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Biometric Characteristics of Kapsiki native taurine breed (*Bos taurus*) Cattle in the Sudano-Sahelian Zone of Cameroon.

Caractéristiques biométriques de la race locale taurine Kapsiki (*Bos taurus*) dans la zone soudano sahélienne du Cameroun.

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RÉSUMÉ

Le taurin Kapsiki, race locale reconnue pour sa trypanotolérance et son rôle socioculturel majeur, souffre d'un déficit de données morphométriques actualisées nécessaires à sa conservation. Cette étude visait à caractériser la diversité biométrique de cette race. Quarante-neuf sujets (36 vaches, 13 taureaux) âgés de plus de 3 ans ont été mesurés dans l'arrondissement de Rhumsiki. Dix-neuf mensurations corporelles ont été prises pour calculer 16 indices biométriques. Les données ont été soumises à des statistiques descriptives, des tests d'effet du sexe et à une Analyse en Composantes Principales (ACP). Les résultats révèlent une absence totale de dimorphisme sexuel sur les indices biométriques ($p>0,05$) qui pourrait être justifiée par l'utilisation préférentielle des mâles dans les rites et sacrifices. Les principales mensurations évaluée ont donné les résultats suivants : Hauteur au garrot (114,54±6,46), hauteur aux fesses (118,74±6,24), profondeur thoracique (54,76±4,70), longueur de corne (23,64±9,24), longueur de la face (42,18±4,50), longueur du front (19,48±1,43), longueur des oreilles (18,08±1,38), longueur du corps (140,06±11,63), longueur du tronc (110,32±8,16), longueur scapulo-ischiale (114,34±9,85), longueur du bassin (37,26±3,97), largeur du bassin (31,66±4,25), longueur de la queue (76,66±6,26), largeur de la face (13,88±1,37), pourtour du thorax (133,14±12,29), circonférence du canon (11,22±1,27), circonférence du jarret (13,26±1,31), circonférence du mufle (38,74±2,91) et poids vif moyen (183,91±47,27kg). Les faibles coefficients de variation (5 à 17 %) témoigneraient d'une forte homogénéité phénotypique. Sur le plan morphologique, le Kapsiki se caractérise par un format longiligne (Indice de longueur corporelle = 1,22 ; Indice corporel relatif = 1,06), une ossature fine (Indice d'ossature du canon = 0,10) et un thorax profond (Indice thoracique = 0,41). Sa tête dolichocéphale (Indice céphalique = 33,35) et ses oreilles proportionnellement longues (Indice auriculaire = 0,16) constituent des adaptations morphologiques majeures à la thermorégulation et à la défense anti-parasitaire. L'ACP, expliquant 60,72 % de la variance sur les deux premiers axes, confirme l'absence de dimorphisme sexuel et structure la population selon un gradient de puissance thoracique (F1) et de format longiligne/bréviligne (F2). Le taurin Kapsiki présente ainsi un morphotype rustique, homogène et parfaitement adapté aux contraintes géoclimatiques soudano-sahéliennes, ce qui justifierait sa valorisation en tant que ressource génétique résiliente face au changement climatique.

Mots-clés : Taurin Kapsiki, biométrie, indice biométrique, Cameroun.

ABSTRACT

The Kapsiki taurine cattle, a local breed recognized for its trypanotolerance and its major sociocultural role, suffers from a lack of updated morphometric data necessary for its conservation. This study aimed to characterize the biometric diversity of this breed. A total of 49 animals (36 cows and 13 bulls) aged over 3 years were measured in the Rhumsiki subdivision. Nineteen body measurements were recorded to calculate 16 biometric indices. The data were subjected to descriptive statistics, sex-effect tests, and Principal Component Analysis (PCA). The results revealed a complete absence of sexual dimorphism in the biometric indices ($p > 0.05$), which could be explained by the preferential use of males in traditional rituals and sacrificial practices. The main body measurements yielded the following values: withers height (114.54 ± 6.46 cm), rump height (118.74 ± 6.24 cm), thoracic depth (54.76 ± 4.70 cm), horn length (23.64 ± 9.24 cm), face length (42.18 ± 4.50 cm), forehead length (19.48 ± 1.43 cm), ear length (18.08 ± 1.38 cm), body length (140.06 ± 11.63 cm), trunk length (110.32 ± 8.16 cm), scapulo-ischial length (114.34 ± 9.85 cm), pelvic length (37.26 ± 3.97 cm), pelvic width (31.66 ± 4.25 cm), tail length (76.66 ± 6.26 cm), face width (13.88 ± 1.37 cm), thoracic girth (133.14 ± 12.29 cm), cannon circumference (11.22 ± 1.27 cm), hock circumference (13.26 ± 1.31 cm), muzzle circumference (38.74 ± 2.91 cm) and live weigth (183.91±47.27kg). The low coefficients of variation (5–17%) indicate a high degree of phenotypic homogeneity. Morphologically, the Kapsiki taurine is characterized by a longilinear body format (Body Length Index = 1.22; Relative Body Index = 1.06), a fine bone structure (Cannon Bone Index = 0.10), and a deep thorax (Thoracic Index = 0.41). Its dolichocephalic head (Cephalic Index = 33.35) and proportionally long ears (Auricular Index = 0.16) constitute major morphological adaptations for thermoregulation and parasite defense. The PCA, which explained 60.72% of the total variance on the first two axes, confirmed the absence of sexual dimorphism and structured the population according to a thoracic development gradient (PC1) and a longilinear/brevilinear body conformation gradient (PC2). The Kapsiki taurine therefore exhibits a rustic, homogeneous morphotype that is perfectly adapted to the geo-climatic constraints of the Sudano-Sahelian zone, supporting its promotion as a resilient genetic resource in the face of climate change.

Keywords: *Kapsiki taurine cattle, biometrics, biometric indices, Cameroon.*

1. Introduction

The origins of indigenous cattle of Africa still remain uncertain despite available archaeological, anthropological and historical evidence (Epstein and Mason, 1984; Blench, 1993). The aurochs (*Bos primigenius*) is believed to have originated in India approximately two million years ago. From there, it gradually spread to other habitats, progressively colonizing Europe, China, and North Africa. Over thousands of years, mutations and natural selection shaped numerous interbreeding populations exhibiting increasingly diverse morphotypes. According to Mayr (1963), this evolutionary process gave rise to three major subspecies on three different continents: (1) *Bos primigenius namadicus*, the ancestor of present-day Asian zebu cattle; (2) *Bos primigenius primigenius*, the European aurochs, which survived until the Middle Ages before becoming extinct in the 16th century; and (3) *Bos primigenius africanus*, also referred to as *Bos primigenius mauretanicus* or *Bos primigenius opisthonomus*, which is considered the ancestral form of indigenous African cattle. Around 8,000 BC, the domestication of cattle by humans greatly accelerated the diversification of bovine populations. In Africa, cattle domestication is believed to have occurred between the Upper Nile Valley (Egypt, Nubia, and Ethiopia) and the Horn of Africa. However, habitat destruction and fragmentation, overexploitation of organisms, climate change, alterations in biogeochemical cycles, pollution, and biological invasions have collectively triggered what is likely a major wave of biodiversity loss driven by human activities (Dominique et al., 2010). More than 10% of the world's known livestock breeds have become extinct over the past few decades, while approximately 15% are currently at risk of extinction (Cicia et al.,2003; FAO, 2012). Many of these endangered breeds possess distinctive, and in some cases unique, genetic and adaptive characteristics. There is now broad scientific consensus regarding the fundamental role of genetic diversity in maintaining the multifunctionality and resilience of ecosystems (Dominique et al., 2010; FAO, 2015; INRA, 2019; Anderson, 2003). However, the concept of "diversity" gained international recognition only after the adoption of the Convention on Biological Diversity during the United Nations Conference on Environment and Development (Earth Summit) held in Rio de Janeiro, Brazil, in 1992. In September 2007, in accordance with the fundamentals of the Convention on Biological Diversity (1992), the international community adopted the first Global Plan of Action (GPA) for Animal Genetic Resources, which comprises twenty-three strategic priorities aimed at combating the erosion of animal genetic diversity and sustainably using animal genetic resources. One hundred and nine delegations from 169 countries, including Cameroon, adopted the Interlaken Declaration on Animal Genetic Resources, through which countries confirmed their collective and individual responsibilities regarding the conservation, sustainable use, and development of animal genetic resources for food and agriculture; global food security; improving the nutritional status of humanity; and rural development. It is against this background that the present study, entitled *"Biometric Characteristics of Kapsiki native taurine breed (Bos taurus) Cattle in the Sudano-Sahelian Zone of Cameroon."*, was conducted to improve knowledge of the biometric and morphological characteristics of this indigenous cattle breed.

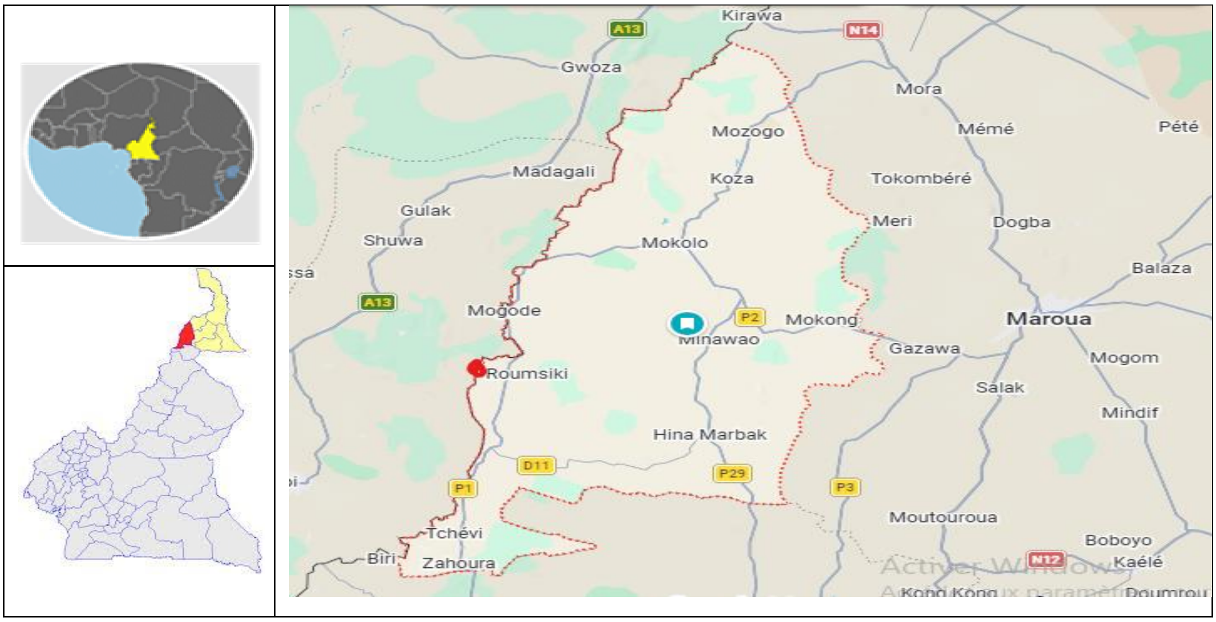
In Cameroon, the cattle population is estimated at 5,040,000 head (INS, 2017). Taurines are poorly represented (1%) compared to zebus (99%) (MINEPIA, 2011). The Kapsiki were estimated at slightly less than 3,000 head (Thys and Wandi, 1970; Thys and Dineur, 1986). Kapsiki cattles originated from ancestral aurochs populations *Bos primigenius primigenius* and *B. primigenius opisthonomus* from two centers of domestication, namely the Middle East and North Africa, respectively (Epstein, 1971). They are known to be resistant or tolerant to heat stress and trypanosomiasis (Hoste et al., 1988; Thys & Wandi, 1970; Achukwi et al., 1997; FAO, 2008; Achukwi & Musongong, 2009; Paguem et al., 2020). Consequently, they represent a reliable alternative for resilience against the adverse effects of climate change (FAO, 2012). They are reared by the Kapsiki and Bana communities on the Mandara Highlands in the Far North Region of Cameroon (Thys and Christian, 1998). However, the Kapsiki breed is currently listed as critically endangered and rare largely as a result of neglect and ongoing genetic erosion (Rege, 1999). Due to their relatively low live weight linked to their small size, they are economically unattractive for milk and meat production. However, they play a very important socio-cultural role in the traditions of local tribes, such as for dowries, festivals, and special rituals (Paguem et al., 2020). Nevertheless, there is almost no updated knowledge regarding the measurements of these taurines. It is therefore urgent to characterize this breed from a conservation perspective. The present study aims to contribute to this effort by providing a detailed morphometric characterization of the Kapsiki taurine, establishing baseline data on body measurements, biometrical indices, and phenotypic variability within the population. This characterization will provide the scientific basis needed for the development of a sustainable conservation program.

2. Materials and methods

2.1 Study area and period

The study was conducted in the Rhumsiki subdivision (Long: 13.582, Lat: 10.530). Precipitation varies between 400 and 1200 mm per year. The average temperature is 28°C, while maxima reach around 40 to 45°C in April. The relief is rugged, rocky, and chaotic, densely populated and cultivated, with domestic trees such as *Acacia albida*, *Celtis integrifolia*, *Ficus spp.*, *Khaya senegalensis*, *Parkia biglobosa*, etc. The flora is dominated by thorny steppes and periodically flooded grasslands. Pedological diversity is linked to contrasts in rainfall and relief. On the exonded lands, there is an alternation of lithomorphic vertisols associated with vertic soils, both conducive to the cultivation of flood-recession sorghum (Mouskouari), more or less leached ferruginous soils exploited for rainy season crops, and halomorphic soils, which are rather sterile. Crops grown include sorghum, millet, cotton, maize, rice, groundnuts, cowpeas, and market gardening (IRAD, 2008). The study took place from March 15 to April 20, 2026.

Fig 1. *Location of the study area.*



Source: https://www.google.com/maps/place/Mayo-Tsanaga (Accessed: 14 June 2026, 19:33)

2.2 Sample Size

The study involved a sample of 49 subjects (36 cows and 13 bulls) over 3 years of age.

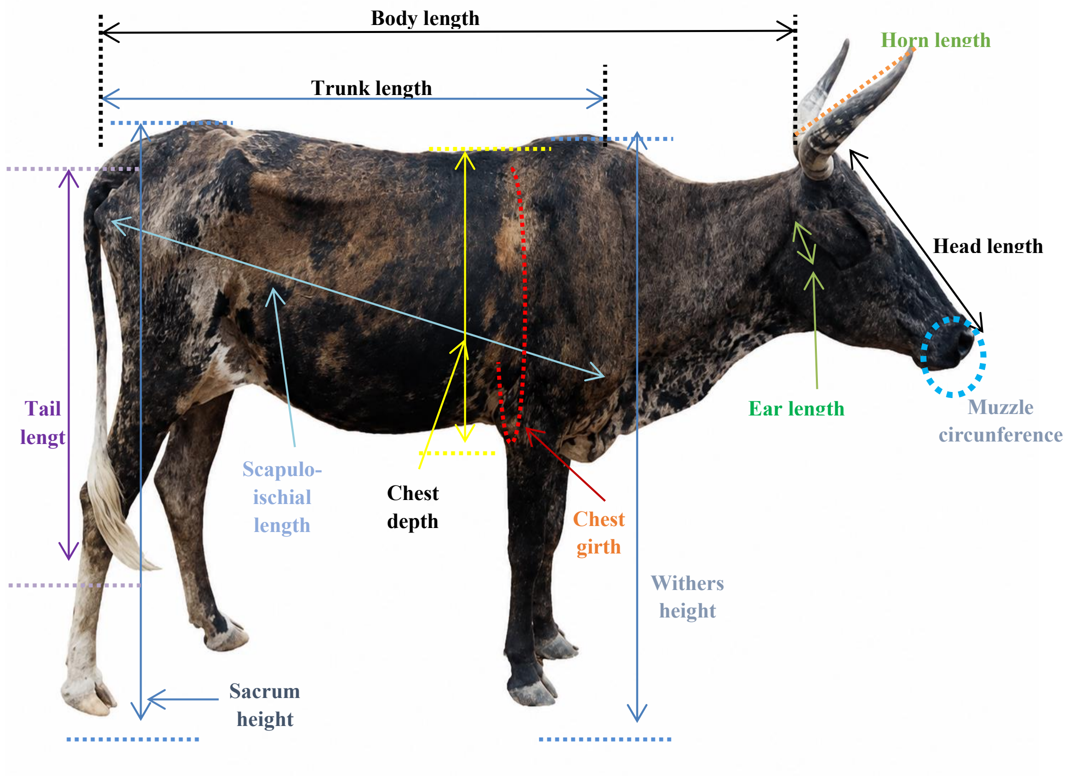
2.3 Data Collection

With the animal placed on perfectly level ground in its normal stance, nineteen (19) biometric measurements (cm) were taken in accordance with the guidelines of AU-IBAR (2015) and FAO (2007) on each animal, in the same order and manner. These are:

- Chest girth: thoracic perimeter taken just behind the animal's forelegs, passing through the girth strap.
- Body length : from the nape of the neck to the base of the tail.
- Head length: from the poll to the muzzle.

- Trunk length: distance between the hump and the base of the tail.
- Pelvic width: distance between the outer points of the hips.
- Scapulo-ischial length: Measure from the point of the shoulder to the ischium.
- Pelvic length (ileo-ischial distance): distance between the hip bones and the pin bones.
- Tail length: length between the base of the tail and its extremity.
- Horn length: the measurement of the longest distance from the root of the horn to its tip, following the outer curvature.
- Ear length: measure the length at the back of the ear, from the root to the tip.
- Forehead length: length between the two horns and the two eyes.
- Face width: distance between the two eyes.
- Withers height: vertical distance from the ground to the point of the withers.
- Sacrum height: vertical distance from the ground to the sacrum.
- Chest depth: vertical distance between the girth strap of the sternum and the spinal column.
- Muzzle circumference: perimeter taken slightly above the nostrils and around the point where the dewlap meets the chin.
- Cannon and hock circumference: perimeter taken at the level of the front cannon and hock.

Photo 1: Biometric measurements of cattle according to AU-IBAR (2015)



Source: *adapted by others*

In the absence of a scale or livestock weighbridge, the barometric method (live weight estimation using body measurements) makes it possible to estimate the live weight of an animal (Korombe, 2017; Delage, 1955; Pagot, 1959; Chollou, 1978; Poivey, 1980; Dineur, 1986; Dodo, 2001; Minvielle, 1974). We used the barometric formula of Dineur et Thys (1986). Indeed, in 1986, Dineur and Thys (1986) initiated studies on the introduction and barymetric evaluation of Kapsiki taurine cattle. One of the main objectives of their work was to establish a barymetric formula specific to the Kapsiki breed using three body measurements (thoracic girth, scapulo-ischial length, and withers height) which were found to be highly and positively correlated with the live weight of the animals. The following formula was retained:

$Y = 0.000141*X^{2.873}$ (R^2=0.9870).

Where Y = Live Weight (kg) and X = Thoracic girth (cm)

Furthermore, we established 16 indices that express the ratio between the developments of two regions of the same animal or between the development of a region and that of the whole body. These are:

- Scapulo-ischial index (ISI) = scapulo-ischial length / Withers height

- Caudal index (QI) = tail length / withers height
- Cannon bone index (CBI)= (cannon circumference / withers height) x 100.
- Hock bone index (HBI)= (hock circumference / withers height) x 100.
- Auricular index (AI) = ear length / withers height
- Cephalic index (CpI) = (face width / face length) x 100
- Proportionality (Pr) = (withers height / scapulo-ischial length) x 100
- Thoracic development (ThD) = withers height / thoracic perimeter
- Surface index (SI) = withers height x scapulo-ischial length
- Thoracic index (ThI) = chest depth / thoracic perimeter
- Dactylo-thoracic index (DThI) = front cannon circumference / thoracic perimeter. It is considered a sign of fineness if it is less than 10%.
- Body length index (BLI) = body length / withers height. An animal is said to be longilinear if BLI > 1; mediolinear if BLI = 1, and brevilinear if BLI < 1.
- Relative body index (RBI) = body length / thoracic perimeter. An animal is said to be longilinear if RBI ≥ 0.90, mediolinear if 0.84 < RBI < 0.90, and brevilinear if RBI ≤ 0.84.
- Auriculo-thoracic index (IAT) = ear length / thoracic perimeter.
- Body profile index (BI) = withers height / body length. The animal is said to be longilinear if ICP < 1; mediolinear if ICP = 1, and brevilinear if ICP > 1.
- Massiveness Index (MI) = live weight / height at withers

2.4 Statistical analysis of data

Descriptive statistics (cross-tabulation) using the "Statistical Package for the Social Sciences (SPSS) version 20 software were used to assess the association between the different variables. Multivariate analyses were used to test the effects of sex, reproduction system, and locality on the various measurements and biometric indices according to the following statistical model:

$Yij = \mu + S_i + e_{ij}$.

Where: Yij = biometric characteristic of animal i; of sex j

μ: overall mean; S_j: effect of sex j (j = 1 – 2); e_{ij}: residual error associated with the characteristics of animal i; of sex j.

XLSTAT-Pro version 2007.8.04 software allowed us to perform pearson correlations to evaluate the direction and degree of association between the different body measurements and live weight; Perform Principal Component Analysis (PCA) based on twenty (20) biometric characteristics; Perform Discriminant Factor Analysis (DFA) based on the measurements. A coefficient of variation of less than 15% is considered to indicate that the population is homogeneous, while a coefficient of more than 15% indicates that the values are relatively dispersed (Peter, 2020; Faria et al., 2010).

3. Results and discussion

3.1 Biometric characteristics of kapsiki taurines

3.1.1 Withers height, sacrum height, and chest depth in kapsiki taurines

Sample sizes, means, standard errors, and coefficients of variation for height measurements in Kapsiki taurines are grouped in Table 1.

Table 1: Sample size, mean, standard error, and coefficient of variation of withers height, sacrum height, and chest depth in Kapsiki taurines

			Withers height	Rump height	Chest depth
Sex		sig	ns	ns	ns
	Cow	n	36	36	36
		µ±es(CV)	113.78±5.95(0.05)	118.42±5.94(0.05)	54.58±4.76(0.09)
	Bull	n	13	13	13
		µ±es(CV)	116.50±7.25(0.06)	119.57±6.88(0.06)	55.21±4.51(0.08)
	Total	n	49	49	49
		µ±es(CV)	114.54±6.46(0.06)	118.74±6.24(0.05)	54.76±4.70(0.09)

µ±se: mean ± standard error, CV: coefficient of variation; n: number of observations; sig:significance

The results in Table 1 show that the sex of the animal did not significantly influence the three measurements. This is probably due to the priority use of males in various traditional ceremonies. This has the direct consequence of a small number of relatively young bulls (between 4 and 6 years of age). Kapsiki taurines show relatively homogeneous measurements, as indicated by the low coefficients of variation (CV < 10%) observed for the three measurements.

3.1.2 Head length measurements in kapsiki taurines

Sample size, mean, standard error, and coefficient of variation for head length measurements in Kapsiki taurines are summarized in Table 2.

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Table 2: Sample size, mean, standard error, and coefficient of variation of head length measurements in Kapsiki taurines

			Horn length	Face length	Forehead length	Ear length
		sig	ns	ns	ns	ns
Sex	Cow	n	36	36	36	36
		µ±es	23.97±8.85	41.75±4.76	19.44±1.38	18.22±1.40
		(CV)	(0.37)	(0.11)	(0.07)	(0.08)
	Bull	n	13	13	13	13
		µ±es	22.79±10.11	43.29±3.51	19.57±1.55	17.71±1.28
		(CV)	(0.44)	(0.08)	(0.08)	(0.07)
	Total	n	49	49	49	49
		µ±es	23.64±9.24	42.18±4.50	19.48±1.43	18.08±1.38
		(CV)	(0.39)	(0.11)	(0.07)	(0.08)

µ±es*: mean±standard error, CV: coefficient of variation; n: number of observations; sig: significance*

Table 2 shows that the different measurements remained statistically comparable between the two sexes. Furthermore, this is a homogeneous population for these measurements, with the exception of horn length. The massive and priority use of males in ceremonies and rites would justify these results.

3.1.3 Body length measurements in kapsiki taurines

The sample size, mean, standard error, and coefficient of variation for trunk length measurements in Kapsiki taurines are presented in Table 3.

Table 3: Sample size, mean, standard error, and coefficient of variation of trunk length measurements in Kapsiki taurines

			Body length	Trunk length	Scapulo-ischial length	Pelvic length	Tail length
		sig	ns	ns	ns	ns	ns
Sex	Cow	n	36	36	36	36	36
		µ±es	139.97±11.43	110.58±8.51	114.08±10.50	38.00±3.69	77.11±6.52
		(CV)	(0.08)	(0.08)	(0.09)	(0.10)	(0.08)
	Bull	n	13	13	13	13	13
		µ±es	140.29±12.12	109.64±7.15	115.00±7.90	35.36±4.03	75.50±5.38
		(CV)	(0.09)	(0.07)	(0.07)	(0.11)	(0.07)
	Total	n	49	49	49	49	49
		µ±es	140.06±11.63	110.32±8.16	114.34±9.85	37.26±3.97	76.66±6.26
		(CV)	(0.08)	(0.07)	(0.09)	(0.11)	(0.08)

µ±es*: mean±standard error, CV: coefficient of variation; n: number of observations; sig: significance*

The results in Table 3 show homogeneity (CV < 15%) in the population. Furthermore, sex did not significantly influence the set of measurements.

3.1.4 Live weight, Face and pelvis width

The live weight, face and pelvis widths are presented in Table 4.

Table 4: Sample size, mean, standard error, and coefficient of variation of pelvis and face width in Kapsiki taurines

			Live weight	Pelvic width	Face width
Sex	sig		ns	ns	*
	Cow	n	36	36	36
		µ±es	181.73±42.26	32.50±3.82	13.58±1.34
		(CV)	(0.23)	(0.12)	(0.10)
	Bull	n	13	13	13
		µ±es	189.94±58.56	29.50±4.53	14.64±1.11
		(CV)	0.31	(0.15)	(0.08)
	Total	n	49	49	49
		µ±es	183.91±47.27	31.66±4.25	13.88±1.37
		(CV)	(0.26)	(0.13)	(0.10)

µ±es*: mean±standard error, CV: coefficient of variation; n: number of observations; sig: significance*

Table 4 shows that sex significantly influenced face width. Indeed, bulls presented statistically higher measurements than cows. However, no significant difference was observed regarding pelvic width.

3.1.5 Muzzle, chest, cannon, and hock circumferences

The muzzle, chest, cannon, and hock circumferences are summarized in Table 5.

Table 5: Sample size, mean, standard error, and coefficient of variation of muzzle, chest, cannon and hock circumferences in Kapsiki taurines

			Thoracic girth	Cannon circunference	Hock circunference	Muzzle circunference
Sex		sig	ns	ns	ns	ns
	Cow	n	36	36	36	36
		µ±es	133.03±11.18	11.11±1.07	13.17±1.14	38.78±3.13
		(CV)	(0.08)	(0.10)	(0.09)	(0.08)
	Bull	n	13	13	13	13
		µ±es	133.43±14.74	11.50±1.64	13.50±1.64	38.64±2.26
		(CV)	(0.11)	(0.14)	(0.12)	(0.06)
	Total	n	49	49	49	49
		µ±es	133.14±12.29	11.22±1.27	13.26±1.31	38.74±2.91
		(CV)	(0.09)	(0.11)	(0.10)	(0.08)

µ±es*: mean±standard error, CV: coefficient of variation; n: number of observations; sig: significance*

Table 5 shows that there is no significant difference between sexes. Indeed, males are relatively underrepresented and younger in all the visited farms, as they are preferentially used in rituals. This youth probably justifies these results.

3.2 Biometric indices of interest

Several biometric indices are used to assess the general conformation of the animal as well as the development of different regions. It consequently allows for the scoring of animals likely to be selected (Sow et al., 1991). With the aim of refining the assessment of the different biometric characteristics of the Kapsiki taurine population, sixteen indices were calculated.

3.2.1 Bone structure and general format indices

The mean, standard error, and coefficient of variation of the hock and cannon bone indices, surface index, and format index according to sex are presented in Table 6.

Table 6: Sample size, mean, standard error, and coefficient of variation of hock bone index, cannon bone index and surface index according to sex

			Hock bone index	Cannon bone index	Surface index
		sig	ns	ns	ns
Sex	Cow	µ±es	0.12±0.01	0.10±0.01	13004.58±1578.73
		(CV)	(0.11)	(0.11)	(0.12)
	Bull	µ±es	0.11±0.02	0.10±0.01	13433.46±1453.43
		(CV)	(0.13)	(0.15)	(0.11)
	Total	µ±es	0.12±0.01	0.10±0.01	13118.37±1558.02
		(CV)	(0.12)	(0.12)	(0.12)

µ±es*: mean±standard error, CV: coefficient of variation; n: number of observations; sig: significance*

The results in Table 7 show the absence of significant differences between bulls and cows (sig = ns for all indices). The low hock (0.12) and cannon (0.10) bone indices indicate fine bones. This skeletal fineness gives the animals lightness and agility favorable for mobility in constraining environments (mountains, difficult trails). The very high body surface index (SI ≈ 13,118 cm^2) gives these animals a large heat exchange surface relative to their volume, facilitating body heat dissipation.

3.2.2 Indices related to morphological type and massiveness

Indices related to morphological type are grouped in Table 7.

Table 7: Mean, standard error, and coefficient of variation of massiveness index (MI), body length index (BLI), relative body index (RBI), auricular index (AI), and Body profile index (BI) according to sex.

			MI (kg/cm)	BLI	RBI	AI	BI
		sig	ns	ns	ns	ns	ns
Sex	Cow	µ±es	1.59±0.33	1.23±0.08	1.06±0.10	0.16±0.01	33.10±6.24
		(CV)	(0.21)	(0.06)	(0.09)	(0.09)	(0.19)
	Bull	µ±es	1.63±0.47	1.21±0.08	1.05±0.10	0.15±0.01	34.04±2.51
		(CV)	(0.29)	(0.07)	(0.10)	(0.09)	(0.07)
	Total	µ±es	1.60±0.38	1.22±0.08	1.06±0.10	0.16±0.01	33.35±5.52
		(CV)	(0.23)	(0.07)	(0.09)	(0.09)	(0.17)

µ±es*: mean±standard error, CV: coefficient of variation; n: number of observations; sig: significance*

The results in Table 6 generally show low coefficients of variation. Sex had no significant effect on any of the indices. The relative body index (RBI = 1.06) and the body length index (BLI = 1.22) show that this is a population of longilinear animals, representing a balance between mobility and compactness. This trait is interpreted as a functional adaptation to walking long distances and better locomotor efficiency in varied terrain. The Cephalic Index (CpI = 33.35) means that the width of the head represents only one-third of its length. It follows that Kapsiki taurines have a markedly long and narrow head (dolichocephaly). This conformation, combined with a relatively high auricular index (0.16), demonstrates a dual adaptation to the tropical environment. The development of nasal cavities and auricular pavilions constitutes an essential morphological device for thermoregulation and protection against disease-vector insects.

3.2.3 Indices related to thoracic development

The proportionality index (Pr ≈ 116.65) indicates a thoracic perimeter clearly superior to the withers height. This significant thoracic development constitutes a major physiological advantage. It reflects good respiratory capacity and endurance, which is an adaptation to prolonged effort.

3.2.4 Indices related to morphological balance

The morphological balance indices are presented in Table 8.

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Table 8: Mean, standard error, and coefficient of variation of indices related to morphological balance according to sex

			ISI	DThI	QI	ThI	AI
Sex		sig	ns	ns	ns	ns	ns
	Cow	µ±es	1.00±0.08	0.08±0.01	0.68±0.06	0.41±0.03	0.14±0.02
		(CV)	(0.08)	(0.14)	(0.09)	(0.08)	(0.12)
	Bull	µ±es	1.00±0.07	0.09±0.02	0.65±0.08	0.41±0.04	0.13±0.02
		(CV)	(0.07)	(0.19)	(0.12)	(0.10)	(0.12)
	Total	µ±es	1.00±0.08	0.08±0.01	0.67±0.07	0.41±0.03	0.14±0.02
		(CV)	(0.08)	(0.15)	(0.10)	(0.08)	(0.12)

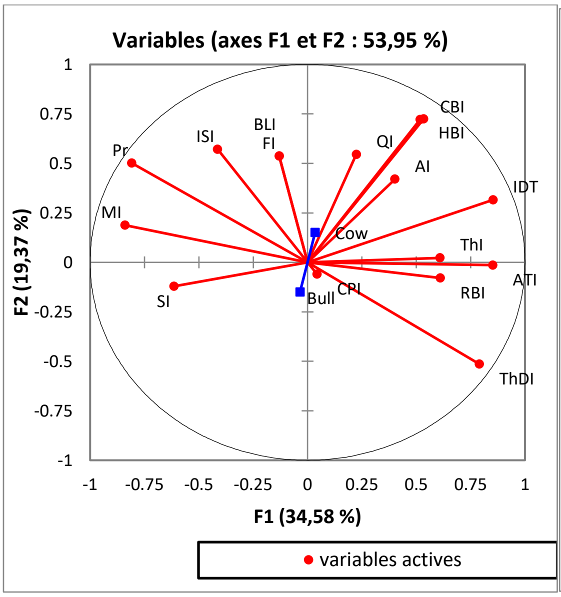
µ±es*: mean±standard error, CV: coefficient of variation; n: number of observations; sig: significance; DTI: Dactylo-thoracic index; ISI: Scapulo-ischial index; ThI: Thoracic index; QI: Caudal index; AI: Auricular index.*

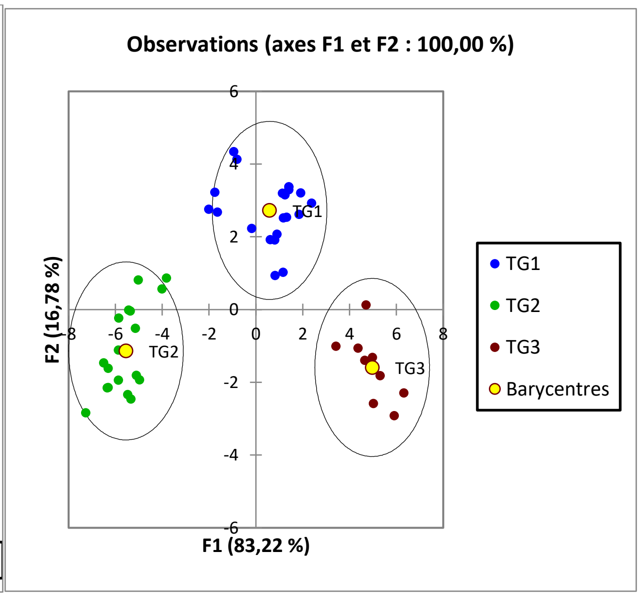
The results in Table 8 generally show low to moderate coefficients of variation (8–19%). Sex had no significant effect on any of the indices. The dactylo-thoracic index (DThI ≈ 0.08) reveals a balanced thorax. The scapulo-ischial index (ISI ≈ 1.00) indicates a morphological balance between the forequarters and hindquarters. The Thoracic Index (ThI = 0.41) shows that the thorax is distinctly deeper than it is wide. This conformation allows for a large respiratory capacity, crucial for oxygenation during intense heat and long walks. The Scapulo-ischial Index (ISI = 1.00) means that the distance between the hip points and the pin bones is balanced with the width of the chest. The animal is well-balanced in its stance.

4. Morphological diversity of kapsiki taurines

The Principal Component Analysis performed on the biometric indices made it possible to summarize the morphological diversity of Kapsiki taurine cattle into three main genetic types (Figures 3 and 4). The first principal axis (F1), which accounted for the largest proportion of morphological variability (37.96%), clearly distinguished massive and compact animals with a brevilinear body conformation (TG3, characterized by strongly positive correlations with the Massiveness Index and Proportionality Index) from longilinear, slender animals with a fine skeletal structure (TG2, characterized by negative correlations with the Relative Body Index and Thoracic Development Index). The second principal axis (F2), predominantly represented by TG1, highlighted skeletal robustness (cannon and hock bone indices) associated with the development of body appendages (ears and tail), in contrast to thoracic width development. Finally, the inclusion of sex as a supplementary variable revealed near-zero correlations with the principal axes, unequivocally confirming the complete absence of sexual dimorphism within the Kapsiki breed for all body proportions investigated.

Fig 2. *Variable-factor correlations* **Fig 3.** *Kapsiki taurine sub-populations*





Source. Principal Component Analysis result **Source.** Principal Component Analysis result

5. Discussion

The results reveal a total absence of sexual dimorphism in both body measurements and biometric indices ($p > 0.05$). Indeed, bulls are preferentially used in traditional ceremonies and ritual practices. During our field surveys, cows estimated to be nearly 37 years old were observed within the herds, whereas no bulls older than five years were recorded. Aka et al. (2022) reported that the use of Muturu taurine cattle for traditional sacrifices and ritual practices leads to the premature slaughter of males, resulting in a shortage of breeding bulls and severe genetic erosion. From a genetic standpoint, this practice constitutes a form of artificial selection that continuously removes the best male phenotypes before they have the opportunity to express their reproductive potential. Consequently, it leads to a drastic reduction in the effective population size (Ne), an increase in the rate of inbreeding, and a considerable limitation of genetic progress within the population. Sex-related effects on biometric traits have been reported in several cattle breeds, including N'Dama cattle (Coulomb, 1976; Akouango et al., 2014; Kanh et al., 2019; Essien A and Adesope, 2003), Djelli zebu (Yahaya et al., 2019), Azaouak zebu (Pagot, 1943), Namchi taurine cattle (Thys and Wandi, 1970), Goudali zebu (Lhoste, 1969; Nsangou et al., 2022; Doba, 2016), and White Fulani zebu (Ngono et al., 2019). In contrast, the complete absence of sexual dimorphism observed in the present study suggests that specific socio-cultural practices affecting the demographic structure of Kapsiki herds may have contributed to reducing the morphological differences generally observed between bulls and cows. The live weight, thoracic girth, withers height, and scapulo-ischial length are 183.91±47.27kg, 133.43 ± 14.74 cm, 114.54 ± 6.46 cm, and 114.34 ± 9.85 cm, respectively. These results are very close to those reported by Ebangi et al. (2011) (live weight = 185.27 ±17.52 kg, thoracic girth = 136.55 ± 4.25 cm, withers height = 110.34 ± 3.17 cm, and scapulo-ischial length = 115.76 ± 4.39 cm) on the same breed. It is possible that, over several decades, Kapsiki taurine cattle have not been significantly affected by the major forces of genetic variation, namely genetic drift, mutation, migration, environmental pressures, and artificial selection. This apparent morphological stability may have contributed to the remarkable homogeneity observed within the population. The various biometric indices calculated in this study constitute valuable selection criteria for genetic improvement programs based on selective breeding. These indices can be easily assessed under traditional farming conditions by livestock keepers in collaboration with animal geneticists. The use of barymetry within breeding schemes was also advocated by Sow et al. (1991), who recommended the use of thoracic girth as a reliable criterion for the selection of animals based on body weight. From a morphometric perspective, West African dwarf taurine cattle breeds (Muturu and Lagunaire) are characterized by a withers height ranging from 80 to 100 cm and an average live weight of 140 to 200 kg (Aka et al., 2022). With a withers height of 114.54 cm and an estimated live weight of 183.91 kg, the Kapsiki taurine occupies an intermediate position between the strictly dwarf taurine breeds (e.g., Muturu) and the larger savanna taurine breeds such as N'Dama. As highlighted by several othors (Aka et al.,2022; Ayalew et al.,2023), the relatively small body size and fine skeletal structure should not be regarded as signs of weakness but rather as evolutionary adaptations that enhance agility, mobility on grazing lands, and heat dissipation. Principal Component Analysis revealed the existence of three genetic morphotypes, providing exploitable phenotypic variability for breeding purposes. The identification of the TG3 group, characterized by more massive animals with a high Massiveness Index, offers a practical opportunity to establish a selection nucleus oriented toward beef production while preserving the adaptive traits (deep thorax and fine skeletal structure) represented by the TG2 group. Under traditional smallholder production systems, Kapsiki taurine cattle appear less massive (MI = 1.60 kg/cm; ThD = 0.41; BLI = 1.22), despite sharing the same longilinear body conformation as the Lagunaire taurine cattle of Ghana (MI = 1.87 kg/cm; ThD = 0.68; BLI = 1.22; Monstma, 1959) and the Muturu cattle of Liberia (MI = 1.99 kg/cm; ThD = 0.77; BLI = 1.12; Karnuah et al., 2018). These findings suggest considerable potential for genetic improvement of Kapsiki taurine cattle, particularly with regard to meat production. The increasing intrusion of zebu cattle, facilitated by regional insecurity associated with Boko Haram activities and recurrent agropastoral conflicts, exposes the Kapsiki breed to a high risk of genetic introgression. If uncontrolled, systematic crossbreeding could lead to the erosion of genes responsible for trypanotolerance and local adaptation, as previously reported for the Muturu breed in Nigeria (Aka et al., 2022).

6. Conclusion

The biometric study of Kapsiki taurine cattle made it possible to establish a precise morphological profile of this indigenous breed, characterized by a longilinear body conformation, a fine skeletal structure, and a deep thorax. The complete absence of sexual dimorphism, likely resulting from socio-cultural practices that preferentially remove the largest males from the population through ritual sacrifices, highlights the urgent need to preserve the male genetic pool of this breed. Although the breed exhibits a high degree of overall phenotypic homogeneity, as evidenced by the low coefficients of variation, Principal Component Analysis revealed the existence of three distinct morphotypes (TG1, TG2, and TG3), structured along gradients of massiveness, body linearity, and skeletal robustness. This morphological variability represents a valuable opportunity for genetic improvement through selective breeding programs. Selection criteria based on the Massiveness Index, Thoracic Index, and Scapulo-Ischial Index could be used to enhance the productive potential of this animal resource while preserving its adaptability and resilience to climate change.

Author Contributions

All authors contributed equally to this study. They participated in the writing, revision, and final approval of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Ethical Considerations

Ethical authorization was obtained from the Institute of Agricultural Research for Development, Cameroon (N° REF. 00418/IRAD/DG/DPAH, Yaoundé, April 1, 2026).

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Appendix. Photograph of fieldwork

Picture 2. Body length (cm)

Picture 3. Head measurements including tail length, cannon and hock circumference (cm)

Picture 4. Pelvic measurements (cm)

Picture 5. chest depth including scapulo-ischial length and chest girth (cm)

Picture 6. sacral height and tail length (cm)

Picture 7. withers height (cm)

Source. Photograph of fieldwork

Références

1. **Achukwi M.D, Tanya V.N, Hill E.W, Bradley D. G., Meghen C., Sauveroche B., Banser J.T. and Ndoki J.N. 1997.** Susceptibility of the Namchi and Namchi cattle of Cameroon to trypanosome infection. *Tropical Animal Health and Production* 4:219–226.
2. **Achukwi M.D. and Musongong G.A, 2009.** Trypanosomosis in the Doayo/Namchi (*Bos taurus*) and zebu White Fulani (*Bos indicus*) cattle in Faro Division, North Cameroon. *Journal of Applied Biosciences* 15: 807 - 814.
3. **Aka S., Soro B., Kanh M. H. K., Kpandji I. K., Koffi M., Sokouri D. P.** 2022. Les taurins nains à courtes cornes de l'ouest africain. *Rev. Mar. Sci. Agron. Vét*. 10(4) 615-622
4. **Akouango P, Mopoundza P, Ewomango RP.** 2014. Étude des mensurations des bovins de race Ndama (*Bos taurus*) dans les pâturages naturels semi inondés de la ferme d'Abo au Congo Brazzaville. J Anim Plant Sci, 20(3): 3137-3143.
5. **Anderson S. 2003.** Animal genetic resources and sustainable livelihoods, *Ecological economics*, vol. 45, pp. 331-339.
6. **AU-IBAR. 2015**. Pictural field guide for linear measurements of animal genetic resources, 65p
7. **Ayalew**, W., Wu, X., Tarekegn, G. M., Chu, M., Liang, C., Sisay Tessema, T., & Yan, P. (2023). Signatures of positive selection for local adaptation of African Native Cattle populations: a review. *Journal of Integrative Agriculture*, 22(7), 1967-1984. https://doi.org/10.1016/j.jia.2023.01.004
8. **Blench R. 1993.** Ethnographic and linguistic evidence for the prehistory of African ruminant livestock, horses and ponies. In: Shaw, T., Sinclair, P., Andah, B. and Okpoko, A (eds.). The Archaeology of Africa, Routledge, London, p.71-103.
9. **Chollou.M ; Denis.J.P et Gauchet.D., 1978.-** Calcul d'une formule barymétrique adaptée au zébu Gobra.- *Rév. Elev. Méd. Vét. Pays trop* 31(4), 447. 450.
10. **Cicia G., Ercole E.D and Marino D. 2003.** "Costs and benefits of preserving farm animal genetic resources from extinction: CVM and Bio-economic model for valuing a conservation program for the Italian Pentro horse," *Ecological Economics*, vol. 45, pp. 445-459.
11. **Coulomb J. 1976.** La race N'Dama: Quelques caractéristiques zootechniques *Rev. Elev. Méd. vét. Pays trop*, 29 (4) : 367-380.

12. **Delage.J ; Poly.J et Vissac.B., 1955.-**Etude de l'efficacité relative de diverses formules de barymétrie applicables aux bovins.- *Ann-zootech* 3,219-231.
13. **Dineur.B et Thys.E., 1986**. Les Kapsiki : race taurine de l'extrême- Nord camerounais. I. Introduction et barymétrie.- *Rev Elev. Méd. Vét. Pays trop*. **39** : 435-442.
14. **Doba E. 2016.** Utilisation de la barymétrie pour l'estimation du poids chez les zébus Gudali variété Ngaoundere. Mémoire présenté pour l'obtention du diplôme de Docteur en médecine vétérinaire, Université de Ngaoundere (Ecole des Sci et de Médecine Vétérinaire), 97p.
15. **Dodo.K ; Pandey.VS et Illiassou.MS., 2001.-** Utilisation de la barymétrie pour l'estimation du poids chez le zébu Azawak au Niger.- *Rev Elev. Méd. Vét pays trop*, 54 (1) :63-68.6 pages.
16. **Dominique G, Isabelle G, Nicolas M. 2010.** Le rôle de la biodiversité dans le fonctionnement des écosystèmes. *Researchgate,* 22p
17. **Ebangi A, Achukwi MD, Messine O, Abba D. 2011.** Characterization of Namchi and Kapsiki taurine cattle breeds of Cameroon in their natural environment. *Trop Anim Health Prod,* 43: 1117–1122. DOI 10.1007/ s11250-011-9810-8
18. **Epstein, H. 1971.** The origin of the domestic animals of Africa Vol. 1 New York, USA, Africana Publishing Corporation.
19. **Epstein**, **H. and Mason, I.L. 1984.** Cattle. In: Evolution of domesticated animals (I.L. Mason, ed.), New York, USA, Longman, 6-27.
20. **Essien A and Adesope O.M. 2003**. Linear body measurements of N'dama calves at 12 months in a South Western zone of Nigeria. *Livestock Research for Rural Development* 4: (15)
21. **FAO. 2007.** Plan d'action mondial pour les ressources zoo génétiques et la déclaration d'interlaken, Rome. 52p.
22. **FAO. 2008.** L'état des ressources zoogénétiques pour l'alimentation et l'agriculture dans le monde, , édité par Barbara Rischkowsky et Dafydd Pilling. Rome. 577p.
23. **FAO. 2012.** Atelier régional sur « La caractérisation et la valorisation des races animales locales et leurs produits » - Moyen-Orient et Afrique du Nord. Du 19-21 Novembre 2012 à l'Institut Agronomique et Vétérinaire Hassan II (IAV Hassan II) du Maroc, 12p
24. **FAO. 2015.** Deuxième rapport sur l'état des ressources zoogénétiques pour l'alimentation et l'agriculture dans le monde. 16p

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Num 36 Juin 2026

1. **Faria FDE, Dias AN, Veloso ALC, Bueno CFD, Couto FAP, Matos JJB, Barreto KZO, Rodrigues PA, Carneiro WA. 2010.** Classification of coefficients of variation in experiments with commercial layers. *Braz J Poult Sci*, 12(4): 255 – 257.
2. **Hoste C.H., Chalon E. d'Ieteren G. Et Trail J.C.M. 1988.** Le bétail trypanotolérant en Afrique occidentale et centrale. FAO. Volume 3. Bilan d'une decennia
3. **INRA. 2019.** Biodiversité : le rôle essentiel des espèces rares dans la multifonctionnalité des écosystèmes. Communiqué de presse Ŕ 8 avril 2019
4. **INS. 2017.** Institut National de la Statistique. Annuaire statistique du Cameroun. Chapitre 14: Pêche et Elevage. 12p.
5. **IRAD. 2008.** Deuxième rapport sur la situation des ressources phytogénétiques pour l'alimentation et l'agriculture au Cameroun. 93p
6. **Kanh K.H.M, Sokouri D.P, Diop M. et Dieng A. 2019. L**a race NDama dans le cheptel bovin du Sénégal. *Int. J. Biol. Chem. Sci*. 13(4): 2315-2331
7. **Karnuah A. B., G. Dunga, A. Wennah, W. T. Wiles, E. Greaves, R. Varkpeh, R. Osei-Amponsah, P. Boettcher (2018).** Phenotypic characterization of beef cattle breeds and production practices in Liberia. Trop. *Anim. Health Prod*. 50: 1287–1294.
8. **Korombe S.H. 2017.** Caractéristiques phénotypiques du taurin Kouri du Niger. Mémoire de Master en Productions Animales et Développement Durable. 37p
9. **Lhoste P. 1969.** Les races bovines de l'Adamaoua (Cameroun). Centre de Recherches Zootechniques de Wakwa. 19 p
10. **Mayr E. (1963).** Animal Species and Evolution. Harvard University Press, Cambridge, 334 p.
11. **MINEPIA. 2011.** Document de stratégie du sous-secteur de l'élevage, des pêches et des industries animales. Division des Etudes, des Statistiques et de la Coopération, 125p
12. **Minvielle F. 1974**. L'estimation du poids vif de bovins marocains par barymétrie. Institut Agronomique et vétérinaire Assan II. 6p
13. **Monstma G. 1959.** Some notes on the conformation of West African Dwarf cattle. *Trop. Agric. Trinidad*, 36: 299–303
14. **Nations Unies. 1992.** Convention sur la diversité biologique, 32p
15. **Ngono EPJ, Meutchieye F, Manjeli Y. 2019.** Biometric assessment of White Fulani cattle in a semi intensive production system in Northern Cameroon using principal components analysis. *Gen Biodiv J*, 3(2): 62-71.

16. **Nsangou A.S., Soh B.G., Kingsley M.T., Felix M. 2022.** Metric characteristics of the zebu (Bos indicus) gudali variety banyo in the high Guinean savannah area of Cameroon. *Black Sea Journal of Agriculture.* 5(2): xx-xx. doi: 10.47115/bsagriculture.1011651
17. **Pagot J. 1943.** Les zebus de l'Azaouak. Bull. *Sen. zootech. épizoot*. 6 : 155-163.
18. **Pagot.J et Delaine.R., 1959.-** Etude biométrique de la croissance des taurins N'Dama.- *Rév. Elev. Méd. Vét. Pays trop*, 4,405.416.
19. **Paguem A., Abanda B., Achukwi M.D., Baskaran p., Czemme S, Renz A., Eisenbarth A. 2020.** Whole genome characterization of autochthonous *Bos taurus* brachyceros and introduced *Bos indicus* cattle breeds in Cameroon regarding their adaptive phenotypic traits and pathogen resistance. *BMC Genetics*, 21:64
20. **Peter F. 2020.** Mesures de dispersion et de forme. Statistiques (les stats en bulles) / Pearson Education, 22p.
21. **Poivey.JP ; Landais.E et Seitz.JL., 1980.-**Utilisation de la barymétrie chez les races taurines locales de la Côte d'Ivoire.- *Rév. Elev. Méd. Vét. Pays trop*.33(3) ,311.317.
22. **Rege J.E.O. 1999**. The state of African cattle genetic resources I. Classification framework and identification of threatened and extinct breeds. *Animal Genetic Resources Information*, 25: 1–25
23. **Sow R.S., Denis J.P., Trail J.C.M. Thiongane P.I., Mbaye M. 1991**. Note sur la barymétrie comme moyen de sélection indirecte du poids vif chez le zébu Gobra au Sénégal. *Revue Eh. Méd. vét. Pays trop.* 44 (1) : 97-100
24. **Thys E et Christian S. 1986.** Des taurins et des hommes Cameroun, Nigeria. Institut français de recherche scientifique pour le développement en coopération. Éditions de l'Orstom Paris, 402 p.
25. **Thys E et Dineur. 1986.** Les Kapsiki : race taurine de l'extrême-Nord camerounais. Introduction et barymétrie. *Rev. Elev. Med. Vet. Pays trop*. 39(3-4) : 435-442
26. **Thys E., Wandi Z. 1970.** La race taurine namshi du Nord-Cameroun. Rapport de tournée de recensement des boeufs Namchi dans l'arrondissement de Poli. Sous-secteur de la Bénoué, Garoua, 13p
27. **Yahaya ZI, Dayo GK, Maman M, Issa M, Marichatou H. 2019.** Caractérisation morphobiométrique du zébu Djelli du Niger. *Int J Biol Chem Sci*, 13(2): 727-744.