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Morphometric and morphological study of Thanjavur Kulli cattle

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Abstract
Thanjavur Kulli is a short-statured native cattle in Thanjavur district. It is traditionally reared by the farmers under zero-input conditions and maintained as part of their ancestral heritage. Field investigation was carried out in 82 animals under random sampling. Morphologically, Thanjavur Kulli cattle are mostly characterized by a greyish white coat colour. The average morphometric values recorded in males for height at withers, body length, chest girth, paunch girth, face length, face width, tail length, ear length and horn length were 115.24±0.44 cm, 106.00±0.33 cm, 136.10±0.39 cm, 139.28±0.52 cm, 37.92±0.06 cm, 23.08±0.04 cm, 96.76±0.25 cm, 20.92±0.25 and 19.54±0.13, respectively and in females, the corresponding values were 107.40±0.34 cm, 101.74±0.22 cm, 130.25±0.28 cm, 133.17±0.82 cm, 47.31±10.57 cm, 20.34±0.14 cm, 91.55±1.98 cm, 19.55±0.23 cm and 17.83±0.28. Due to medium sized body women use to rear for livelihood security. The declining population of these cattle is due to indiscriminate crossbreeding. Considering its unique genetic characteristics and adaptability, there is an urgent need to conserve these Thanjavur Kulli cattle as an important indigenous germplasm resource.

Keywords: Thanjavur kulli cattle, Phenotype characterization, Morphology, conservation

Introduction
India holds the mega bio-diversity centres in the world with vast livestock genetic resources. In India, cattle provides increased economic stability to the farmers (Dash *et al.*, 2013) [1]. At present, India ranks first in cattle population with 53 indigenous cattle breeds recognized by the National Bureau of Animal Genetic Resources (NBAGR), which includes four native breeds in Tamil Nadu such as Kangeyam, Pulikulam, Bargur and Umblacherry. Lesser known cattle such as Alambadi, Malaimadu and Nattukuttai which is still unrecognized (Selvan *et al*., 2023) [2]. According to the 20th livestock census, the total livestock population in India was 536.76 million. When compared to the previous livestock census there is a 4.3 percentage increase in livestock population. The total livestock population in rural and urban area is 514.11 million and 22.65 million respectively. Out of the total livestock population, cattle population contributes 193.46 million and there is 1.3 percentage increase in cattle population over the 2012 (livestock census – 2019) [3]. Due to the divergent range of agro ecological zones, the number of cattle populations in India has increased (Sharma *et al*., 2015) [4]. In the recent livestock census it was reported that the exotic or crossbred population has increased to 29.3 percentages. But the indigenous cattle population was decreased by 6 percentages. The indigenous cattle population was reduced from 2.46 million to 1.8 million from the years 2012 to 2019. Due to increase numbers of cross breed population certain native type cattle are being neglected by the farmers and its numbers are getting decreased day by day in a particular area and the number of certain unique cattle population is in alarming state and unnoticed. (Selvaramesh *et., al*., 2025) [5]. This is majorly due to changes in farming practices, increased mechanization, and shifting of consumer preferences towards exotic cross breeds gives more amount of milk than indigenous cattle breeds (Pundir *et al.*, 2009) [6]. Proper Breed characterization is most important and crucial for decision-making in any livestock improvement and breeding programmes. For conservation programs and genetic improvement

of livestock species, genetic characterization and genetic diversity assessment is an essential component (Dash *et al*., 2013) [1]. Thanjavur Kulli cattle are one of the short and medium sized type cattle densely reared in and around Thanjavur and Tiruchirappalli districts of Tamil Nadu state, India. But these animals are also found in some parts of Pudukkottai and Dindigul districts of Tamil Nadu. As the name indicates 'Kulli' means short in stature. So far, no study has been conducted in Thanjavur Kulli cattle and there is no litereature support for the research work on kulli cattle and hence the present study was undertaken to study the morphological and morphometric characteristics of Thanjavur kulli cattle.

2. Materials and Methods

2.1. Description about field study area

The present study on Thanjavur kulli cattle was carried out in Thanjavur, Trichy, Dindigul and Pudukottai districts of Tamil Nadu from January 2025 to July 2025. From each district two blocks were selected and three villages were identified from each block. The villages were chosen by rearing more numbers of Thanjavur kulli cattle by each farmer in their household. The survey was carried out in the villages of Sanoorapatti, Pudukkudi, Thuvakudi, Maniyeripatti, Eachankottai, Kovilur, Kakkarai, Adanakottai, Kadambangudi, Arasangudy, Asur, Ellakudy, Vengur, Alambakkam, Perakambi,

2.2. Sampling design

Data was randomly collected from 70 farmers and a total of 82 animal's data was collected through questionnaire method. The questionnaire was prepared in order to collect the information about rearing of thanjavur kulli cattle. From each animal the morphological characteristics and morphometrical measurements were recorded. During the survey, physical traits of animals of all ages and sexes were noted. Body measurements were measured by using standard metallic tape. Different body measurements were recorded on 82 animals of different age and sex and all the data collected were analyzed using IBM SPSS statistical software - version20. Different morphological and morphometrical characters studied were given below in Table 1.

Table 1: Morphological and morphometric characteristics studied in Thanjavur Kulli cattle

Sl. No.	Morphological characters	Morphometric characters
1.	Coat colour	Height at wither
2.	Muzzle colour	Body length
3.	Eyelids colour	Chest girth
4.	Tail switch	Paunch girth
5.	Hooves colour	Face length
6.	Horn colour	Face width
7.	Horn pattern	Ear length
8.	Ear length	Tail length
9.	Ear orientation	Skin thickness
10.	Forehead profile	Horn length
11.	Hump	Horn circumference at base, mid and tip
12.	Udder conformation	Horn distance at base, mid and tip

The following physical traits were measured in Thanjavur kulli cattle and the description was given in table 2.

Table 2: Description of different morphometric measurements of Thanjavur Kulli cattle

Body length	Oblique distance between point of shoulder and pin bone
Height at withers	Distance between the top of the withers and ground
Chest girth	Circumference of the body just behind the elbow
Paunch girth	Circumference of the belly just in front of the external angle of ilium
Face length	Distance between the occipital crest to upper edge of muzzle
Face width	Width immediately above eyes
Tail length	Length of tail from the base to tip including the switch
Ear length	Length of the ear measured from the base to tip
Horn length	Distance between the base and tip of the horn
Circumference of horn	Circumference of horns at base, mid and tip
Distance between horns	Distance between horns at base, mid and tip
Skin thickness	Double fold thickness taken at neck and flank regions with the help of vernier caliper with an accuracy of 0.05 millimetre divided by two and averaged

3. Result and discussion

The breeding area chosen in such a way that the animal was reared by the farmers from generation after generation and was traditionally reared in the breeding tracts. The animals chosen were morphologically similar and it was found that the population density was more in thanjavur district. In each household a minimum of five to a maximum of ten animals are being reared for supporting their livelihood. Since the animals are compact in size more numbers can be accommodated with minimal available space. Animals are kept in open paddock area during night hours after grazing and a temporary thatched roof shed was constructed to keep the animals during rainy season (Figure.2). The animals are taken daily for grazing to nearby pond or to uncultivated grazing areas were dry or green grasses are available. (Figure.4.) The overall morphological features of Thanjavur kulli cattle identified were given in table 3.

Table 3: Morphological features of Thanjavur Kulli cattle

Body part Features	Body part Features
Body Colour	Greyish white
Skin	Soft and pliable
Body	Symmetrical with well-developed body and muscles
Forehead	Straight and sometimes slightly dished forehead,
Horn	The horns were medium in length, mostly Spreading upward and outward with a pointed tip.
Eyelids	Black
Ears	Ears were medium sized and held horizontally
Muzzle	Mainly black in colour
Chest	broad and well-ribbed
Limbs	small to medium sized and strong
Hump	Small-sized hump in females and well developed in males
Udder	The udder was not so prominent, but tucked up with the abdomen, having small to medium-sized cylindrical teats, set uniformly
Milk vein	Not prominent
Hoof	Black in colour

At birth the coat colours of calf was predominantly in reddish brown in colour, showing white shading on the face, underside of the neck, dewlap and inner legs. The reddish brown coloured coat became white to grey colour as the age advanced (Figure 3.). At the age of six months, the coat colour predominantly became light greyish coat from brownish coat colour**.** The primary colour is a pale gray with a slightly darker shades around the legs and hooves. The typical coat colour of the Thanjavur Kulli cattle was greyish white and sometimes grey with dark shade on neck and thigh region. The head of Thanjavur Kulli cattle was broad and moderately prominent, tapering gradually towards the muzzle. The horns were medium in length, spreading upward and inward with a pointed tip. Sometimes horns were upward and outward, upward and forward also noticed. More variations in the horn pattern was noticed. Ears were medium sized and held horizontally. Small to medium-sized dewlap with Small-sized hump was observed. The chest of Thanjavur Kulli cattle appeared broad and well-ribbed. Dark- or black colour shade was noticed in the knee joint of forelimbs and fetlock joints in all the four limbs. The limbs were small to medium sized and strong. The hooves were black in colour. The tail was of medium length, extending slightly below the hock joint ended up with a black switch. The switch was well-furnished with long, coarse, black hairs. Majority of the cattle witnessed were possessing tight and compact build body, while a few animals loosely built. In Thanjavur Kulli cattle cows, the udder was not so prominent but having small to medium-sized cylindrical teats, set uniformly. Milk vein was also not prominent, The preputial sheath was fairly visible, but not pendulous in males. In general, the Thanjavur Kulli cattle were found to be a small to medium-sized breed with typical coat colour of white to grey colour. The body colour and horn pattern were the distinguishing features of the breed.

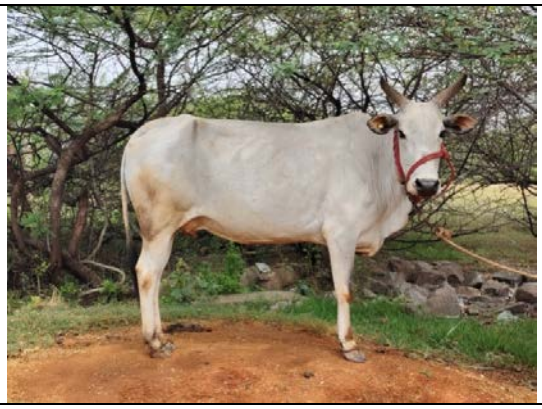

Fig 1: Thanjavur Kulli Cow

Fig 2: Housing pattern of thanjavur kulli cattle.

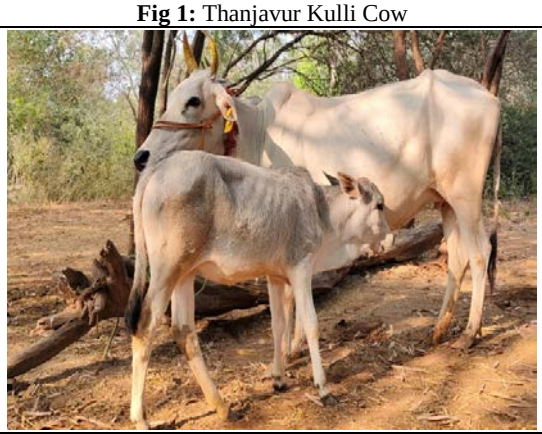

Fig 3: Adult cow with five months old female calf

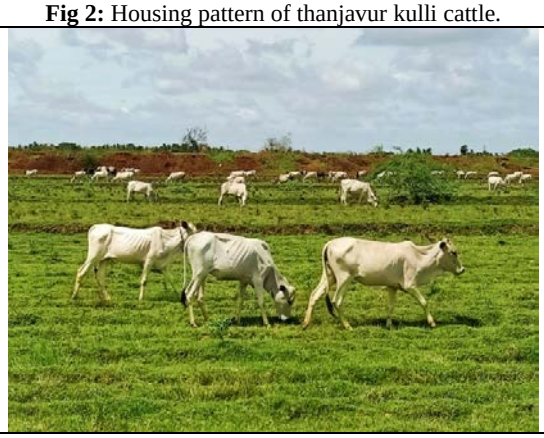

Fig 4: Herd of Thanjavur Kulli cattle in grazing land

3.1. Morphometric measurements:

The lease square means (±S.E) of body measurements of Thanjavur kulli cattle analysed were presented in Table 4 and for the young stocks the lease square means (±S.E) of body measurements were analysed and given in Table. 5.

In Thanjavur Kulli cattle young stock, the face length of young male and female was 34.94±1.3 cm and 35.9±0.79 cm respectively. In adult cow and bull, the face length was 37.92±0.06 cm and 36.56±0.56 cm. Ear length of adult male and female was 20.92±0.25 cm and 19.55±0.23cm respectively. Tail length extended from 71.13±3.7 cm in young males to 96.76±0.65 cm in adult males. When compared with the other native cattle in Umblachery cattle**,** the face length increased from 21.96±0.30 cm in bull calves (3 months) to 42.93±0.20 cm in bullocks, while face width ranged from 17.04±0.21 cm to 26.93±0.30 cm (Premkumar, 1995) [7]. Correspondingly, ear length varied from 13.38±0.23 cm in young calves to 22.79±0.41 cm in bullocks, and tail length extended from 40.31±0.13 cm in calves to 104.88±0.55 cm in bullocks. In Kangayam cattle**,** the face length of adult cow and bull was 48.26 cm and 54.61 cm respectively (Littlewood, 1936) [8]. The face length of adult cow and bull was 44.70 and 48.26 respectively (Pattabhiraman, 1958) [9]. The ear length of adult cow and bull was 21cm and 21.59 cm (Littlewood, 1936) [8]. The ear length of adult cow and bull was 19.05 cm and 20.32 cm (Pattabhiraman, 1958) [9]. In Bargur cattle, the face length increased from 19.0±0.71 cm at birth to 47.36 cm in adult males and 42.32±0.82 cm in females. The face width followed a similar trend, increasing from 7.5±0.20 cm at birth to 14.26±0.43 cm in adult males and 14.09±0.25 cm in adult females. Ear length ranged between 10.0±0.41 cm at birth and 18.2±0.57 cm in adult males, while tail length extended from 26.5±0.96 cm to 69.92±1.83 cm in males and 62.42±1.33 cm in females (Ganapathi. *et al*. (2013) [10].

3.2. Body length

The body length of young stock of Thanjavur Kulli cattle was 87.81±3.24 cm in males and 87.5±1.84 cm in females, while in adults it measured 106±0.33 cm in males and 101.74±0.22 cm in females. The mean body length of Pulikulam female animals at 24-30 months, 36-42 months, 48-54 months and adult bulls were 103.33±0.76 cm, 103.36±0.91 cm 109.40±0.93 cm and 118.26±0.92 cm respectively. (Srinivasan, G. and Sathiamoorthy, T. 2020) [11]. The body length of bargur cattle was 119.40±5.53cm in males and 115.58±1.31 in females and (Ganapathi., 2013) [10]. The body length of Umblachery cattle was 112.20±1.60 cm in bulls and 103.60±0.70 in cow (Rajendran *et al*., 2008) [12], Malaimadu (104.80 ± 0.71; Selvan *et al.,* 2022) [13], Vechur 83–105 cm; (Marimuthu, 2011) [14], Kasargod (106.0 ±5.8 cm in males and 96.0±1.2 cm in females; Sosamma Iype, 2016) [15]. The body length of Thanjavur Kulli was almost comparable with Alambadi cattle (122.9 cm in bulls and 127.5 cm in cows; Parameswari, 2018) [16] and slightly lower than that reported for Krishna Valley bulls (129.4 cm), while being higher than Krishna Valley cows (113.2 cm).

3.3. Height at wither

The height at withers of adult Thanjavur Kulli cattle (115.24±0.44 cm in males and 107.4±0.34 cm in females) was found to be moderate when compared with other indigenous breeds. It was higher than that of small-sized breeds such as Vechur (83–105 cm; Marimuthu, 2011) [14], Kasargod (103.3±4.1cm in males and 90.0±1.1 cm in females; Sosamma Iype *et al*., 2016) [15], Umblachery (112.2 ±1.60 cm in bulls and 103.6±0.70 cm in cows; and Malaimadu females (110.48 cm overall), but lower than Krishna Valley (121.4 cm in bulls and 106.96 cm in cows; Ramesha *et al*., 2001) [17], Alambadi (120.6 cm in bulls and 121.4 cm in cows; Parameswari, 2018)[16], and Bargur (119.4 cm in bulls and 115.6 cm in cows; Ganapathi, 2013) [10]. Pulikulam bulls (117.3 cm; Srinivasan., 2020) [18] were slightly taller than Kulli males, while Malaimadu males (110.48 cm; Selvan *et al.,* 2023) [2] were shorter than Kulli. Thus, the Kulli breed occupies an intermediate position between the smaller native breeds and the comparatively larger-sized cattle such as Krishna Valley, Alambadi and Bargur.

3.4. Chest girth

The chest girth of adult Thanjavur Kulli cattle (136.1±0.39 cm in males and 130.25±0.28 in females) was higher than that of Bargur (119.2 cm in bulls and 124.3 cm in cows; Ganapathi, 2013) [10] and slightly above Kasargod (133.1 cm in males and 124.4 cm in females; Sosamma Iype *et al*., 2016) [15], while being almost equal to Malaimadu cattle (133.0 cm; Selvan *et al.,* 2023) [2]. When compared with larger breeds, the chest girth of Kulli was lower than that of Krishna Valley as reported 144.8 cm in bulls and 136.96 cm in cows; Ramesha *et al*., 2001) [17] in Umblachery bulls it was reported as 145 cm; Pulikulam bullock 149.7 cm; Singh *et al.,* (2012) [19], and Alambadi cattle it was reported as 145.5 cm in bulls and 152.08 cm in cows Parameswari, (2018 [16]. In Vechur cattle, the chest girth ranged from 95 to 150 cm, within which the values of Kulli also fall, though generally higher than those of female Vechur. Overall, the chest girth of Thanjavur Kulli cattle indicates a moderate body size, comparable to Malaimadu and Kasargod, but smaller than the larger-sized breeds such as Krishna Valley, Pulikulam, Umblachery, and Alambadi.

3.5. Body weight

The average body weight of adult Thanjavur Kulli cattle was 181.55±1.11 kg in males and 159.73±0.91 kg in females. It lower than that of Malaimadu cow (171.9 kg; Selvan *et al.,* 2023) [2] but higher than Vechur (130–200 kg in males and 95–150 kg in females; Marimuthu, 2011) [14]. Thanjavur Kulli cattle was almost comparable with Kasargod cattle (182.5±22.7 in bull and 146.4±3.3cm in cow; Sosamma Iype, 2016) [15]. Similarly, larger indigenous breeds such as Bargur, Pulikulam, Umblachery, and Alambadi generally exhibited higher body weights in the range of 200–300 kg. Thus, the Thanjavur Kulli breed represents an intermediate category, heavier than the smaller native breeds but lighter than the comparatively larger-sized cattle of southern India.

3.6. Horn

The horn length of adult Thanjavur Kulli cattle (19.5 cm in males and 17.3 cm in females) was intermediate when compared with other native breeds. It was shorter than that of Malaimadu cattle (28.6 cm; Selvan *et al.,* 2023) [3] and Krishna Valley cattle, which generally exhibited greater horn spread and circumference, but longer than that of Kasargod cattle (8.3–11.2 cm; Sosamma Iype *et al*., 2016) [15]. Thus, the horn traits of Thanjavur Kulli indicate a moderate size, distinguishing the breed from the shorter-horned Kasargod cattle and the longer-horned Malaimadu and Krishna Valley cattle.

Table 4: Morphometric measurements (in centimetre) of Young stock (1-3 years) and Adult (3 years and above)

Characters	Youngstock [29]		Adult [38]	
	Male [8]	Female [21]	Male [5]	Female [33]
Height at withers	101.68±1.75	99.8±1.05	115.24±0.44	107.4±0.34
Body length	87.81±3.24	87.5±1.84	106±0.33	101.74±0.22
Chest girth	114.06±4.26	100.2±2.63	136.1±0.39	130.25±0.28
Paunch girth	102.01±0.85	99±0.69	139.28±0.52	133.17±0.82
Face length	34.94±1.3	35.9±0.79	37.92±0.06	36.56±0.56
Face width	21.36±0.26	20±0.14	23.08±0.04	20.34±0.14
Tail length	77.11±3.47	81.4±2.42	96.76±0.25	91.55±1.98
Ear length	18.13±0.12	17.5±0.14	20.92±0.25	19.55±0.23
Horn length	8.79±0.65	8.5±0.5	19.54±0.13	17.83±0.28
Horn circumference at base	10.11±0.57	9.5±0.26	18±0.07	14.2±0.2
Horn circumference at mid	5.44±0.46	6.1±0.28	13±0.31	10.72±0.18
Horn circumference at tip	3.21±0.29	3.3±0.38	5.32±0.29	3.09±0.14
Horn distance at base	7.03±0.73	9.2±0.47	5.28±0.12	3.76±0.07
Horn distance at mid	8.43±0.93	11.1±0.43	9.92±0.31	11.63±2.69
Horn distance at tip	7.94±0.2	7.5±0.23	9.02±0.37	9.69±0.4
Body weight	108.44±11.2	81.23±6.25	181.55±1.11	159.73±0.91

Figures in parentheses are number of observations

Table 5: Morphometric measurements of Calves of (0-3 months), (4-6 months) and (6-12 months) in cm.

Characters	0-3 months [5]	4-6 months [5]	6-12 months [5]
Height at withers	72.6±0.86	78.2±0.68	83.2±2.08
Body length	64.3±0.9	76.66±0.56	77.3±2.2
Chest girth	71.5±0.35	85.1±0.62	89.9±1.55
Paunch girth	67.2±0.37	91.5±0.77	100.52±1.39
Face length	23±0.35	27.58±0.3	32.2±0.86
Face width	12.2±0.37	15±0.28	16.5±0.47
Tail length	47.2±0.34	65.86±0.33	65.24±1.35
Ear length	14.2±0.37	15.02±0.17	17.62±0.28
Skin thickness	2.276±0.03	2.82±0.06	2.578±0.21

Figures in parentheses are number of observations.

4. Conclusion

This study provides a baseline data on morphological and morphometric characteristics of Thanjavur kulli cattle. From the study it is concluded that the Thanjavur kulli cattle was a small to medium sized animal with the typical coat colour of greyish white. The livestock keepers of Thanjavur Kulli cattle are rearing these animals from generation after generations for ensuring their livelihood security since these animals are being kept for milk production and by selling the milk the livelihood is secured. More over the farmers mainly kept these animals for their ancestral legacy and they maintain the livestock's with zero input. From the Survey, it came to know that these animals are distinct morphologically different from the other recognized native cattle and this unique germplasm needs to be highlighted for conservation measures.

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