

# Morphometric characterisation of indigenous taurine cattle in their natural environment in Cameroon

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## Abstract

The morphometric characterisation of indigenous taurine breeds of cattle in their natural environment was undertaken in three agroecological zones of Cameroon. Descriptive traits for 97 animals, such as sex, age, coat colour, skin pigmentation, ear shape, and temperament, were observed visually and recorded for each breed identified. Biometric information was got by measuring body parts such as live weight (LW), body length (BoL), ear length (EL), head length (HL), heart girth (HG), neck length (NL), horn length (HoL), height at wither (HW) and thigh diameter (TD). There was a strong association ( $P < 0.0001$ ) between the breed and the localities. Bakossi breed were dominated by a black/white coat colour while Namchi and Kapsiki breed demonstrated a high coat colour polymorphism. All the taurine had dark skin pigmentation, and 60.83 % were docile. Their LW ranged from 199.9 kg (Namchi) to 229.9 kg (Kapsiki), BoL from 116.6 cm (Namchi) to 121.4 cm (Kapsiki), tail length (TL) from 11.1 cm (Kapsiki) to 17.4 cm (Bakossi), HG from 134.4 cm (Namchi) to 142.7 cm (Kapsiki), HoL from 21.4 cm (Bakossi) to 27.3 cm (Kapsiki), and HW from 105.0 cm (Namchi) to 116.9 cm (Kapsiki). Apart from LW, BoL, and shoulder length, the other linear body measurements presented significant differences between breeds ( $< 0.05, 0.01$ ). This study provides new information regarding the qualitative and quantitative traits of taurine breeds in Cameroon. Therefore, deep molecular characterisation should be carried out to confirm the breed's types and possible admixture.

**Keywords:** Bakossi cattle, Kapsiki cattle, Namchi cattle, indigenous taurine breeds

## 1 Introduction

The Cameroon native cattle are mostly types of taurine, which are known to be trypanotolerant and adapted to the local environment and production systems. In addition, some of these breeds have critical traits of hardiness (ability to survive during drought and other conditions of low and marginal water supply and availability) that will be essential to maintain animal populations that are adapted to niches and marginal agro-ecological conditions (Ngono *et al.*, 2018). There are very few indigenous livestock breeds locally ad-

apted to Cameroon and very little information on their numbers or traits. Many of them are now seriously endangered or have disappeared, without the risk status being demonstrated or defined (Ebangi *et al.*, 2011). These indigenous cattle breeds are more localised herds that require urgent characterisation and priority conservation actions (Ebangi *et al.*, 2002). It is believed that the Cameroon taurine cattle were introduced from the centre of domestication in Asia either through Egypt, along the Nile River, or through the Horn of Africa (Olivier 1983; Staw & Hoste 1987; Rege *et al.*, 1994 as cited by Ebangi *et al.*, 2011). Due to their constitution and environment, the Cameroon taurine breed has undergone long processes of natural selection resulting from

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a long association with natural challenges and has developed unique genes or gene complexes that confer onto them valuable genetic traits that include, among others, trypanotolerance, hardiness and resistance to diseases, dwarfism, and low production and productivity (Ebangi *et al.*, 2011).

Namchi is a short horn cattle breed which is trypanotolerant (Achukwi *et al.*, 1997 as cited in Ngono *et al.*, 2018), mostly found in the Soudano-sahelian area of Cameroon, within the Poli Mountains in the Faro division of the North region. It is also raised at the foothill of the Alantika Mountains by the Doayo tribe of Cameroon. It is also called Doayo, M'bougi, M'bouye, Namji, Namshi and Poli according to the locality where it is found. Their meat is mainly used for feasts and rituals (Ebangi, 2002). This breed is considered as endangered (Ebangi *et al.*, 2002). Kapsiki or Kirdi breed are found on the Sahelian side within the Mandara Mountains located at an altitude of 600 m between Mokolo and Bourrah in the Tsanaga Division of the Far North Region of Cameroon. The Namchi and Kapsiki cattle are the major taurine (shorthorn) breeds of Cameroon with origin as complex as for most African cattle populations (Rege *et al.* 1994 as cited in Ebangi *et al.*, 2011). Rege *et al.* (1994) estimated the population of Namchi cattle to range between 1060 and 7000 head, which represented 0.02 to 0.14 % of the 4.9 million head of African Shorthorns (Rege *et al.*, 1994). Sauveroche & Thys (1994) estimated the population of Kapsiki to range between 3000 and 4100 head representing 0.06 to 0.08 % of the African Shorthorns. These estimates fall within levels of threat (1000 to 5000 breeding females) defined by various conservation groups (FAO, 1992) and they are considered endangered as these breeds are not found outside Cameroon (?).

Age at first calving under village conditions averaged 48 months for the Kapsiki (Dineur & Thys, 1986) and 36 months for the Namchi (ILCA, 1979), while calving intervals is 12 months for the Namchi (ILCA, 1979). An on-station estimate of 15 months has been reported for calving intervals of Kapsiki (Tawah & Mbah, 1989). The Namchi appear to mature earlier and to have shorter calving intervals than the Kapsiki and the Bakossi in Cameroon, however, the Kapsiki's environment is more stressful, both in terms of climate and nutrition than that of the Namchi. Generally, calving intervals were much shorter for these breeds than they were for other Shorthorns and zebus in the west and central African region, even under village conditions. Calving rates ranged from 70 percent on-farm (Dineur *et al.*, 1982) to 84 percent on-station (Tawah & Mbah, 1989) for the Kapsiki.

Bakossi cattle, also known as Bakuri or Kosi, are a savannah shorthorn breed of cattle in Cameroon. They are used for their meat, hides, payment of bride price and rituals. Their

coats vary from black to white but more than half of them is either brown or black (ILCA, 1979). Their calving interval is between 18 and 24 months, and this breed is also trypanotolerant (Epstein 1971). Originally the Bakossi cattle were kept by a tribe of the same name located in Southwestern Cameroon, West of Nkongsamba on the border between the South-West and Littoral Region (ILCA, 1979). No estimate has been given for the number of Bakossi cattle present in Cameroon, as some researchers contend that they have been diluted already.

Increasing human population, disposable incomes and improving quality of life have increased the demand for livestock products which turned to an increased need for higher productive cattle. Due to the market pressure to adopt improved cattle breeds, indigenous taurine breeds have been neglected. As a result, the breeds are becoming diluted and face degeneration. There is no designed animal breeding approach to increase productivity without loss of biodiversity. There is a need for genetic improvement and conservation of Cameroon's indigenous cattle. As it is well known, the assessment of genetic diversity is a prerequisite for the management and conservation of animal genetic resources (Cañon *et al.*, 2001 as cited by Ngono *et al.*, 2014). Therefore, it is essential to characterise these breeds both phenotypically and genetically to be able to keep their specificity before replacement or admixture occurs and to design rational breeding strategies for their improvement and conservation. This study aimed to evaluate the morphometric characteristics of the Cameroon indigenous cattle in their natural environment,

## 2 Materials and methods

### 2.1 Experimental Area

This study was undertaken in the three agro-ecological zones of Cameroon (Fig. 1), where the indigenous cattle were originally located, as reported by Epstein (1971) including, the Sudano-Sahelian, Western Highlands and Mono-modal Humid Forest and all the breeds identified were recorded. The breeds were identified based on ILCA (1979) description.

### 2.2 Data collection

All the indigenous taurine breeds of cattle in Cameroon where identified following Espain (1971) and ILCA (1979) description of the breeds. After breed identification was completed, data were randomly collected in five different localities of the three agroecological zones on a sample of 97 adult cattle (30 Namchi, 30 Kapsiki, and 37 Bakossi) aged



**Table 2:** Coat colour and sex of the Bakossi, Namchi and Kapsiki breeds of cattle in Cameroon.

Coat colour	Namchi cattle		Kapsiki cattle		Bakossi cattle	
	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)
Black	0.0	6.7	16.7	3.3	10.8	2.7
Black, Spotted	10.0	0.0	13.3	0.0	2.7	27.0
Black, white	0.0	0.0	0.0	0.0	54.1	0.0
Brown	26.7	0.0	13.3	0.0	0.0	0.0
Dark red	6.7	0.0	3.3	0.0	0.0	0.0
Dark red, spotted	3.3	0.0	0.0	0.0	0.0	0.0
Pink	0.0	0.0	30.0	0.0	0.0	0.0
Pink, spotted	3.3	0.0	3.3	0.0	0.0	0.0
Spotted	3.3	6.7	3.3	0.0	0.0	0.0
Spotted, Brown	13.3	0.0	3.3	0.0	0.0	0.0
White	10.0	0.0	0.0	3.3	0.0	2.7
White spotted	10.0	0.0	6.7	0.0	0.0	0.0
Total	86.7	13.3	93.3	6.7	67.7	32.4

Note: F = female, M = male; the P value is 0.029.

**Table 3:** Skin pigmentation and coat colour of the Bakossi, Namchi and Kapsiki breeds of cattle in Cameroon.

Coat colour	Skin pigmentation				Total (%)
	Black (%)	Dark (%)	Pink (%)	White (%)	
Black	5.2	8.3	0.0	1.0	14.4
Black, Spotted	5.2	2.1	1.0	0.0	8.3
Black, White	1.0	25.8	0.0	0.0	26.8
Brown	1.0	7.2	1.0	4.1	13.4
Dark red	0.0	4.1	0.0	0.0	4.1
Dark red, Spotted	1.0	0.0	0.0	0.0	1.0
Pink	0.0	1.0	8.4	0.0	9.3
Pink, Dark red	0.0	0.0	0.0	1.0	1.0
Pink, Spotted	0.0	0.0	2.1	0.0	2.1
Spotted	1.0	2.1	1.1	0.0	4.1
Spotted, Brown	0.0	3.1	1.0	1.0	5.2
White	1.0	0.0	0.0	4.1	5.2
White, Spotted	0.0	3.1	1.03	1.0	5.2
Total	15.5	56.7	15.5	12.4	100.0

pigmentation. The black/white which was the dominant coat colour was strongly associated with the dark skin pigmentation which is the dominant skin pigmentation.

### 3.2 Tail type and temperament of indigenous taurine cattle of Cameroon

There was a strong association ( $P < 0.0001$ ) between the breeds and the tail shape, 76.3 % of the indigenous taurine of Cameroon had a straight tail (Table 4) and just 23.7 % had curly tails which are mostly the Namchi, while the straight tail is mostly found for Bakossi and Kapsiki breed. There

was a strong association ( $P < 0.0001$ ) between the breed and the temperament.

A total of 60.83 % of cattle were docile which were mostly made up of the Kapsiki (100 %) and Namchi (70 %) while 39.2 % of the taurine were aggressive with Bakossi (78.4 %) most aggressive (Table 4). The Bakossi and the Kapsiki had straight tails while the Namchi had both curly and straight tails. Fig. 2, shows the phenotypic characteristics of the Namchi, Kapsiki and Bakossi respectively. Their horn shapes, head shape, colour polymorphism and their tail shapes.

**Table 4:** Tail type and temperament of the Bakossi, Namchi and Kapsiki breeds of cattle in Cameroon.

Characteristic	Breed type			Total (%)
	Bakossi (%)	Kapsiki (%)	Namchi (%)	
<i>Tail shape</i>				
Curly	13.5	0.0	60.0	23.7
Straight	86.5	100.0	40.0	76.3
<i>Temperament</i>				
Aggressive	78.4	0.0	30.0	39.2
Docile	21.6	100.0	70.0	60.8

**Fig. 2:** The coat colour and horn shapes of the Namchi (A), Bakossi (B), and Kapsiki (C) breeds of cattle in Cameroon.

### 3.3 Linear body measurement of Cameroon taurine breeds of cattle

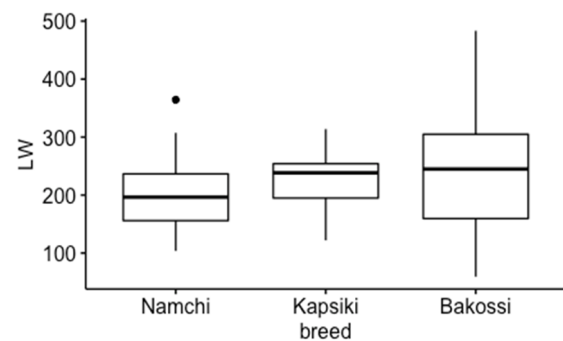
The descriptive statistics indicate that 30 Namchi, 37 Bakossi and 30 Kapsiki were identified during the study. Apart from LW, BL and SL that did not show any significant difference between the three breeds, the other linear body measurements present significant differences between breeds. Once significant differences were found, the means were separated using the Turkey HSD test. The Tukey multiple comparisons of means show that Kapsiki and Bakossi have different long ears ( $F < 0.05$ ) as well as Namchi and Kapsiki. The same tendency was observed for the HL. The Kapsiki and Bakossi show significant differences in BaL.

### 3.4 Distribution of LW within each taurine breed of cattle in Cameroon

The summary suggests that the data regarding LW in Namchi cattle had one outlier which was greater than 300 kg, whereas Kapsiki and Bakossi cattle were well distributed short of outliers. This study also shows that Bakossi cattle had a great variability in the LW as compared to that of the other breeds of taurine cattle in this study.

## 4 Discussion

According to FAO (2012), the characterisation of animal genetic resources for food and agriculture involves three types of information: Phenotypic, genetic, and historical.

**Fig. 3:** Live weight (LW) distribution of the Bakossi, Namchi and Kapsiki breeds of cattle in Cameroon.

Information obtained through characterisation is essential for planning the management of Animal Genetic Resources (AnGR) at local, national, and global level. According to the Global Plan of Action for Animal Genetic Resources (FAO, 2007), "A good understanding of breed characteristics is necessary to guide decision-making in livestock development and breeding programs". The Cameroon taurine breeds have valuable genetic traits such as trypanotolerance, hardiness and resistance to diseases, dwarfism, and low production and productivity (Ebangi *et al.*, 2011). This gives them an advantage over the Trypano-susceptible Zebu (Gudali and Mbororo cattle) breeds of cattle in Cameroon.

According to Ebangi *et al.* (2002), the main indigenous (taurine) cattle in Cameroon are the Namchi and the Kapsiki, whereas, in this study, three breeds (Bakossi, Namchi and the Kapsiki) were identified. The animals were named based on the local name given by the farmers and based on the description by ILCA (1979). All the taurine breeds kept in Cameroon were dominated by females, and this is because many farmers preferred to keep females for reproduction than males and because one male can mate up to five females (Ojong *et al.*, 2021). The Bakossi cattle coat colour ranged from black to white and this is in agreement with

**Table 5:** Linear body measurement of the Bakossi, Namchi and Kapsiki breeds of cattle in Cameroon.

Traits	Breeds		
	Bakossi(n = 37)	Namchi (n = 30)	Kapsiki (n = 30)
LW (kg)	227.8±15.8 <sup>a</sup>	199.9±10.8 <sup>a</sup>	229.8±8.4 <sup>a</sup>
BoL (cm)	121.4± 4.3 <sup>a</sup>	116.6± 2.4 <sup>a</sup>	117.3± 4.8 <sup>a</sup>
CL (cm)	34.7± 1.0 <sup>a</sup>	30.8± 0.7 <sup>b</sup>	33.9± 0.6 <sup>a</sup>
LL (cm)	33.3± 1.1 <sup>a</sup>	29.5± 0.8 <sup>b</sup>	34.9± 0.6 <sup>a</sup>
TL (cm)	72.4± 2.2 <sup>b</sup>	71.8± 1.8 <sup>b</sup>	78.5± 1.6 <sup>a</sup>
RL (cm)	25.9± 1.1 <sup>a</sup>	23.3± 0.7 <sup>b</sup>	21.9± 0.6 <sup>b</sup>
TD (cm)	51.5± 2.0 <sup>ab</sup>	55.6± 1.4 <sup>a</sup>	50.6± 1.2 <sup>b</sup>
BL (cm)	83.7± 2.2 <sup>b</sup>	84.3± 1.6 <sup>b</sup>	91.5± 1.1 <sup>a</sup>
NL (cm)	34.2± 1.2 <sup>ab</sup>	31.3± 1.1 <sup>b</sup>	36.8± 1.5 <sup>a</sup>
HW (cm)	109.2± 2.4 <sup>b</sup>	105.1± 1.7 <sup>b</sup>	116.9± 1.6 <sup>a</sup>
HoL (cm)	21.4± 1.9 <sup>b</sup>	24.8± 1.9 <sup>ab</sup>	27.3± 1.7 <sup>a</sup>
SL (cm)	24.8± 0.9 <sup>a</sup>	25.8± 0.6 <sup>a</sup>	25.2± 0.6 <sup>a</sup>
HG (cm)	139.1± 3.1 <sup>ab</sup>	134.4± 2.6 <sup>b</sup>	142.7± 2.3 <sup>a</sup>
BaL (cm)	67.9± 1.3 <sup>a</sup>	63.6± 1.2 <sup>b</sup>	68.9± 1.3 <sup>a</sup>
EL (cm)	15.3± 0.9 <sup>c</sup>	17.2± 0.5 <sup>b</sup>	20.1± 0.4 <sup>a</sup>
HL (cm)	41.5± 1.2 <sup>b</sup>	42.4± 0.7 <sup>b</sup>	45.7±0.5 <sup>a</sup>

n = sample size; <sup>a,b,c</sup> in the same line, the means with the same superscripts show no significant difference ( $P \leq 0.05$ ) between the breeds;  $X \pm E.S$ : mean  $\pm$  standard error. Live weight (LW), body length (BoL), chine length (CL), loin length (LL), tail length (TL), rump length (RL), thigh diameter (TD), Barrel length (BL), neck length (NL), height at withers (HW), horn length (HoL), shoulder length (SL), heart girth (HG), back length (BaL), ear length (EL), and head length (HL).

what was reported by ILCA (1979) on the coat colour of Bakossi cattle. Namchi is made up of black, white, brown, black spotted, brown spotted, dark red, spotted, pink spotted, and dark red spotted, this is in accordance with the report of Ngono *et al.* (2018), who reported that Namchi displays a high coat colour polymorphism with red-brown being the dominant colour. Kapsiki also displays a high coat colour polymorphism with black being the dominant colour which is in line with Ebangi *et al.* (2002) who reported that the coat colour for Kapsiki is dominated by black.

The indigenous taurine cattle of Cameroon have a high coat colour polymorphism with the female showing more coat colour polymorphism than the male. The skin pigmentation for the entire taurine breed of cattle in Cameroon was mostly dark, and this is because of the tropical environment in which they live coupled with the fact that most of them are not housed (Seo *et al.*, 2007). The Bakossi cattle are usually more aggressive, while the Namchi and Kapsiki are docile animals, which may be due to the fact that the Kapsiki and Namchi are mostly housed in kraals at night (Ojong *et al.*, 2021) making them familiar with their owners. The Bakossi breed lives mainly in the Baleng forest, where they only receive attention when the Baleng people want to perform their rituals or hold a ceremony.

From our study, all the taurine breeds had similar LW, with Kapsiki having the highest, although insignificant. This may be due to possible admixture for Kapsiki, as they were reared with Zebu cattle, whereas Namchi and Bakossi were reared independently. This aligns with what Ebangi *et al.* (2002) report: Kapsiki is larger than Namchi; these values are also within the range of 168–380 kg for the Ghana shorthorn, as reported by Rege *et al.* (1994). All taurines in Cameroon had a similar BoL, showing that Cameroon taurines are similar in body length. The BoL in this study is consistent with the BoL reported by Karnuah *et al.* (2018) on the body length of the Muturu and the Ndama Muturu found in Ghana.

The tail of Kapsiki is longer than that of Bakossi and Namchi; this can also be because of a possible admixture between Zebus and the Kapsiki since they are bred together. It was observed in this study that Kapsiki had a higher BL when compared to Bakossi and Namchi. The small size of Bakossi can be because they are not domesticated and are allowed to feed themselves. The Bakossi spent more energy searching for food and water, which reduced their body weight and BL. Namchi with the lowest HW had the highest TD; this may be because the dwarfism gene is more manifest in the Namchi cattle than in the Kapsiki and Bakossi cattle. Kapsiki had a significantly higher HW than the Bakossi and the Namchi; this is in agreement with the report of Ebangi *et al.* (2011), who reported a significantly higher HW for

Kapsiki than Namchi on the characterisation of Doayo and Kapsiki taurine cattle breeds of Cameroon in their natural environment. The NL for Kapsiki was higher than that for Namchi, also attributed to the proper care given to Kapsiki rearing.

All the cattle in this study had shorthorns with a variation in length. This is in accordance with the work of Ebangi *et al.* (2002) reporting on the horn length of Kapsiki and Namchi. Kapsiki had a longer horn than Bakossi and the Namchi. The higher horn length for Kapsiki can also be due to the already mentioned possible crossbreeding of Kapsiki with Zebus. The horn length of the taurine of Cameroon ranges between 21.4 cm for Bakossi to 27.3 cm for Kapsiki this study confirms the classification given to Cameroon taurine as short-horn cattle. The value for horn length of West African taurine reported by Troare *et al.* (2016) also falls within the range obtained in this study. The HG for Kapsiki was higher than for Bakossi and Namchi, and this is in line with that reported by Ebangi *et al.* (2011), who reported a higher HG for Kapsiki than Namchi. The HG of this study is higher than that reported by Troare *et al.* (2016) on West African taurine and, also, higher than the HG of Muturu found in Nigeria reported by Oladepo *et al.* (2018) on the morphometric traits and differentiation of selected indigenous cattle breeds in Nigeria. These results on the HG are also higher than those of Muturu of Ghana with a HG of 37.0 cm and Ndama of Ghana with 37.7 cm reported by Karnuah *et al.* (2018).

Some limitations of this study could be the fact that LW was estimated rather than weighed and there could be a potential bias due to the equation used. Also, some of the differences in length could be due to age rather than breed since we could not fully confirm the age of the animals studied. Some of the interesting traits of these breeds that need further investigation are their trypanotolerance, heat stress and hardiness ability. There is also a lack of information on their reproductive parameters which are an important part of their production.

## 5 Conclusion

The study provides new information on the qualitative and quantitative traits of the indigenous taurine cattle breeds of Cameroon and indicates a great diversity in the qualitative and quantitative traits of these cattle breeds. It is therefore recommended that more in-depth molecular studies be carried out to confirm the different breed types. Conservation strategies should also be put in place to help preserve the breeds. Reproduction centres should be established to support the multiplication of trypano-tolerant breeds.

## Conflict of interest

They were no conflict of interests amongst the authors.

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## Authors' contributions

Emmanuel Takor Ojong (Conceived the research, data collection, data analysis and manuscript writing). Pius Mbu Oben (Research supervisor), Kingsley Agbor Etchu (Supervised the Research work and Manuscript writing). Hako, A, (Data collection, data analysis and Manuscript writing), Joseline Motsa'a Sob (Data analysis and manuscript writing), Ndaleh Wozerou Nghonjuyi (Data analysis and manuscript writing). Christian Keambou Tiambo (Conceived the research, data collection, further data analysis and Manuscript writing).

## Ethical statement

An ethical clearance was collected from University of Buea – Institutional Animal Care and Use Committee (UB-IACUC). The purpose for the study was stated to the farmers and their participation was voluntary and anonymous.

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