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Arun Prabhakar
MVSc. Scholar, LPM Section,
Indian Veterinary Research
Institute, Uttar Pradesh, India

Sofi Aaqib Rashid
Ph.D. Scholar, LPM Section,
National Dairy Research
Institute, Haryana, India

Atul Kumar Singh Tomar
Principal Scientist, LPM Section,
Indian Veterinary Research
Institute, Uttar Pradesh, India

Vipin Maurya
Ph.D. Scholar, LPM Section,
Indian Veterinary Research
Institute, Uttar Pradesh, India

Ganga Prakash Channa
Ph.D. Scholar, LPM Section,
Indian Veterinary Research
Institute, Uttar Pradesh, India

Correspondence
Arun Prabhakar
MVSc. Scholar, LPM Section,
Indian Veterinary Research
Institute, Uttar Pradesh, India

Effect of genetic and non-genetic factors on various coat characteristics in Tharparkar and Vrindavani cattle

Arun Prabhakar, Sofi Aaqib Rashid, Atul Kumar Singh Tomar, Vipin Maurya and Ganga Prakash Channa

Abstract

The present study was conducted on a total of 42 milch animals (21 Tharparkar cattle and 21 Vrindavani cattle) at cattle and Buffalo farm (Indian Veterinary Research Institute). The objective was to study the effect of various genetic and non-genetic factors on coat characteristics like coat colour, coat score coat thickness etc. The effect of breed, age at calving, season of calving and parity was found to be significant ($p < 0.05$) on most of the coat characteristics except hair coat score and hair diameter. Vrindavani cattle had higher hair length and higher hair densities in all seasons in comparison to Tharparkar cattle ($p < 0.05$). The coat thickness was lower in Vrindavani cattle ($p < 0.05$). From the present study, it was concluded that various genetic and non-genetic factors affect coat characteristics in cattle.

Keywords: Coat score, Tharparkar, Vrindavani, coat thickness

Introduction

India is the highest producer of milk in the world with an annual growth of 6.27% (DADF annual report, 2016-17) [8]. Dairy cattle in India consist of Indigenous, crossbred and exotic cattle. As per the 19th Livestock Census (2012), total cattle population was 190.9 million of which crossbred/exotic cattle represented around 21% (39.79 million) while the indigenous cattle population constitute around 79% (151.17 million). Tharparkar is an important indigenous milch breed. Tharparkar cattle yield around 1975 ± 10.90 kg (Gahlot, 1999) [4] to 2064.57 ± 18.02 kg (Chand, 2011) [2] milk in 305 days of lactation. The animals are very well adapted to desert conditions due to their capacity to thrive on poor quality forage and high heat tolerance. The genetic constitution of Vrindavani cattle carries 50–75% inheritance from exotic cattle breeds like Holstein-Friesian, Jersey and Brown Swiss and 25–50% from indigenous Harijana breed (Pandey *et al.*, 2006) [7]. The Vrindavani cattle has almost all possible coat colors in addition to roan, light-dark brown, black and white and brown and white. Vrindavani cattle yield around 3,000 kg milk in 305 days of lactation with 4–4.5% fat (DARE/ICAR, Annual Report, 2007-08) [3]. The objective of the study was to study the effect of various genetic and non genetic factors like breed, age at calving, season of calving, parity etc. on various coat characteristics in Tharparkar and Vrindavani breeds of cattle.

Materials and Methods

The present study was conducted on a total of 42 milch cows (21 Tharparkar and 21 Vrindavani cows) at cattle and buffalo farm, Indian Veterinary Research Institute (ICAR - IVRI), Izatnagar (UP), India, which is located at an altitude of 169.2 m above the mean sea-level, at latitude of $28^{\circ}22'$ north and at longitude of $79^{\circ}24'$ east. The mean annual temperature is about 21°C . The mean monthly temperature ranges between around 13°C in January and 30°C in May, whereas the extreme temperature ranges between about 5°C and 40°C and relative humidity ranges between 15 and 85 percent. The data was classified into age at calving class, season of calving class, parity as follows:

Age at calving

Age at calving (years)	Age at calving class
< 4	1
4.1 to 6	2
6.1 to 8	3
> 8	4

Season of calving

Season of calving	Season of calving class
Winter (December to February)	1
Summer (March to June)	2
Rainy (July through September)	3
Autumn (October to November)	4

Parity

The effect of parity of milch animals on coat characteristics was also taken in to consideration. Cows up to 3rd parity in both breeds were taken for the present study.

Results and Discussion

The effect of breed was found to be significant ($p>0.05$) on most of the coat characteristics except coat score and hair diameter (Table 1). Both breeds showed significant differences in coat thickness with Vrindavani cattle having thinner coats ($p>0.05$). Vrindavani cattle showed higher hair length and higher hair density as compared to Tharparkar cattle ($p>0.05$). Pan (1964) [6] observed significant differences in hair length of Jersey and Sahiwal cattle. Hair length for Jersey was longer than Sahiwal. However, no significant differences in hair diameter for Jersey and Sahiwal were observed. The hair diameters were similar, but Sahiwal had little thicker hair diameter than Jersey (Pan, 1964) [6].

Table 1: Effect of breed on coat characteristics

Particulars	Tharparkar cows	Vrindavani cows	p-value
Coat thickness (mm)	13.76±0.66	9.21±0.23	<0.05
Coat score	3± 0.67	3±0.12	>0.05
Weight of hair coat (mg)	53.45±6.12	79.83±10.19	<0.05
Hair density (hair/cm ²)	355± 120	475±85	<0.05
Hair length (mm)	12.82±0.69	16.53±0.45	<0.05
Hair diameter (µm)	50±10	54±10	>0.05

The effect of age at calving class was found to be significant ($p>0.05$) on most of the coat characteristics except coat score and hair diameter (Table 2). All classes showed significant differences in coat thickness with Vrindavani cattle having thinner coats ($p>0.05$). In both Tharparkar and Vrindavani cattle, it was observed that almost all parameters like the coat score, coat thickness, weight of hair coat, hair length, hair diameter and hair density were maximum in between the 6-7 or more than 7 years of age at calving of animals and the least

values were observed in-between 3-4 years of age at calving, except hair density and hair length, which were highest in between 3-4 years of age at calving in Vrindavani cattle. Coat thickness and hair length were maximum in between 4-5 years of age at calving in Tharparkar cattle. Maia *et al.* (2005) [5] noticed that the hair diameter became thicker as the Holstein cows get older. However, during the study, it was also found that 6-7 years age group animals had thicker hair diameter than the 3-4 years age group of animals.

Table 2: Effect of age at calving class on coat characteristics

Particulars	Tharparkar cows				Vrindavani cows			p-value
	1	2	3	4	1	2	3	
Age at calving class								
Coat thickness (mm)	13±0.40	13.05±1.2	14.34±2.65	15.68±1.1	10.63±0.37	10.09±0.62	9.64±0.39	<0.05
Coat score	2.75±0.25	3.05±0.44	3.35±0.71	3.85±0.88	3.18±0.12	3.05±0.44	3.35±0.71	>0.05
Weight of hair coat (mg)	60.5±28.50	45±14.00	50.85±9.85	24.55±10.55	125.54±8.01	94.57±9.94	69.67±8.84	<0.05
Hair density (hair/cm ²)	254.5±35	306.5±28	358±20	392.5±13	402.57±22	464.86±16	520.43±45	<0.05
Hair length (mm)	9.03±0.34	10.92±0.23	11.77±0.31	13.33±0.15	18.58±0.65	19.91±0.48	21.58±0.34	<0.05
Hair diameter (µm)	40±10	45±5	50±5	65±10	50±10	55±10	55±10	>0.05

The effect of season of calving was found to be significant on most of the coat characteristics except coat score and hair diameter ($p>0.05$) (Table 3). All classes showed significant differences in coat thickness with Vrindavani cattle having thinner coats ($p<0.05$). In Tharparkar cattle, coat score, weight of hair coat and hair diameter were found to be maximum in rainy season while, coat thickness and hair

density was maximum during winter and hair length was maximum during autumn season of calving. In Vrindavani cattle, the values for coat score and coat thickness were maximum in spring season while, weight of hair coat and hair length was maximum during winter and hair density was maximum in summer calvers.

Table 3: Effect of season of calving class on coat characteristics

Particulars	Tharparkar cows				Vrindavani cows				p-value
	1	2	3	4	1	2	3	4	
Season of calving class									
Coat thickness (mm)	11.89±0.92	13.47±0.89	14.58±0.50	14.96±0.72	8.56 ±0.62	9.31 ±0.84	10.13 ±0.22	10.8±0.56	<0.05
Coat score	3.13±0.09	3.25±0.17	3.05±0.05	3.25±0.29	3.18±0.12	3.05±0.44	3.35±0.71	3.20±0.11	>0.05
Weight of hair coat (mg)	116±13.63	93.7±13.59	97±20.46	98.25±14.31	151.5±21.5	118.18±19.15	107.00±23.00	112.57±15.17	<0.05
Hair density (hair/cm ²)	406.43±45.00	378.13±25.00	332.42±45.00	275.43±35.00	536.43±45.00	490.39±25.00	435.57±30.00	385.69±25.00	<0.05
Hair length (mm)	17.74±0.32	15.89±0.22	15.04±0.13	13.94±0.39	21.18±0.78	19.81±0.76	19.10±0.78	17.80±0.69	<0.05
Hair diameter (µm)	55±5	50±5	50±5	40±10	70±5	70±15	55±10	50±5	>0.05

Berman and Volcani (1961) [1] observed that in Holstein cattle, highest hair diameter were found in summer calvers followed by spring and winter calvers, whereas the weight of hair coat (mg/cm²) in Holstein cow was maximum in winter and minimum in spring and autumn calvers. Similar results

were reported by Maia *et al.* (2005) [5], who studied physical hair-coat properties of Holstein cows. They found that the length of hair was longer in March and April and average density of hair coat was highest in February and March.

The effect of parity was found to be significant ($p>0.05$) on most of the coat characteristics except coat score and hair diameter (Table 4). Both breeds showed significant differences in coat characteristics as the number of parity increased ($p<0.05$). The increase in the values of coat

characteristics was higher in Vrindavani cattle as compared to Tharparkar cattle as the number of parity increased. The study on the effect of parity on almost all coat traits of Tharparkar as well as Vrindavani cattle indicated that the values for these traits were maximum in 3rd parity (Table 4).

Table 4: Effect of parity on coat characteristics

Particulars	Tharparkar cows			Vrindavani cows			p-value
	1	2	3	1	2	3	
Coat thickness (mm)	10.77±0.57	11.78±0.79	16.78±1.36	10.42±0.39	10.66±0.79	10.62±0.93	<0.05
Coat score	2.50±0.12	2.85±0.18	3.20±0.21	3.26±0.12	3.05±0.44	3.35±0.71	>0.05
Weight of hair coat (mg)	78.5±17.81	102.29±8.56	112.5±19.26	114.97±8.36	138.04±13.67	156.84±24.68	<0.05
Hair density (hair/cm ²)	355.87±45.90	389.36±53.12	424.17±20.56	471.43±27.98	512.73±30.56	567.86±21.77	<0.05
Hair length (mm)	12.53±0.21	14.61±0.33	17.15±0.19	16.63±0.56	19.25±0.31	21.43±0.15	<0.05
Hair diameter (µm)	45±5	50±5	60±5	55±5	65±5	70±5	>0.05

Conclusion

Coat characteristics like coat score, coat thickness, hair diameter, hair length etc. are unique to different breeds. These characteristics are affected by various genetic and non-genetic factors like breed, age at calving, season of calving and parity. Study of the coat characteristics in Tharparkar and Vrindavani breeds is important because these are related to the transfer of energy with the environment and therefore, play a role in the thermoregulation in these animals. This is especially important in tropics where animals are exposed to extreme conditions of weather. The proper understanding of all the factors affecting the coat characteristics will be helpful in selection of suitable animals for particular conditions.

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