



Phenotypic characterization of Dagri cattle of Gujarat

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ABSTRACT

A hill cattle population locally known as Dagri reared by tribals from eastern border districts of Gujarat adjoining to Madhya Pradesh and Rajasthan, mainly Dahod and Chhotaudepur and to some extent Panchmahal, Mahisagar and Narmada was investigated for its phenotypic characterization. A total of 606 animals were examined for body measurements. Body weight of the newborn calf (4) and preweaning weight (24) were recorded by actual measurement on the weighing scale while, the body weight of animals above 1-year (606) was derived from body measurements using standard formula. Body measurements in males, females and heifers were taken on 606 animals. Milk composition was studied in milk samples from 50 cows. Draughtability was also studied on 11 pairs of bullocks. Dagri animals possessed predominantly white coat colour (males 95.45%; females 86.89%). Muzzle colour was mainly black (males 95.45%; females 91.59%). Eyelids were mainly black (males 100%; females 98.22%). Horn and tail switch were mainly black while hoof colour was mainly pale black. Horns were curved and oriented upward-outward. Forehead was straight. Ears were small oriented horizontally. Dagri cattle had small hump, dewlap and naval flap. The udder was bowl shaped, small sized with round tipped cylindrical teats and with no prominent milk vein. The means (cm) for chest girth, body length, height at withers and hip height were 134.40±4.03, 115.46±3.37, 106.66±2.11 and 109.13±1.84, respectively, in adult males and 128.93±0.35, 110.82±0.34, 102.46±0.28 and 104.99±0.26, respectively, in adult females. The means (cm) for face length, tail length, horn length, horn circumference, hump height, navel length, dewlap length, forehead width, ear length and ear width were 35.86±1.00, 67.33±1.37, 21.64±2.65, 18.00±0.85, 10.00±0.66, 05.87±0.54, 78.40±2.57, 15.66±0.54, 21.06±0.78 and 10.00±0.32 respectively in adult males and 35.95±0.10, 66.91±0.25, 19.26±0.29, 12.91±0.10, 06.98±0.06, 01.40±0.06, 72.86±0.35, 13.12±0.05, 19.23±0.11, 10.50±0.06 cm, respectively, in adult females. The mean body weight (kg) at different age groups, viz. birth weight, pre-weaning weight, body weight at 12 months, body weight at 24 months and adult weight were 16.75±0.25, 27.12±2.02, 60.02±19.85, 108.08±13.72, 223.85±14.70, respectively, in males and 13.0±1.0, 27.1±3.01, 66.5±7.16, 116.7±8.67, 169.63±1.21, respectively, in females. Reproduction traits, viz. age at first oestrus, age at first mating, age at first calving were 32 to 42, 42 to 48 and 48 to 60 months, respectively, in females. Production traits, viz. daily milk yield, lactation length and lactation milk yield were 1.75 kg, 120–240 days and 75–600 kg, respectively. These data were derived from farmers' personal interview at their doorstep. Milk fat and SNF percentage were 4.08% and 9.18%. This lesser known population of hilly cattle was not recognized and registered as distinct breed before this investigation. This study played a major role in recognition and registration of this population. As a result of these efforts it is now recognized and registered as new cattle breed with accession no. INDIA_CATTLE_0400_DAGRI_03046.

Keywords: Cattle, Dagri, Phenotypic characterization

India is rich in livestock biodiversity with the total number of 197 indigenous breeds of livestock and poultry, which include 50 for cattle, 17 for buffalo, 34 for goat, 44 for sheep, 7 for horses and ponies, 9 for camel, 10 for pig, 3 for donkey, 1 for yak, 19 for chicken, 2 for duck and 1 for geese (Anonymous 2020).

Gujarat has valuable genetic resources of cattle (Gir, Kankrej and Dangi), buffalo (Mehsani Jaffrabadi, Surti, and Banni), sheep (Patanwadi, Panchali, Marwadi), goat

(Kachchi, Surti, Zalawadi, Mehani, Gohilwadi, Kahmi), horses (Kathiawari, Marwari and Kachchi-Sindhi) and camel (Kachchi and Kharai), donkey (Halari) as well as poultry (Ankaleshwar and Busra) (Anonymous 2018). Still, several potential populations, e.g. Aravali chicken deserve recognition, etc. The distribution of cattle breeds in Gujarat indicates central Gujarat and south Gujarat are represented by the non-descript population.

A non-descript population of cattle reared by tribal people in the eastern hilly region of central Gujarat adjoining to Rajasthan and Madhya Pradesh was identified having uniform phenotypic characters distinct from different other recognized cattle breeds. The animals are smaller in size as compared to neighbouring breeds Malvi breed of Madhya

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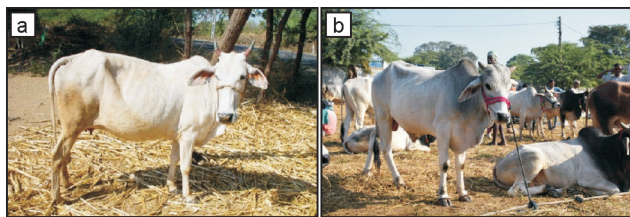


Fig. 1. (a) Dagri cow (b) Dagri bull.

Pradesh, Nari cattle from Rajasthan, Kankrej breed of Gujarat and well adapted to adverse climate condition and hilly terrain. This population described as Gujarat Malvi by state AH department was suggested to be investigated for phenotypic characterization and eventual registration as new breed of cattle. Hence, present study was carried out to phenotypically characterize hill cattle of central Gujarat. On the basis of phenotypic and molecular characterization of Dagri cattle, we applied for recognition and registration as new cattle breed and in February 2020, the Dagri cattle was registered as 45th cattle breed of India and 4th cattle breed of Gujarat (Anonymous 2020).

MATERIALS AND METHODS

Information on various management practices opted by the livestock owners in the region and performance traits were generated by interviewing the farmers from 33 villages of 6 tehsils in Dahod, 34 villages from 4 tehsils of Chhotaudepur and 11 villages of 2 tehsils of Mahisagar districts using a structured questionnaire. Farmers were interviewed to know the habitat, status, management, utility and performance of the cattle available. Farmers were interviewed for choice of breed, utility, sale and purchase of animals, animal housing, feeding, breeding, prevalent diseases in the area and performance of the breed. Performance traits like birth weight, age at maturity and calving, lactation milk yield, lactation length, dry period, service period, calving interval and draught performance were collected by conversation with the farmers from the surveyed villages. Physical characteristics were recorded on animals of different age and sex during the survey. Fourteen different body measurements and physical characteristics were recorded on 606 animals of different age and sex.

Morphological traits were recorded with the help of measuring tape and were classified according to age group of the animal. Details of the observations containing physical and morphological traits were recorded in the prescribed format provided by National Bureau of Animal Genetic Resources (NBAGR), Karnal for evaluation of breed of cattle and buffalo under field draught utility of hill cattle under field condition. Different morphological observations were recorded on males (15) and females (591) of Dagri cattle by visiting several times to the area. The morphological observations include colour of body coat, muzzle, eyelids, tail switch, hooves and horns, types of hump, dewlap, naval flap, etc. and shape, size, teat shape, teat tip, etc. of udder in females.

Body weight of the new born calf (4) and pre-weaning weight (24) were recorded by actual measurement on weighing scale, while body weight of animals beyond 1 year (606) were derived from body measurements using standard formula. The measurements of different body parts in males, females and heifers include chest girth, body length, height at withers, face length, tail length, horn length, horn circumference, hump length, navel flap length, dewlap length, forehead width, ear length, and hip height. Data were analysed for descriptive measures, e.g. mean, standard error, CV %, range, etc.

RESULTS AND DISCUSSION

White coat was the most prominent colour (95.45% in males, 86.89% in females) with minor proportion of gray/grayish white (4.55% in males, 6.31% in females) Dagri cattle, Pundir *et al.* (2010) reported that body coat of hill cattle of Almora district varied in different colours and shades, i.e. white (26.6%), black (19.6%), reddish/red (16.2%), brown (11.6%), gray (7.5%), reddish-white (5.8%), greyish white (5.2%), black and white (2.9%), whitish brown (2.3%) and reddish-brown (2.3%). The forehead of Dagri animals was straight in majority of cattle, while, invariably dished in Malvi cattle (Srivastava *et al.* 2002), usually flat in Gaolao cattle (Kargirwar *et al.* 2004). While the forehead was broad and was slightly bulging with long, drooping sideways in Red Kandhari (Pundir and Singh 2008), well proportionate with the prominent poll and concave in Vrindavani (Singh *et al.* 2011) and straight in majority of Gangatiri cattle (Bhinchhar *et al.* 2017).

The muzzle colour was black in majority of cases (95.45%) followed by grey (4.55%) in males and pink (6.96%), grey (1.13%) and greyish white (0.16%) in female Dagri cattle while, black in Krishna Valley (Karthickeyan *et al.* 2006) and in Siri cattle (Bera *et al.* 2016). In Maland Gidda, the muzzle colour was predominantly black, however, the muzzle colour was carrot or pinkish in fawn and white coat animals (Singh *et al.* 2008). Eyelids were mainly black (100%) in males and black (98.22%) followed by brownish (0.16%), grey (0.16%), greyish red (0.16%), and pink (0.16%) in females of Dagri cattle. Singh *et al.* (2008) reported that the eyelids were predominately black in Maland Gidda. Black and brown eyelids were observed by Pundir *et al.* (2010) in the hill cattle of Almora district (Uttarakhand).

The shape of horns was curved in males and females. Orientation of horns was upward and outward in males (100%) and females (93.46%); some minor proportion in female had upward (1.96%), downward (1.63%), forward (1.14%), outward (0.98%), backward (0.49%) and upward backward (0.33%) horns. Rekha *et al.* (2012) reported that the orientation of horns in Shahabadi cattle was outward, upward, inward with pointed tips in the majority of cases, while, Adgale *et al.* (2017) observed mostly curved 92.34% and straight 7.66% horns in Khillar cattle.

Length of horns and circumference were 21.64 ± 2.65 cm and 18 ± 0.85 cm in males while 19.26 ± 0.29 cm and

12.91±0.10 cm in females of Dagri cattle. Sharma *et al.* (2013) reported the average horn length of females as 14.72±1.38 cm in hill cattle of Rudraprayag. Horn colour was mainly black in both males and females of Dagri cattle. Similarly, black horns were observed in Malvi cattle (Srivastava *et al.* 2002) and Bargur cattle of Tamil Nadu (Pundir *et al.* 2009) while, Pundir *et al.* (2015) reported that Manipuri cattle had black (82%) followed by gray (18%) horns.

Tail switch in Dagri cattle was mainly black (100% in males and 99.19% in females), however, in minor proportions brownish (0.16%) and white (0.49%) were observed in females. Black coloured switch was observed by Singh *et al.* (2008) in Malnad Gidda cattle of Karnataka and in Shahabadi cattle of Bihar (Rekha *et al.* 2011). Singh *et al.* (2011) reported that the half of the population had black and remaining half of the population had white tail switch in Vrindavani cattle.

Hooves were pale black (100%) in males and females of Dagri cattle. Similarly black hooves also reported in Ponwar cattle (Gaur *et al.* 2003), in local cattle of Assam (Kayastha *et al.* 2011) and in non-descript cattle of Konkan region (Khirari *et al.* 2014). In Dagri cattle small hump (but more prominent in bulls), dewlap, and naval flap were observed. Likewise small hump in cow but prominent hump in bulls with small to medium dewlap was observed in Malnad Gidda cattle of Karnataka (Singh *et al.* 2008).

Dagri cattle had bowl-shape small-size udder with a round-tipped cylindrical teat, milk veins were not prominent. Similarly, Pundir *et al.* (2014) also reported small udder with no prominent milk vein in hill cattle of Uttarakhand, while, Singh *et al.* (2008) reported bowl shape small udder with funnel shape teat and pointed tips in Malnad Gidda cattle of Karnataka.

In the present study, the mean body weight (kg) of Dagri population at different age, viz. birth weight, pre-weaning weight, 12 months weight, 24 months weight and adult weight were recorded in males and females (Table 1).

Body weight and other body measurements are compared with other hill cattle breeds and breeds from neighbouring tracts. Pundir *et al.* (2013) reported that birth weight ranged from 7 to 14 kg in hill cattle of Uttarakhand, which is comparable with present findings. Singh *et al.* (2011) reported average birth weight as 22.13±0.12 kg in Vrindavani cows. Similarly, higher values of pre-weaning weight than present results were reported by Ghafoor *et al.* (1980) in Red Kandhari cattle (88.71 kg), by Pawar *et al.*

(1987) in Deoni cattle (91.53±7.53 kg), and by Gokhale *et al.* (2009) (85.75±2.37 kg) in Khillar cattle. Higher values 12 months weight than present results were reported by Yadav (2008) in Deoni cattle (175.93±8.61 kg) and by Shikalgar (2011) in Khillar cattle (127.99±0.98 kg), respectively.

Higher values of 24 months body weight than the present results were reported by Yadav (2008) in Deoni cattle (267.88±58 kg) and by Shikalgar (2011) in Khillar cattle (175.34±1.68 kg). Lower values of 13–24 months body weight were reported by Dhal *et al.* (2007) as 86.72±0.39 kg in males and 72.15±0.41 kg in females of Khariar cattle. Higher values of adult bull / bullocks body weights were reported by Mwandotto (1988) in Sahiwal cattle (423.5±1.9 kg), by Banerjee (1998) in Hallikar cattle (340 kg), by Gokhale (2009) in Khillar cattle (408.83±2.14 kg) and by Jadhav (2010) in Khillar cattle (489.59±6.61 kg). Higher values of adults cows body were reported by Pundir *et al.* (2007) in Red Sindi cattle (320 kg), by Yadav (2008) in Deoni cattle (313.01±9.72 kg), by Gokhale *et al.* (2009) in Khillar cattle (305.14±1.64 kg) and by Jadhav (2010) in Khillar cattle (409.68±43 kg), by Banerjee (1998) in Hallikar cattle (227 kg), by Shikalgar (2011) in Khillar cattle (209±4.99 kg). The present finding indicated that Dagri breed has less body weight as compared to other draught purpose cattle breeds but comparable to other hilly cattle breeds.

Measurements of different body parts in adults males, adult females and heifers of Dagri cattle were taken and means of body measurements with standard error and range are presented in Table 2. Chest girth in Dagri cattle at different age groups, viz. an adult male, adult female and heifers up to 4 years were observed as 134.40±43, 128.93±0.35 and 117.18±1.23 cm, respectively. Present finding of chest girth was higher than that reported in Malnad Gidda cattle (118.36±0.67 cm) (Singh *et al.* 2008) but lower than that in Red Sindi (162 cm) (Pundir *et al.* 2007), Deoni cattle (152.24±15 cm) (Yadav, 2008), Kankrej cattle (162.56±0.56 cm) (Pundir *et al.* 2011). Body length in Dagri adult male, adult female and heifers up to four years of age were found as 115.46±3.37, 110.82±0.34 and 100.09±1 cm respectively. The lower body length as compared to the present results was reported by Pundir *et al.* (2007) as 105.50 cm in Red Sindi cattle, by Munde (2012) as 109.80±0.51 cm in Gaolao cattle but the higher body length as compared to the present results was reported by Singh *et al.* (2002) as 116.43±26 cm in Deoni cattle and

Table 1. Mean body weights at birth and different ages of Dagri cattle

Parameter	Male			Female		
	Mean±SE	Range	CV %	Mean±SE	Range	CV %
Birth weight	16.75±0.25 (2)	16.0–17.0	2.11	13.0±1.0 (2)	12.0–14.0	10.87
Pre-weaning weight	27.12±2.02 (14)	19.0–50.0	27.95	27.1±3.01 (100)	21.0–50.0	35.15
12 months weight	60.02±19.85 (4)	39.0–99.0	57.30	66.5±7.16 (3)	53.4–78.1	18.64
24 months weight	108.08±13.72 (4)	87.3–134.0	22.00	116.7±8.67 (18)	69.4–218.7	31.50
Adult weight	223.85±14.70 (10)	142.1–281.5	19.68	169.63±1.21 (577)	100.2–247.08	17.18

Table 2. Measurements (cm) of different body parts in adult males, adult females and heifers up to 4 years of age in Dagri population

Parameter (cm)	Male (adults)				Females (adults) >4 years				Heifers up to 4 years of age			
	No.	Mean±SE	Range	CV %	No.	Mean±SE	Range	CV %	No.	Mean±SE	Range	CV %
Chest girth	15	134.40±4.03	103–158	11.62	500	128.93±0.35	101–156	6.22	91	117.18±1.23	89–146	10.06
Body length	15	115.46±3.37	89–129	11.3	500	110.82±0.34	85–137	7.04	91	100.09±1.00	73–122	9.58
Height at withers	15	106.66±2.11	92–117	7.66	500	102.46±0.28	84–115	6.12	91	97.81±0.72	79–108	7.09
Face length	15	35.86±1.00	28–40	10.89	500	35.95±0.10	27–40	6.04	91	33.97±0.30	26–39	8.57
Forehead width	15	15.66±0.54	13–20	13.36	500	13.12±0.05	20–Oct	9.28	91	12.47±0.16	10–20	12.49
Horn length	15	21.64±2.65	4–42	47.55	500	19.26±0.29	4–40	34.42	33	10.40±0.91	3–22	68.15
Horn circumference	15	18.00±0.85	11–24	18.49	500	12.91±0.10	9–22	18.56	33	10.93±0.45	7–17	42.23
Hump height	15	10.00±0.66	5–14	25.91	500	06.98±0.06	4–13	18.72	91	06.29±0.14	3–9	21.37
Dewlap length	15	78.40±2.57	66–94	12.69	500	72.86±0.35	47–89	11.02	91	67.16±1.20	34–87	17.11
Navel length	15	05.87±0.54	3–10	35.79	500	01.40±0.06	0.5–9	100.42	37	01.45±0.15	0.5–7	99.90
Ear length	15	21.06±0.78	16–27	14.4	500	19.23±0.11	11–25	13.19	91	19.20±0.27	11–25	13.89
Ear width	15	10.00±0.32	9–13	12.53	500	10.50±0.06	7–21	12.07	91	10.25±0.18	6–21	16.80
Hip height	15	109.13±1.84	98–119	6.54	500	104.99±0.26	87–117	5.62	91	100.06±0.70	82–113	6.76
Tail length	15	67.33±1.37	56–78	7.93	500	66.91±0.25	45–86	8.54	91	62.92±0.78	41–76	11.90

by Das *et al.* (2018) as 123.59±0.45 cm in Red Kandhari cattle. Breeding tract of this breed falls between that of Kankrej, Malvi and Nari. Although there is continuous gene flow from Malvi through sale of cows and bulls in breeding tract of this breed, Dagri is much smaller than all these 3 breeds.

Height at withers were observed as 106.66±2.11, 102.46±0.28 and 97.81±0.72 cm for an adult male, an adult female and heifers up to 4 years of age, respectively. The higher height at withers in adult than the present findings were reported by Singh *et al.* (2002) as 122.06±2.39 cm in Deoni Cattle, by Pundir *et al.* (2007) as 112.75 cm in Red Sindhi cattle, by Pundir *et al.* (2011) as 124.49±0.28 in Kankrej cattle, by Shinde (2013) as 135.70±0.37 cm in Red Kandhari cattle. While, comparable height at withers was reported by Iype *et al.* (2016) in Kasargod cattle as 96.0±1.2 cm in females and 106.0±5.8 cm in males. The hip heights were 100.06±0.70, 104.99±0.26 and 109.13±1.84 cm in an adult male, an adult female and heifers up to 4 years of age, respectively, which is much lower than that of adults, reported by Das *et al.* (2018) as 127.80±0.50 cm and by Bainwad (2017) as 133.17±0.36 cm in Red Kandhari cattle. The present findings of height at withers and hip height in Dagri cattle indicated that the Dagri is a typical hilly cattle.

Face length for age groups, viz. an adult male, an adult female and heifers up to four years of age were observed as

35.86±1, 35.95±0.10 and 33.97±0.30 cm, respectively. The comparable finding was reported by Kayastha *et al.* (2011) for adult indigenous cattle of Assam as 35.035±0.195 cm. Higher values of face length than the present finding were reported by Pundir *et al.* (2015) as 38.73±0.39 cm in Mizoram local adult cattle, by Singh *et al.* (2002) as 49.82±0.91 cm in adult Deoni cows, by Singh *et al.* (2008) as 41.32 cm in adult Pulikulam breed of Tamil Nadu, by Pundir *et al.* (2010) as 36.10±0.03 cm, 33.85±0.02 cm in adult hill cattle of Kumanu region and Garhwal and by Adgale *et al.* (2017) as 52.23±0.10 cm in adult Khillar cattle.

Tail length was found to be 67.33±1.37, 66.91±0.25 and 62.92±0.78 cm in an adult male, an adult female and heifers up to 4 years of age of Dagri population, respectively. Comparable finding was reported by Shinde (2013) as 65.39±0.21 cm in Red Sindhi cattle. Higher values than the present findings were reported by Pundir *et al.* (2007) in Kankrej cattle (89.34±0.34 cm) and by Das *et al.* (2018) in Red Kandhari cattle (75.53±0.43 cm).

Horn length and horn circumference in Dagri cattle were observed as 21.64±2.65, 18±0.85 cm in adult male, 19.26±0.29, 12.91±0.10 cm in adult female, 10.40±0.91, 10.93±0.45 in heifers up to 4 years of age, respectively. Lower values of horn length than the present findings were reported by Kayastha (2006) in Assam local cattle (13.230±0.502 cm), by Singh (2008) in Manipur local cattle

(12.97±0.30 cm), by Shinde (2013) as 8.74±09 cm and by Das *et al.* (2018) as 5.79±09 cm in Red Kandhari cattle. Higher values of horn length than the present results were reported by Pundir *et al.* (2011) as 42.47±0.53 cm in Kankrej cattle. For horn circumference, lower values than the present findings were reported by Kayastha (2006) in Assam local cattle (11.368±0.081 cm), by Singh (2008) in Manipur local (12.60±0.18 cm).

Hump height in Dagri cattle was 10±0.66, 6.98±0.06 and 6.29±0.14 cm in an adult male, an adult female and heifers up to 4 years of age, respectively. Gokhale *et al.* (2009) reported hump height of 18.456±0.07 cm and 13.78±0.06 cm in males and females in Khillar cattle which is higher than the present findings. Present finding indicated that the hump is less prominent in Dagri cattle. The dewlap length in Dagri cattle at different age groups, viz. an adult male, an adult female and heifers up to 4 years of age were 78.40±2.57, 72.86±0.35 and 67.16±1.20 cm respectively, which was lower than 106.56±0.45 cm as reported in adult Khillar males. Interestingly, it is higher than that reported in females, 69.55±0.27 cm in Khillar cattle (Gokhale *et al.* 2009). Naval length in Dagri cattle at different age groups, viz. an adult male, an adult female and heifers up to 4 years of age were observed as 05.87±0.54, 01.40±0.06 and 01.45±0.15 cm respectively, which were lower than that reported by Gokhale *et al.* (2009) as 8.38±0.05 cm and 79±0.03 cm in males and females, respectively, in Khillar cattle.

Forehead width in Dagri cattle at different age groups, viz. an adult male, an adult female and heifers up to 4 years of age were 15.66±0.54, 13.12±0.05 and 12.47±0.16 cm, respectively. The comparable finding was reported by Kayastha (2006) as 13.15±0.071 cm in Assam local cattle of an adult age, by Singh (2008) as 14±0.10 cm in Manipur local cattle of adult age and by Tolengkomba *et al.* (2012) as 14.90±0.15 cm in adult local cows of Manipur.

Ear length and ear width in Dagri cattle were observed as 21.06±0.78, 10±0.32 in an adult male 19.23±0.11, 10.50±0.06 cm in adult female and 9.20±0.27, 10.25±0.18 cm heifers up to 4 years of age, respectively, which were lower than that reported in Red Sindhi cattle by Pundir *et al.* (2007), in Red Kandhari cattle by Shinde (2013) and Das *et al.* (2018).

Milk production per day, lactation length and total

lactation milk yield of the Dagri breed of cattle were derived from farmers' interviews at their doorstep. While fat and SNF percentage in the milk of Dagri cattle were tested at livestock products technology department and are presented in Table 3.

The average daily milk yield and overall lactation milk yield in Dagri cow were 1.75±0.06 kg/day and 315.9±11.78 kg, respectively. Sometime farmers are not milking at all and milk suckled completely by male calf. The present finding of daily milk yield is comparable to the findings reported by Pundir *et al.* (2013) in Uttarakhand hill cattle (1.61 kg to 2.57 kg), by Iype *et al.* (2016) in Kasargod cattle (1.4±0.04 kg). The overall mean lactation length based on 278 observations was 180 days. The overall lactation milk yield was comparable to the findings of Kayastha (2006) in Assam local (304.862 kg) and of Singh (2008) in Manipur local cattle (312.49±3.68 kg) and by Sahoo *et al.* (2003) in Malvi (915.6±21.7 kg).

The overall fat and SNF per cent in milk of Dagri cattle were 4.08±0.40% and 9.18±0.22%. The present finding of fat % was comparable to the findings of Singh *et al.* (2007) in Gangatiri cattle (4.33%); Kuralkar *et al.* (2015) in Deoni cattle (4.20±0.15%); Iype *et al.* (2016) in Kasargod cattle (3.9±0.3%). However, higher values than the present finding were reported by Kayastha *et al.* (2006) in Assam native cattle (5.34±0.06%) and by Singh (2008) in Manipur indigenous cattle (5.42±0.03%). While, the overall SNF per cent in milk was higher than that reported by Kayastha *et al.* (2006) in Assam native cattle (8.54±0.03%), by Singh (2008) in Manipur indigenous cattle (8.47±0.02%), by Kuralkar *et al.* (2015) in Deoni (8.43±0.05%) and by Iype *et al.* (2016) in Kasargod (8.56±0.17%). It is pertinent to mention that our result is based only on 36 milk samples.

The reproductive performance of Dagri cattle is presented in Table 4. There are no organized farms of this lesser-known population in the area. Hence, data were recorded at farmers' doorstep through personal interviews.

The age at first oestrus and age at first calving in Dagri cattle were 40 months and 53 months. The age at first estrus in present study was lower than reported by Iype *et al.* (2016) in Kasargod cattle (24.9±0.5 months) but the age at first calving was higher than reported by Kayastha (2006) in Assam local cattle (43.05±0.18 months), by Singh (2008) in Manipur local cattle (42.95±0.08 months), by Kuralkar

Table 3. Milk production parameters estimated in Dagri cattle

Trait	First lactation			Overall		
	No.	Mean±SE	Range	No.	Mean±SE	Range
Daily milk yield (kg)	41	1.85±0.16	0.5–4	278	1.75±0.06	1–6
*Peak milk yield (kg)	–	–	–	–	–	–
Lactation length (days)	41	150	120–240	278	180	150–240
Lactation milk yield (kg)	41	278.04±25	75–600	278	315.9±11.78	75–650
Fat %	14	4.04±0.42	3.1–5.2	36	4.08±0.40	3–5.5
SNF %	14	9.08±0.23	8.6–9.7	36	9.18±0.22	8–9.8

*, As most of the animals allowed suckling, this trait could not be measured.

Table 4. Reproductive performance of Dagri cattle

	No.	Mean	Range
<i>Male</i>			
Age at first mating (months)	12	36	33–40
<i>Female</i>			
Age at first oestrus (months)	278	40	36–42
Oestrous cycle duration (days)	278	21	19–25
Oestrus duration (hr)	278	18	16–19
Age at first mating (months)	278	44	42–48
Age at first calving (months)	278	53	48–60
Service period (days)	278	220	150–250
Calving interval (days)	278	500	475–547

et al. (2015) in Deoni (44.50±0.30 months) and by Pundir *et al.* (2014) in Tripura indigenous cattle (44 months); by Iype *et al.* (2016) in Kasargod (36.4±0.8 months). The higher age at first calving may be due to poor development of reproductive organs owing to poor nutrition.

The service period and calving interval in Dagri cattle were 220 and 500 days. The shorter service period than the present result was reported by Bainwad *et al.* (2017) in Red Kandhari cattle as 139.92±0.66 days. Similarly, shorter calving interval than present finding was reported by Nivsarkar *et al.* (2000) in Gaolao cattle as 387.00 days, by Phule and Maske (2012) in Gaolao cattle as 387 days, by Bainwad *et al.* (2017) in Red Kandhari cattle as 423.42±0.61 days.

The observations regarding the draughtability of Dagri bullocks were recorded on 22 working males (bullocks and bulls) used for the draught purpose. The task like ploughing is considered as hard work. Opinion and farmers' experience were also considered for the draughtability of Dagri bullocks. To know the draught performance of the bullocks of the breed, 4 hr ploughing of agricultural land was done during September–October. Observations regarding physiological responses like temperature, respiration and pulse rate recorded before and after operations are presented in Table 5.

The physiological parameters like body temperature, respiration and pulse rates, showed very positive results towards the adaptability of these cattle to hot humid climate of hilly area. Based on phenotypic characterization of Dagri cattle, it was found that Dagri is typical hill breed smaller than most of indigenous breeds except, Vechur, Panganur and other dwarf indigenous breeds. Based on production performance and draught performance, Dagri is judged to be a draught purpose breed.

Pure animals are found in hilly tract. In plains, purity is diluted due to inclusion of Dahod for execution of mandatory AI program from government aspiration district, grading up with Gir through AI is implemented. All AI born calves are Gir cross, red in colour and taller than pure calf inducing many cases of dystocia (as per discussion with local VO and owners). Hence, there is urgent need to establish breeding farm for Dagri cattle for its conservation and genetic improvement.

Table 5. Draught performance of Dagri bullocks

Number of bullocks: 11 pairs (bullocks' constantly work for 4 hr)		
Physiological parameter	Before work	After work
Rectal temperature (°F)	100.4±0.06	101.2±0.07
Respiration rate /min	30±0.78	39±1.33
Pulse rate /min	52±17	61±1.45
Average duration of work per day (h)	4–6 hours during morning and evening	

Dagri has excellent drought and heat tolerance capacity and best adapted to semi-arid climate of middle Gujarat and most suitable for agricultural operations in hilly area. Phenotypic characters includes, viz. body coat colour of cattle is predominantly white, sometimes with grey shade. Dagri cattle are small in size as compared to other breeds of Gujarat and most hilly breeds of the country. It has slender and compact body, straight forehead, prominent depression on inner side of both horn bases, prominent supraorbital groove. Dagri cattle are sturdy in nature, with moderate to tractable temperament and are resistant to tropical diseases as compared to exotic or crossbreds and adapted well to the extensive housing system. Dagri cattle has less feed intake because of small size, hence it can survive mostly on grazing and is hardly stall fed.

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