	0.002
Chest girth (cm)	174.64±0.86[b]	160.13±0.99[a]	<0.001
Face length (cm)	45.27±0.28[b]	38.14±0.58[a]	0.001
Face width (cm)	14.10±0.15	13.34±0.39	0.597
Ear pinna length (cm)	19.75±0.16[b]	18.42±0.10[a]	0.017
Horn length (cm)	19.00±0.39	16.48±0.37	0.158
Body weight (kg)	407.41±3.14[b]	341.64±2.50[a]	<0.001
Body surface area (cm^2)	4.30±0.02[b]	3.89±2.5[a]	<0.001

Means bearing different superscripts in a row differ significantly (P<0.05).

CONCLUSION

The alternate hypothesis was accepted and it was concluded that the two crossbreds differ significantly (p<0.05) with each other on the basis of morphometry, which deserves the development of specific guidelines on their welfare, housing requirements, managemental practices, transportation, handling, ration formulation, drug dosage and breeding. Further the baseline information generated on these crossbreds, will act as a reference for future research nationally as well as internationally.

REFERENCES

Aamir, H., Babiker, S.A., Youssif, G.M. and Hassan, Y.A. (2010). Phenotypic characterization of Sudanese Kenana cattle. Research Journal of Animal and Veterinary Sciences. 5: 43-47.

Anonymous (2017). Resources available. Department of Animal and Sheep Husbandry. Jammu and Kashmir Government. http://jkash.nic.in/.

Anonymous (2019). Basic Animal Husbandry and Fisheries Statistics. Department of Animal Husbandry, Dairying and Fisheries, Government of India, New Delhi.

Brody, S. (1945). Bioenergetics and Growth with Special Reference to the Energetic Efficiency Complex in Domestic Animals. Reinhold Publishers, New York, pp. 403.

Cerqueira, J.O.L., Araújo, J.P.P., Vaz, P.S., Cantalapiedra, J., Blanco -Penedo, I. and Niza-Ribeiro, J.J.R. (2013). Relationship between zoometric measurements in Holstein-Friesian cow and cubicle size in dairy farms. International Journal of Morphology. 31(1): 55-63.

Dahiya, S.P. and Rathi, S.S. (2002). Identification of type indicators for prediction of production efficiency in Indian cattle. Indian Journal of Animal Research. 36:122-124.

Hamadani, H., Khan, A.A., Banday, M.T. and Khan, H.M.(2020). Comparative analysis of performance traits of different dairy cattle reared in the srinagar city of J and K. Asian Journal of Dairy and Food Research. 39(2): 135-138.

Khan, S., Anwar. K., Kaleem, K., Saeed, A., Nabi, H., Hayat, A., Ahmad, Z., Hayan, F. and Safirullah (2015). Study of phenotypic and morphometric characteristics of Achai cattle at Livestock Research and Development Station Dir(Lower), Pakistan. Pakistan Journal of Nutrition. 14(4): 201-203.

McDowell, R.E., Lee, D.H.K., McMullan, H.W., Fohrman, M.H. and Swett, W.W. (1954). Body weights, body measurements and surface area of Jersey and Sindhi-Jersey crossbred females. Journal of Dairy Science. 37: 1420-1428.

Okan, A. and Ozdal, G. (2016). Some production traits and phenotypic relationships between udder and production traits of Hair goats. Indian Journal of Animal Research. 50: 983-988.

Prasad, J. (2012). Principles and Practices of Dairy Farm Management. Seventh edition. Kalyani Publishers. New Delhi.

Pundir, R.K., Singh, P.K., Dangi, P.S. and Singh, B. (2016). Siri cattle - An endangered breed of Sikkim, India. Indian Journal of Animal Sciences. 86(8): 947-949.

Rao, M.V.D., Seshaiah, Ch.V., Rao, S.J., Vinoo, R. and Kumar, D.S. (2020). Relationship between Morphometric and Milk Production Characters in Ongole Cattle. Indian Journal of Animal Research. DOI: 10.18805/ijar.B-4111.

Rasby, R. (2011). A Guide to Udder and Teat Scoring Beef Cows. ANGUS Journal pp. 112-115. http://www.angusjournal.com/ArticlePDF/Udders%2008_11%20AJ.pdf.

Snedecor, G.W. and Cochran, W.G. (1980). Statisical Methods, 7th Edition. Iowa State University Press Ames, Iowa.

Thomas, C.K., Sastry, N.S.R. and Ravikiran, G. (2012). Dairy Bovine Production. Kalyani Publishers. New Delhi.

Tomar, S.S. (2004). Textbook of Animal Breeding. Inbreeding. Kalyani Publishers, New Delhi. pp. 238-246.

Verma, D., Sankhyan, V., Katoch, S. and Thakur, Y.P. (2015). Principal component analysis of biometric traits to reveal body confirmation in local hill cattle of Himalayan state of Himachal Pradesh, India. Veterinary World. 8(12): 1453-1457.