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RESEARCH ARTICLE

Physical and morphometric characteristics of unidentified cattle breed of northern Karnataka region of India

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Abstract: A study was undertaken to characterise the non-descript cattle of North Karnataka region. Raichur and Yadgir districts were randomly selected and divided into two blocks each and five villages were selected in each block. The morphological characteristics of male and female cattle of 0-3 months, 3-6 months, 6-12 months, 1 to 3 years and >3 years age was recorded from totally 388 animals. The results indicated that these cattle were short in nature, docile in temperament with three colour variants *viz.*, brown, black and white. These cattle are called Javari in their breeding tract. Horn of these cattle was directed upward, medium sized with horizontal ears. The average horn length, chest girth, body length and height at withers (cm) were 19.63±0.49, 142.81±0.88, 118.73±0.81 and 105.89±0.48 in adult cows respectively, whereas in adult bulls were 26.65±0.61, 173.23±1.20, 142.15±1.08 and 118.05±0.56, respectively. These cattle were reared under semi intensive system, sent for grazing in the day time without any supplemental feeding and kept under Kutcha housing or in open space during night hours. Therefore it was evident from the current study, that these cattle were having unique characteristic features.

Keywords: Cattle, non-descript, North Karnataka, morphometry, biometry

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Introduction

In India, there are 53 recognized native cattle breeds that are categorised as 3 groups: milch, draught, and dual purpose, based on their use in dairying or agriculture. The phenotypic, utility pattern, and adaptability of cattle populations grown and adapted in India's various agro-climatic settings and production systems are vastly different (Srivastava et al. 2019). The indigenous breeds are now prone to rapid genetic degradation and dilution mainly due to unplanned breeding and the entry of exotic germplasm through cross breeding also because of mechanization of farm operations (Groeneveld et al. 2010). Genetic diversity conservation is critical for any species' long-term survival, especially for the rapidly changing environmental conditions (Tesfa et al. 2017). The loss of these breeds is equal to lose of global insurance policy against food security issues in the upcoming years (Shah et al. 2016). Around 22 per cent of well-known livestock breeds have been extinct in the previous century, with another 27 per cent facing varied degrees of extinction (Rege and Tawah, 1999). As per the available reports, each week, nearly two breeds of poultry and cattle are lost (FAO, 2007). Therefore, the conservation of native animal resources is a viable strategy for reducing the extinction of these livestock breed diversity (Srivastava et al. 2019).

There is a chance that at least 30 to 50 new cattle breeds may be discovered in the next 20 years (Sharma and Niranjan, 2016).According to the 20th Livestock Census, India has 192.49 million cattle population, an increase of 0.8 per cent compared to the previous Census. There are 50.42 million exotic/crossbred cattle and 142.11 million indigenous/non-descript cattle. Karnataka is having rich indigenous genetic resources with six cattle breeds, one buffalo breed, two goat breeds, five sheep breeds and one poultry breed (NBAGR, 2023). The indigenous cattle population of Karnataka accounts for 1,22,88,358 but still much of the population is unidentified. With this background the current investigation was undertaken to characterise the cattle population of Raichur and Yadgir districts of Karnataka.

Materials and Methods

Locale of the study

The current study was conducted purposively in Raichur and Yadgir districts of Karnataka because it is breeding tract of non-descript cattle called as Javari.

Yadgir and Raichur districts were selected and classified in to four blocks; two from each district were selected randomly. The non-descript cattle (Javari cattle) was grouped in to five categories based on the age. From each block, sixteen animals were selected in 0 to 3 and 3 to 6 months age group, twenty animals in 6 to 12 months and 1 to 3 years old, each group with equal number of males and females. Whereas, in adult (>3 years) 10 male animals and 15 female animals were selected. The total number of animals used for the study was 388, each block consisting of 97 animals. The study was conducted from May 2022 to January 2023.

Physical and morphometric data on males and females of different age group were recorded. In the selected blocks, sampling was done in 5 villages. For morphological characterization, care was taken to collect the data randomly, from animals belonging to true-to-type non-descript cattle, as identified on the basis of their external appearance and typical morphometric characteristics. Various physical characteristics *viz.* basic temperament, size of hump, dewlap, Navel flap, penis sheath flap, and coat colour, skin colour, muzzle colour, eye lid colour, hoof colour, tail switch colour, horn colour and shape, horn size, length, thickness and orientation, head- fore head and face, udder shape and size, teat shape, milk veins were observed.

Biometric characteristics

The different biometric characteristics *viz.,* face length and width, body length, ear length and width, chest girth, paunch/barrel girth, tail length, horn length and circumference, height at withers, distance between hip bones and pin bones were recorded from the Javari cattle herds with the help of scale and measuring tape. Data collected was classified according to age group and sex of the animal.

Body weight

The body weight was 0 to 3, 3 to 6, 6 to 12 months old animals' was measured using hanging weighing balance. For adult cattle, it was calculated by the following formula: *Agarwal's modified Shaffer's formula*

Body weight = chest girth (inch)×body length (inch)/ Y

Where, Y is

9, if chest girth is less than 65 inches

8.5, if chest girth is between 65-80 inches

8, if chest girth is over 80 inches

Statistical analysis

The collected data were scored, compiled, tabulated suitable statistical methods with help of using Microsoft Excel, 2016. The data was analysed systematically commensurate with objectives of the study using statistical software SPSS 22.0 (SPSS version 22, SPSS Inc. Chicago, Illinois) as per procedure described by Snedecor and Cochran (1994).

Results and Discussion

Origin, Geographical distribution and native tract of the breed

Karnataka State is located between 11.50° and 18.50°North latitudes and 74° and 78.50° East longitudes. The North Eastern Dry Zone, spread over 1762604 ha, accounts for 9.26 per cent of the total geographical area (1,91,791 sq.km.) of Karnataka State. It is situated between 15° 57' and 17° 36' north latitude and 76° 6' and 77°33' east longitude. This zone comprises 5 blocks (Afzalpur, Chittapur, Gulbarga, Jewargi, and Sedam) of Gulbarga district, 3 blocks (Shahapur, Shorapur and Yadgir) of Yadgir district and 3 blocks (Devdurga, Manvi and Raichur) of Raichur district. Annual rainfall is between 633.22 to 806.6 mm.

Agriculture is the main occupation of the surveyed blocks of Yadgir and Raichur districts. The main crops of the districts are Paddy, Groundnut, Chilli, Green gram and Cotton, including horticulture crops. Sheep husbandry is also a major occupation of farmers in these districts.

Population status of cattle

This zone indicates the predominance of rain dependent dry land agricultural area. Total livestock population in Yadgir and Raichur districts were 10,05,218 and 13,14,529, respectively. The cattle population in the Yadgir district is 2,33,336 and in Raichur district is 2, 45,374.

Physical characteristics

The results of physical characteristics of Javari cattle have been presented in Table 1. It was found that majority of the adult bulls and cows were docile in nature in the study area. The animals were handled by women for milking purpose. The cows were showing fright reaction towards entry of strange in their vicinity. Many of the cows were left for grazing in peri-urban area, so, they are acclimatized to human interactions and traffics. The bulls were owned by small and marginal farmers, they were also handled by women's and children's at home. Mostly, the animals in peri-urban area were more docile when compared to the animals reared under semi-intensive system of rearing in villages.

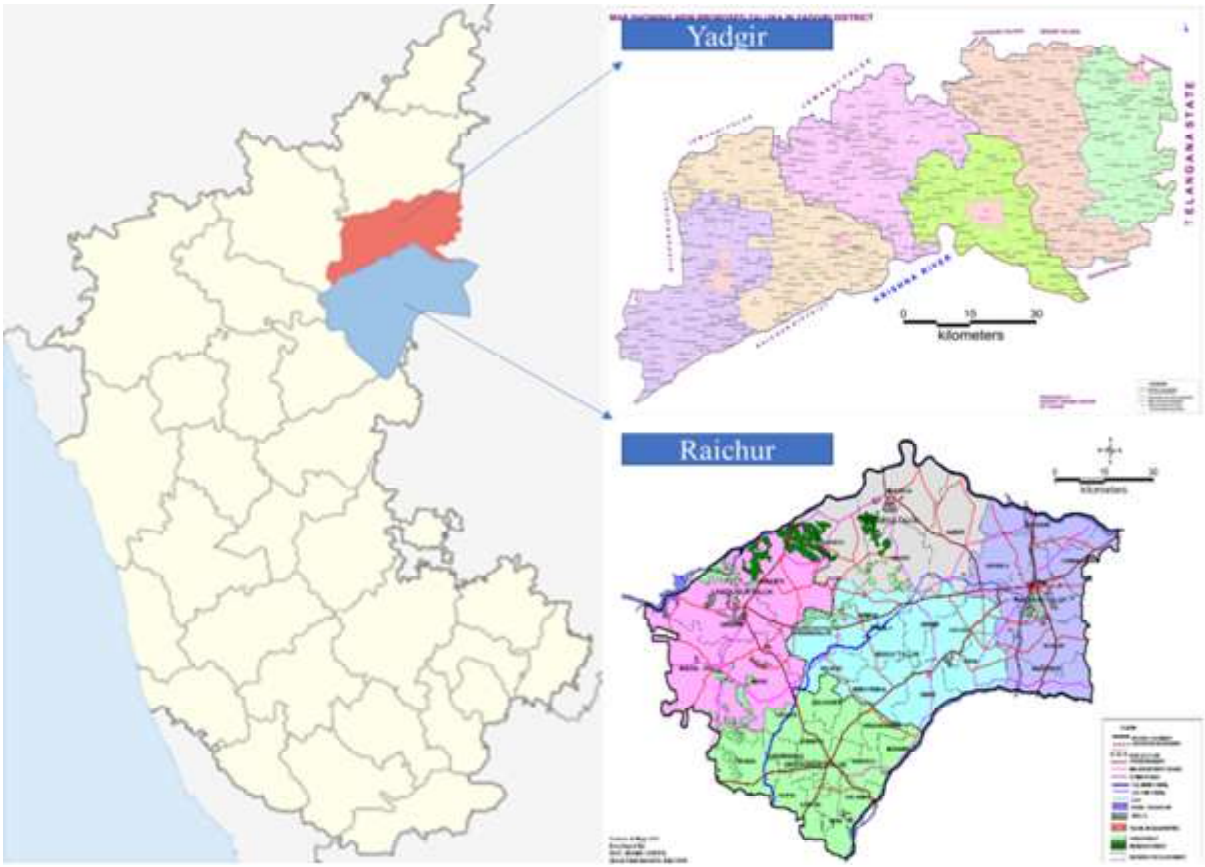

Fig. 1 Geographical maps of Yadgir and Raichur districts of North Karnataka

The predominant coat colour of the bulls and cows was found brown and white, black colour was rare. The predominant light coat colour might be due to hot climatic conditions of the region, which might have influenced the animals to adapt to such adverse climatic conditions which help them to protect against solar radiations. The close breed in the adjacent districts was Krishna valley, Karthickeyan et al. (2006) revealed that, the coat colour of the Krishna Valley bulls was found to be greyish white with dark colour shades on the fore- and hind limbs, cows were light grey in colour, but few brown coloured and black and white coloured were also noticed. But, the Deoni cattle were categorised into three strains on the basis of coat colour variation viz. Wannera (pure white along with black colour at the side parts of the face), Shevera (pure white body with irregular black patches) and Balankya (pure white along with black patches on the lower parts of the body) (Kuralkar et al. 2015).Similarly, short breed of Karnataka, the Malnad Gidda cattle were found in 5 different colours *viz*, black, brown, red, fawn and white, sometimes mixture of any two colours were also seen, but black colour was majorly present (Singh et al. 2008). In other Mysore type cattle, Singh et al. (2012) revealed that coat colours of Pulikulam cows were white or greyish white colour in most of animals and bulls were either black or blackish grey.

The white or light coat colour of the Javari cattle might help them to reduce the direct effect of heat stress by reflecting more incident solar radiation from the body (Katiyatiya et al.2017). The light coloured coats help to reflect 50 % to 60 % of direct solar radiation than the dark-coloured animal (McManus et al. 2009). Felius et al. (2011) mentioned that coat colour is the most obvious characteristic of cattle, at least for non-experts. Coat colour characteristics were also considered to indicate genetic purity and are relevant for the classifying a breed. Also, the coat colour is the important morphological adaptive trait, which imparts adaptive ability to livestock during heat stress exposure (Gaughan et al. 2019). The primary layer which protects the animals against solar radiation is coat colour. The coat colour of the breeds of tropical countries helps in reflecting the solar radiation; thereby protects the animals against the adverse climatic conditions (Fanta, 2017). Whereas, the breeds with a dark coat colour will absorb more solar radiation which increases their heat load. In a study, it was observed that the cow with lighter coloured coat showed lesser shade-seeking behaviour than the darker one (Tucker et al. 2008).

The muzzle colour of bulls was found black followed by white and brown colour whereas in females prominent was brown

followed by black colour. Similar results were found in Pulikulam cattle (Singh et al. 2012), tribal Kathani cattle (Kulkarni et al. 2013) and Konkan cattle (Singh et al.2019). These results indicated that black muzzle colour was the most common in indigenous cattle. But, Pundir et al. (2007) noticed white, grey and black muzzle colour in Kenkatha, Kankrej and Gangatiri cattle. The eyelid colour of the Javari cattle found was predominantly black in bulls and cows compared to brown colour. Similarly, Pundir et al. (2007) reported that Kenkatha and Red Sindhi cattle have black colour eyelids but, Kankrej cattle have grey coloured eyelids. Also, the eyelid colour of majority of the non-descript cattle of Konkan region was black (Khirari et al. 2014).

Table 1: Physical characteristics of unidentified cattle of North Karnataka

Parameters	Yadgir		Raichur		Overall	
	Cow (n=30)	Bullock (n=20)	Cow (n=30)	Bullock (n=20)	Cow (n=60)	Bullock (n=40)
Temperament						
Aggressive	7	2	5	3	12 (20%)	5 (12.50%)
Docile	23	18	25	17	48 (80%)	35 (87.50%)
Coat colour						
Brown	16	10	19	11	35 (58.33%)	21 (52.50%)
White	8	9	9	7	17 (28.33%)	16 (40.00%)
Black	6	1	2	2	8 (13.33%)	3 (7.50%)
Muzzle colour						
Brown	13	1	9	4	22 (36.66%)	4 (10%)
White	0	2	0	7	0	9 (22.50%)
Black	17	17	21	9	38 (72.33%)	27 (67.50%)
Eyelid colour						
Brown	1	0	0	1	1 (1.66%)	1 (2.50%)
Black	29	20	30	19	59 (98.33%)	39 (97.50%)
Hoof colour						
Yellow	3	0	0	1	3 (5%)	1 (2.50%)
Black	27	20	30	19	57 (95%)	39 (97.50%)
Tail switch						
Brown	17	12	10	14	27 (45%)	26 (65%)
White	1	0	1	0	2 (3.33%)	0
Black	12	8	19	6	31 (51.66%)	14 (35%)
Hump size						
Small	27	0	29	0	56 (93.33%)	56 (93.33%)
Medium	3	20	1	20	4 (6.67%)	40 (100%)
Large	0	0	0	0	0	0
Dewlap size						
Small	1	0	2	0	3 (5%)	0
Medium	29	20	28	20	57 (95%)	40 (100%)
Large	0	0	0	0	0	0
Penis sheath						
Small		1		0	1 (2.50%)	
Medium	-	19	-	20	39 (97.50%)	-
Large		0		0	0	
Navel sheath						
Small	30	3	30	0	60(100%)	3 (7.50%)
Medium	0	17	0	20	0	37 (92.50%)
Large	0	0	0	0	0	0

Horn size						
Small	4	0	7	0	11 (18.33%)	0
Medium	26	20	23	20	49 (81.66%)	40 (100%)
Large	0	0	0	0	0	0
Horn colour						
White	8	5	7	2	15 (25%)	7 (17.50%)
Black	22	15	23	18	45 (75%)	33 (82.50%)
Horn shape						
Straight	30	20	30	20	60(100%)	40 (100%)
Horn orientation						
Upward - outward	30	20	30	20	60(100%)	40 (100%)
Head shape						
Straight	30	20	30	20	60(100%)	40 (100%)

Table 2: Udder characteristics of adult unidentified cows of North Karnataka

Parameters	Yadgir (N=30)	Raichur (N=30)	Overall (N=60)
Udder size			
Small	27	29	56 (93.33%)
Medium	3	01	4 (6.67%)
Udder shape			
Pendulous	1	0	1 (1.67%)
Pear	8	11	19 (31.67%)
Globular	21	19	40 (66.66%)
Teat size			
Small	27	25	52 (86.67%)
Medium	3	5	8 (13.33%)
Large	0	0	0
Teat shape			
Cylindrical	25	25	50 (83.33%)
Funnel	5	5	10 (16.67%)
Pear	0	0	0
Milk vein			
Prominent	0	0	0
Not prominent	30	30	15 (100%)

The hoof colour of Javari cattle found was black colour in most of the animals. Similar results were found in Assam cattle (Kayastha et al. 2011) and Kathani cattle (Kulkarni et al. 2013).

The tail switch colour of majority of the bulls was brown coloured followed by black. Whereas, in females, brown and black coloured tail switch was almost equally distributed and few animals had white coloured switch. But, the tail switch of the Krishna Valley cattle, Pulikulum cattle and Konkan cattle was mostly black in colour (Karthickeyan et al. 2006; Singh et al. 2012; Singh et al. 2019).

All the bulls in the study area had medium sized hump and dewlap whereas, majority of the cows had small sized hump and medium sized dewlap. It might be due to medium sized body of the animals and it can be classified as Mysore type cattle. In the present study, it was observed that males had prominent humps compared to females. Similarly, majority of Konkan cows and bulls had small hump and followed by medium sized humps. In majority of bulls dewlap was large but, in case of cows, dewlap was mostly small sized (Singh et al. 2019).Similar results were found in Krishna Valley cattle (Karthickeyan et al. 2006), Pulikulam cattle (Singh et al. 2012) andKathani cattle (Kulkarni et al. 2013).

Majority of the bulls had medium sized penis sheath and medium sized navel sheath whereas, all the cows had small sized navel flap. Similar findings were reported in Konkan cattle (Singh et al. 2019).

All the bulls studied had medium sized and straight horn but in case of females 81.66 % of the cows had medium sized horn. All animals had upward and outward orientation horns. But, 82.50 % of bulls and 75 % of cows had black coloured and 17.50 % of

bulls and 25 % of the cows had white coloured horn. All the animals had straight face and forehead with horizontal ears. But, in Krishna Valley cows Karthikeyan et al. (2006) found that the face of the breed is narrow and the forehead is wide and concave. The head of Krishna Valley is surmounted by short, slate coloured, curved horns usually emerging in an outward direction from the outer angles of the poll and slightly upwards and then inwards with a mild twist. Also, Singh et al. (2019) reported that among majority of the Konkan cattle the shape of horns was straight similar to Javari cattle of Yadgir and Raichur districts. Commonly, the horn orientation was found to be mostly outward, upward and backward. The horn colour was blackish, however creamy and mixed horn colour were also observed.

The horizontal orientation of ears indicates the alertness character of the animals. Most of the non-descript animals were low yielders and mainly used for draft purpose. These characters are of alert animals. Similarly, Joshi and Phillips (1953) recorded horizontal ears in Amritmahal cattle.

The body size of the cattle studied in all four blocks of Yadgir and Raichur districts of North Karnataka was small in comparison to other breeds in the vicinity *viz.* Khillar, Krishna Valley and Deoni. The smaller body size of cattle breeds of tropical climatic conditions is beneficial for surviving in harsh environments (Sejian et al. 2018; Madhusoodan et al. 2019). The climatic conditions of the region are harsh and ambient temperature will be higher during summer which might be the reason for non-adaptability of cross bred cows in these districts, which indirectly influences the milk production of these districts. But, Javari cattle are adopted to these climatic conditions because of their physical and morphometric characteristics. A study showed that dwarf breeds of cattle use different heat tolerance mechanisms than standard cattle breeds, making them better adapted to hotter climates (Martin et al. 2018). Morphological characters of livestock are very important for the adaptation of animals during the stressful condition (Barendse, 2017) as they directly influence the heat exchange mechanisms such as cutaneous convection, radiation and evaporation between the animal and the surrounding environment (McManus et al. 2009). Morphological adaptation includes coat color, fur depth, hair type, and hair density, fat storage in hump or tail, skin color and body size (Khalifa, 2003).

The udder size of majority of the animals in the study area was small and majority of them had globular type of udder followed by pear shape and some of the animals had pendulous shaped

Table 3: Morphometric characteristics of different age groups of unidentified cattle of North Karnataka

Trait	Cow (N=60)	Bullock/Bulls (N=40)	1-3 Y Female (N=40)	1-3 Y Male (N=40)	6-12 m female (N=40)	6-12 m male (N=40)	Female calves (N=32)	Male calves (N=32)
Horn length	19.14±0.49	26.65±0.61	8.09±0.48	11.30±0.43	1.42±0.12	2.75±0.21	1.42±0.12	1.27±0.15
Horn Circumference	12.48±0.19	19.39±0.34	7.70±0.45	11.10±0.37	1.64±0.15	2.80±0.17	1.64±0.15	1.42±0.15
Face length	39.17±0.39	43.60±0.35	35.98±0.30	35.33±0.34	28.14±0.16	30.68±0.32	28.14±0.16	28.28±0.20
Face width	17.55±0.13	19.43±0.28	15.78±0.13	16.26±0.14	12.25±0.14	12.35±0.12	12.25±0.14	12.67±0.14
Ear length	18.34±0.24	20.20±0.19	17.15±0.20	16.86±0.16	14.47±0.27	15.86±0.17	14.47±0.27	14.66±0.25
Ear width	10.62±0.16	11.36±0.18	9.61±0.14	9.03±0.10	7.87±0.09	8.80±0.09	7.87±0.09	8.44±0.14
Chest girth	142.78±1.08	173.23±1.20	120.90±1.25	119.82±1.38	91.53±0.58	98.40±0.93	91.53±0.58	94.13±0.95
Paunch girth	152.99±1.72	180.43±1.26	129.31±1.20	124.20±1.47	94.96±0.75	101.40±1.07	94.96±0.75	96.06±1.07
Body Length	118.73±0.81	142.15±1.08	104.48±1.27	106.79±0.92	82.70±0.71	89.43±0.93	71.17±0.88	74.94±1.36
Body weight	244.12±4.81	419.45±7.98	152.05±5.24	156.68±4.81	87.69±2.24	90.15±1.95	72.06±1.09	75.81±2.06
Height at Withers	105.89±0.48	118.05±0.59	98.85±0.69	102.18±0.83	81.19±0.63	87.60±0.83	81.19±0.63	82.25±0.78
Height at rump	109.48±0.39	121.48±0.66	102.83±0.65	106.05±0.79	84.03±0.46	90.28±0.82	84.03±0.46	85.34±0.62
Top line	141.17±0.88	155.88±1.11	122.15±1.23	125.05±1.34	91.92±0.87	101.00±0.98	91.92±0.87	93.66±1.26
Distance bw Hip bones	30.38±0.31	34.12±0.53	24.84±0.36	24.38±0.39	18.20±0.31	18.92±0.25	18.20±0.31	17.71±0.34
Distance bw Pin bones	18.25±0.24	20.03±0.36	13.70±0.35	13.75±0.41	10.88±0.27	9.70±0.17	10.88±0.27	10.80±0.28
Tail length	94.38±0.94	107.40±1.24	80.52±0.95	83.20±1.16	57.31±0.55	63.97±1.10	57.31±0.55	56.22±1.05

udder as depicted in Table 2. Also, majority of the animals had small sized teats in Javari cattle of Yadgir and Raichur districts. The teat shape of many of the cows was cylindrical and some cows had funnel shaped teats. The smaller udder and teats might be due to their small body size and low milk yielding ability of the animals. But, in Krishnavalley, the udder in the female is medium-sized with short teats and fore teats are longer than hind (Karthikeyan et al. 2006). The udder shape of tribal Kathani was observed as bowl followed by rounded, trough and pendulous in cows (Kulkarni et al. 2013). As the Javari cattle milk yield is lesser, the milk vein was not prominent in the cows studied.

Morphometric characteristics

The average biometric measurements of animals*viz.*horn length and horn circumference are presented in Table3.The Deoni cattle had smaller horns compared to Javari cattle where, horns were medium, thick and emerge from the sides of the pole (Singh et al. 2002). Similarly, the Ponwar cattle were also having small to medium horns and curve inward with pointed tips (Gaur et al. 2015). Also, the horns of Pulikulam cattle of Tamil Nadu were generally wide-spread (in some cases tips were closer), long, thick at bottom and pointed at tips, orientation was outward, upward, backward and inward ending with pointed tips with varying sizes, smaller but thicker in bulls as compared to cows (Singh et al. 2012). But, in Khillar breed, it was observed that the average horn length in cows, bullocks and bulls were found to be longer. The curved horns were observed commonly in Khillar cattle (Adgale et al. 2017).

The results of face length, face width and ear length are depicted in Table 3. These results indicate that the Javari cattle had moderate/ medium sized face. Similarly, Face of Konkan cattle was moderate in length and width (Singh et al. 2019). But, the face length of Wannera, Shevera, Balankya strains of Deoni adult cows and bulls was found to be longer compared to the present findings (Kuralkar et al. 2015).The ears were short and horizontally placed in Javari cattle in all ages. Similar to our study, Singh et al. (2019) also recorded the similar average ear length of Konkan cattle in cows, bullocks, young males, young females and calves. Which indicates the proportionate confirmation of different bodily parts according to body size of the animals. Whereas, Singh et al. (2002) reported that the average ear length in Deoni cattle breed of 26.18±0.52 cm. But, the average ear length observed in Krishna valley cattle breed was 15±0.0 cm which is lesser than the reported results (Karthikeyan, 2006).

The results of average chest girth, paunch girth, body length, height at withers, height at rump and body weights of Javari cattle are presented in Table 3.It was found that the average chest girth Javari cattle is higher compared to of Konkan cattle (Singh et al. 2019). Chest girth reported in different breeds of cattle in India ranged from 121.60±0.76cm to 191.10±0.41 cm (Pundir et al. 2007). The body lengths of Javari cattle are higher compared to Malnad Gidda of Karnataka (Singh et al. 2008) and lesser than Konkan cattle (Singh et al. 2019).The height withers of Javari cattle is lesser compared to adult male and females of Deoni cattle (Singh et al. 2002). But higher than Malnad Gidda breed of Karnataka (Singh et al. 2008). Also, the Javari cattle are having higher height compared to Konkan cattle (Singh et al. 2019). The height at rump of Javari cattle is shorter as compared to other draught breeds of Karnataka. The height at rump was smaller than Khillar cattle (Jagdale, 2019).The body weight of Javari cattle was lesser compared to Khillar cattle (Jagdale, 2019).

The distance between hip bones and pin bones, and the length of tail with switch and without switch in Javari cattle is depicted in Table 3. The tail length of Javari cattle were higher compared to Konkan cattle (Singh et al. 2019).

Conclusions

The non-descript cattle in Yadgir and Raichur districts of North Karnataka have distinct set of morphological features, which are not found in other recognised cattle breeds in neighbouring regions. Animals adapted to harsh climatic conditions with low management inputs in terms of feeds, fodder, and health care. The cattle are mainly reared for draught, manure purpose and household milk consumption. The cattle have variation in coat colour (brown, black and white) and having white skin colour. The cattle have medium sized straight horns with outward orientation, black coloured hooves, horizontal ear orientation, poorly developed udder with small teats, low milk yielders. Further, it was observed during study that these cattle were reared under semi intensive system, sent for grazing in the day time without any supplemental feeding and kept under kutcha housing or in open space during night hours. Therefore, it was evident from the current experiment, that these cattle were having unique characteristic features and are different from the known breeds of Karnataka. Furthermore, their distinctive traits make them eligible for registration with the nodal agency as a new cattle breed.

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