Assessment of Morphological Differences in Taurine Breeds of Burkina Faso

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Abstract

This study aims to assess the morpho biometric characteristics of Gourounsi and Lobi cattle populations in Central-South, Central-West and South-West regions of Burkina Faso. These breeds were described using visual appraisal criteria and measurements. A total of twenty-three quantitative traits (such as muzzle circumference, horn length, withers height) and twenty-one qualitative parameters (such as horn shape, coat colour) were investigated within a sample of 159 cattle aged at least 5 (05) years. Quantitative data were analysed using descriptive statistics and multivariate analyses, while qualitative characteristics were assessed in terms of percentage of occurrence. The results indicate that the most distinguishing characteristic among the animals is their physical size. Typology through classification allowed for their separation into three distinct groups, but they are identifiable by two phenotypes: the small-sized Lobi cattle and the large-sized Gourounsi cattle. Analysis of the qualitative parameters does not provide enough information that would differentiate the three populations studied.

Keywords: Taurine cattle, Gourounsi, Lobi, morpho biometric, Burkina Faso

Différences morphologiques dans les populations taurines du Burkina Faso

Résumé

Cette étude vise à évaluer les caractéristiques morpho biométriques des populations taurines Gourounsi et Lobi dans les régions du Centre-Sud, centre-Ouest et Sud-Ouest du Burkina Faso. Ces animaux ont été décrits à l'aide de critères d'appréciation visuels et des mensurations. Vingt-trois traits quantitatifs (telles que la circonférence du museau, la longueur des cornes, la hauteur au garrot, etc.) et 21 paramètres qualitatifs (telles que la forme des cornes, la couleur du pelage, etc.) ont été étudiés sur un échantillon de 159 bovins âgés d'au moins cinq (5) ans. Les données quantitatives ont été analysées à l'aide de statistiques descriptives et d'analyses multivariées, tandis que les caractéristiques qualitatives ont été évaluées en termes

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de pourcentages d'apparition. Les résultats révèlent que les animaux se distinguent le mieux par leur format. La typologie par la classification a permis de les séparer en trois groupes mais identifiables sous deux phénotypes : les taurins Lobi de petite taille et les taurins Gourounsi, plus grands. L'analyse des paramètres qualitatifs ne donne pas des renseignements permettant de différencier les trois populations étudiées.

Mots clés : Taurins, Gourounsi, Lobi, morpho biométrie, Burkina

Introduction

In many African countries, livestock farming constitutes a socio-economic activity characterized by a wealth of animal genetic resources. These resources offer specific opportunities for exploitation depending on agro-ecological zones and disease resistance (FAO, 2008). This has facilitated the development of livestock farming in some challenging regions. Consequently, trypanosensitive zebus are found in arid regions, while trypanotolerant taurine's inhabit humid areas infested by tsetse flies, the principal vectors of trypanosomes (LHOSTE *et al*., 1993). In Burkina Faso, livestock farming holds significant socio-economic prominence, engaging over 80% of households as a source of total or partial income (MRA, 2008). This sector indeed contributes more than 18.2% to the country's Gross Domestic Product (GDP) and accounts for 26.3% of its export values, ranking as the third-largest foreign exchange earner after gold and cotton (MRAH, 2012). Within the broader livestock sector, cattle rearing assumes a substantial role due to its capacity to produce meat, milk and plowing. The Burkina Faso cattle population is estimated at 9.091 million heads (MRAH, 2014), with an annual growth rate of approximately 2%. Burkina Faso ranks second in the UEMOA region in terms of the numerical significance of its cattle population, trailing only behind Mali (MRA, 2006). It boasts a significant animal heritage, particularly the trypanotolerant cattle category, known as « Lobi/Baoulé » in the southwestern region and as « Gourounsi » taurine's in the Central-Western and Central-Southern regions. In these regions, livestock farming encounters a significant obstacle in the form of African animal trypanosomiasis transmitted by tsetse flies. Despite considerable efforts invested in combating this disease, including the administration of trypanocides and vector control, the complete eradication of trypanosomiasis remains a major concern (LANKOANDE, 2002). Nevertheless, these areas possess substantial livestock potential due to the availability of space for pasture, food resources and water. Farmers have the opportunity to increase both livestock numbers and animal production to meet the growing demand for animal-derived products. In this context, the exploitation of trypanotolerant cattle could be a viable and even desirable alternative for sustainable livestock farming in tsetse-infested areas. Unfortunately, taurine cattle are frequently crossbred with zebu populations because they often suffer from their small size and lower milk production compared to zebus. However, studies have shown that despite their small size, these breeds are more productive than trypanosomiasis-sensitive animals under tsetse fly infestation conditions (AGYEMANG *et al.*, 1997). There is a limited amount of research on the various indigenous taurine

breeds in the country, especially Gourounsi taurine's. Yet, knowledge in this regard can contribute to the preservation of taurine livestock, which represents cultural and socio-economic heritage. This necessitates not only maintaining the purity of the breed but also actively investing in its development. This study aims to determine the primary morphobiometric parameters of taurine populations in Burkina Faso and describe their phenotypic diversity.

I. Material and Methods

A cross-sectional survey conducted facilitated the collection of individual morphobiometric data from 159 taurine cattle individuals. The sampled individuals were from two taurine cattle breeds in Burkina Faso: the Gourounsi and the Lobi. Among these breeds, three distinct populations were identified, differentiated by their geographical regions. The Gourounsi breed, comprised two separate populations: one in the Sanguié province and another in the Nahouri province. In contrast, the Lobi breed, which predominantly inhabits the western region of Burkina Faso, was represented by a single population located in the Ioba province (Figure 1). This sample consisted of 134 females and 25 males, categorized into the following presumed taurine breeds: Gourounsi (89 females, 17 males) and Lobi (45 females, 8 males). The age range for females was between 5 and 17 years, while males ranged from 5 to 8 years. These animals were sampled across 23 villages spanning the three provinces within the study area. The higher number of females compared to males is justified by their numerical predominance and their longer duration within herds, whereas males are typically utilized at a relatively young age. Data collection methodology drew inspiration from the manual for training surveyors in morphobiometric surveys of local bovine breeds in West Africa, as part of the CORAF/Introgression 03.GRN.16 project. Qualitative characteristics encompassed head profile (concave, convex and straight), ear carriage (horizontal, erect and drooping), horn colour, muzzle colour, eyelid colour, hoof colour, head markings and horn shape, as well as attributes related to dewlap (developed, moderate, underdeveloped) and backline (concave, convex, straight). The coat was described in terms of its overall appearance (uniform, piebald, spotted) and colour (white, fawn, reddish fawn, wheat, black, red piebald, sandy, etc.). Particularities in the coat, such as brindling, speckling and mottling were also documented. Mammary development was assessed as developed, moderate or small. Measurements included dimensions of the head, horns and body were obtained using a measuring rod and a tape measure. A total of 25 measurements were recorded for each animal. Head measurements included head length, head width, skull length, skull width, face length and muzzle circumference. Body measurements encompassed height at the withers (HW), thoracic girth (TG), sacrum height (SH), scapulo-ischial length (SIL), chest depth (CD, chest width (CW), shoulder width (SW), hip width (HW), ischium width (IW), pelvic length (PL), teat length (TL) and tail length (TlL). These

measurements were conducted with efforts made to keep the animals as still as possible on level ground without any tension or arching. Due to the field survey conditions, most of measurements were made with animals confined in enclosures or grazing areas. In some cases, when facilities allow it, measurements were taken in restraining chutes. Live weights were ascertained utilizing an AGRETO digital scale, which boasts a capacity of 4,000 kg and precision to 0.001 kg. The animals were positioned on a flat surface interconnected with the digital scale through iron bars.

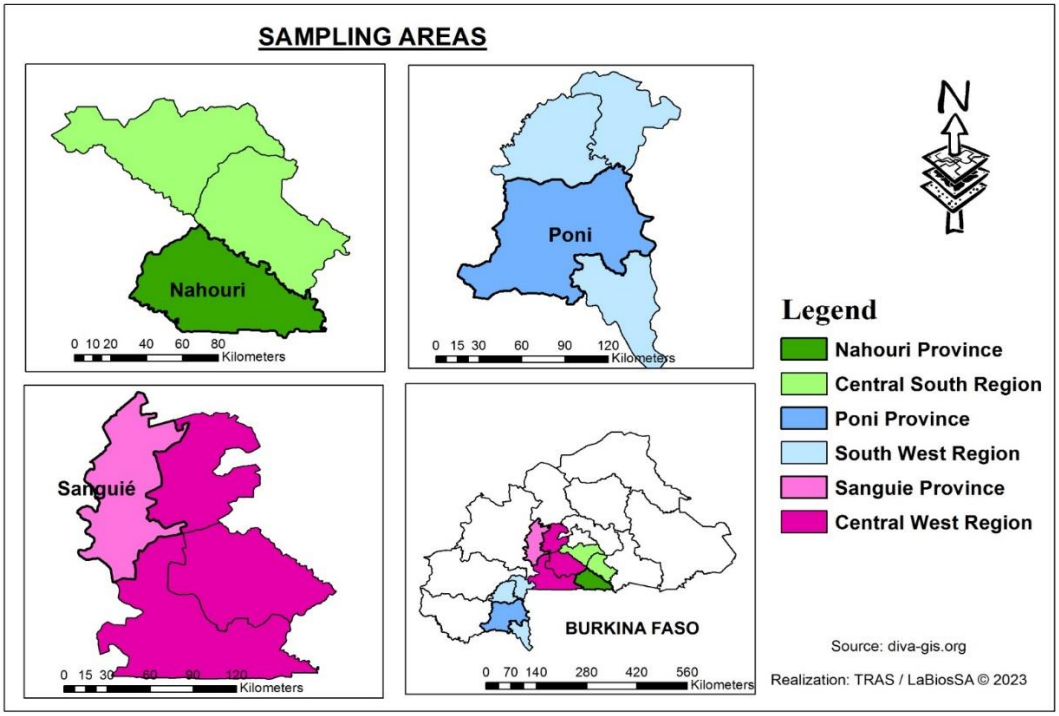

Figure 1 : Study area location map

Data Analysis

The survey data were entered using Excel 5.0 software and subsequently analysed using the R software (R Core Team, 2014). The lsmeans and hglm packages were used for modelling purposes in estimating least square means. Basic statistical data for both quantitative and qualitative body measurements were recorded. The least squares means and standard error were calculated for 23 morphological traits within each of the three sampled populations. Principal component analysis of the quantitative parameters and multiple correspondence analysis followed by hierarchical cluster analysis were conducted using the FactoMineR library to identify the characteristics that best separate the studied populations.

II. Results

II.1. Quantitative traits

Table 1 presents a general overview of the data, indicating that Lobi females are smaller in size and lighter than Gourounsi females. In terms of the evaluated quantitative parameters, the Lobi cattle exhibit lower values with a significant difference ($p<0.05$) compared to the Gourounsi one for most of the measurements, except for cranial width, facial width, muzzle circumference, ischium width and shoulder width, where no significant differences in means were observed. The same trend is observed in males (Table 1). The results in table 2 show that for most of the evaluated quantitative parameters, Lobi males have lower values than Gourounsi males. When compared to Gourounsi cattle from the Central-South region, Lobi cattle exhibit lower values with significant differences for 17 body traits measured in females and 19 for males. In males, only horn length, ischium width and hip width do not show statistically significant differences ($p<0.05$) in values (Table 2). Conversely, a comparison with Gourounsi from the Central-West region reveals more instances where differences in values between them and the Lobi are not statistically significant. These include facial widths, muzzle circumference, thoracic girth, chest depth and shoulder width. Tables 1 and 2 indicate that the measured values for the main evaluated body traits are higher in males than in females, except for Gourounsi from the Central-West region, where females appear to have higher values than males. However, considering the standard errors in these cattle breed, it is evident that they are higher in males. Consequently, the values in males exhibit a wider range than those in females. The average withers height varied from 100.5 ± 0.78 cm in Central-South Gourounsi females to 105.52 ± 1.98 cm in males, while in Central-West Gourounsi, it ranged from 101.32 ± 0.74 cm to 101.62 ± 2.37 cm in females and males, respectively, and in Lobi cattle, it ranged from 93.94 ± 0.75 cm in females to 95.81 ± 2.22 cm in males. The average scapulo-ischial length varied from 120.10 ± 1.01 cm in Central-South Gourounsi females to 125.90 ± 2.70 cm in males, while in Central-West Gourounsi, it ranged from 119.95 ± 0.96 cm to 117.28 ± 2.23 cm in females and males, respectively, and in Lobi cattle, it ranged from 110.41 ± 0.98 cm in females to 114.00 ± 3.02 cm in males. The average teat length varied between 2.16 ± 0.10 cm and 2.31 ± 0.09 cm in Gourounsi cattle and 1.26 ± 0.09 cm in Lobi one.

Table 1: Least Squares Means (in cm, except for live weight in kg) and their Standard Errors (in parentheses) of evaluated Body traits in females.

Body traits	Populations		
	GourCS	GourCW	Lobi
N	42	47	45
Live weight	181.28 (3.96)[a]	193.87 (3.74)[b]	164.57 (3.96)[c]
Head length	42.44 (0.29)[a]	42.81 (0.27)[a]	38.82 (0.28)[b]
Head width	18.77 (0.21)[a]	18.59 (0.20)[a]	17. 36 (0.20)[b]
Cranial length	20.98 (0.20)[a]	21.74 (0.19)[b]	20.35 (0.19)[a]
Cranial width	15.62 (0.18)[a]	15.36 (0.17)[a]	15.35 (0.17)[a]
Facial length	21.46 (0.30)[a]	20.86 (0.28)[a]	18.47 (0.29)[b]
Facial width	12.85 (0.16)[a]	12.61 (0.15)[a]	12.45 (0.15)[a]
Muzzle circumference	35.01 (0.34)[a]	34.54 (0.32)[a]	34.51 (0.32)[a]
Horn length	21.35 (0.93)[a]	22.62 (0.86)[a]	13.72 (0.88)[b]
Ear length	14.78 (0.25)[a]	14.56 (0.24)[a]	12.90 (0.24)[b]
Withers height	100.5 (0.78)[a]	101.32 (0.74)[a]	93.94 (0.75)[b]
Thoracic girth	134.97 (1.09)[a]	135.15 (1.03)[a]	131.70 (1.05)[b]
Sacrum height	104.67 (0.86)[a]	105.49 (0.81)[a]	96.70 (0.83)[b]
Scapulo-ischial length	120.10 (1.01)[a]	119.95 (0.96)[a]	110.41 (0.98)[b]
Body length	85.57 (0.84)[a]	85.76 (0.79)[a]	79.62 (0.81)[b]
Chest depth	50.46 (0.38)[a]	51.17 (0.36)[a]	49.07 (0.37)[b]
Chest width	14.98 (0.38)[a]	15.31 (0.36)[a]	12.05 (0.37)[b]
Shoulder width	25.38 (0.34)[a]	26.02 (0.32)[a]	25.39 (0.33)[a]
Hip width	27.35 (0.37)[a]	28.12 (0.35)[a]	29.32 (0.36)[b]
Ischium width	11.70 (0.21)[a]	11.87 (0.20)[a]	12.25 (0.20)[a]
Pelvic width	34.29 (0.58)[a]	34.27 (0.55)[a]	30.90 (0.56)[b]
Tail length	101.42 (1.75)[a]	95.89 (1.67)[b]	90.60 (1.69)[c]
Teat length	2.16 (0.10)[a]	2.31 (0.09)[a]	1.26 (0.09)[b]

GourCS: Gourounsi from the Central-South; GourCW: Gourounsi from the Central-West ; N : population size ; ([a,b,c]) Means with the same letter on the same line do not significantly differ at $p<0.05$.

Table 2: Least squares mean (in cm, except for live weight in kg) and their standard errors (in parentheses) of evaluated body traits in males.

Body traits	Populations		
	GourCS	GourCW	Lobi
N	10	7	8
Live weight	234.75(8.89)[a]	183.07(10.63)[b]	189.06 (9.94)[c]
Head length	43.90 (0.82)[a]	42.42(0.98)[a]	39.50 (0.92)[b]
Head width	20.60 (0.58)[a]	18.71 (0.69)[b]	17. 93 (0.64)[b]
Cranial length	22.40 (0.61)[a]	22.14 (0.73)[a]	20.62 (0.68)[b]
Cranial width	17.80 (0.49)[a]	16.71 (0.59)[a]	15.75 (0.55)[b]
Facial length	21.50 (0.52)[a]	20.28 (0.62)[a]	18.87 (0.58)[b]
Facial width	13.90 (0.29)[a]	12.71 (0.34)[b]	12.71 (0.32)[b]
Muzzle circumference	37.95 (0.64)[a]	35.28 (0.76)[b]	35.62 (0.71)[b]
Horn length	16.70 (1.44)[a]	16.92 (1.72)[a]	14.87 (1.61)[b]
Ear length	14.85 (0.51)[a]	13.85 (0.62)[a]	12.68 (0.58)[b]
Withers height	105.52 (1.98)[a]	101.62 (2.37)[a]	95.81 (2.22)[b]
Thoracic girth	143.50 (2.29)[a]	130.57 (2.74)[b]	134.87 (2.56)[b]
Sacrum height	109.72 (1.90)[a]	104.85 (2.28)[a]	98.53 (2.13)[b]
Scapulo-ischial length	125.90 (2.70)[a]	117.28 (2.23)[b]	114.00 (3.02)[c]
Body length	89.60 (2.40)[a]	83.00 (2.87)[b]	81.18 (2.69)[c]
Chest depth	53.48 (1.28)[a]	50.42 (1.53)[b]	51.51 (1.43)[b]
Chest width	13.86 (0.60)[a]	13.37 (0.72)[a]	11.83 (0.67)[b]
Shoulder width	29.08 (0.78)[a]	26.07 (0.93)[b]	26.13 (0.87)[b]
Hip width	30.30 (1.12)[a]	26.71 (1.34)[b]	29.50 (1.25)[a]
Ischium width	11.30 (0.48)[a]	10.42 (0.57)[a]	11.75 (0.53)[a]
Pelvic width	36.30 (1.34)[a]	34.28 (1.61)[b]	32.81 (1.50)[c]
Tail length	102.22 (2.23)[a]	94.00 (2.53)[b]	92.00 (2.37)[c]

GourCS: Gourounsi from the Central-South; GourCW: Gourounsi from the Central-West ; N : population size ; ([a, b,c]) Means with the same letter on the same line do not significantly differ at $p<0.05$.

II.2. Principal Component Analysis (PCA)

Out of the 159 sampled individuals, this projection involved 152 individuals, comprising 50 Lobi, 49 Central-South Gourounsi, and 53 Central-West Gourounsi. It enabled the identification of two dimensions explaining the variations: Dimension 1 accounts for 37.71% of the total variation, while Dimension 2 explains only 9.58% of this variation. The principal plane constructed by axes 1 and 2 (Figure 2) illustrates possible the various possible correlations between the variables. These variables include withers height, sacrum height, scapulo-ischial length, head length and width, facial length, ear length, pelvic length, tail length, cranial length, cranial width, chest width, chest depth, cranial width, hip width, muzzle circumference and live weight.

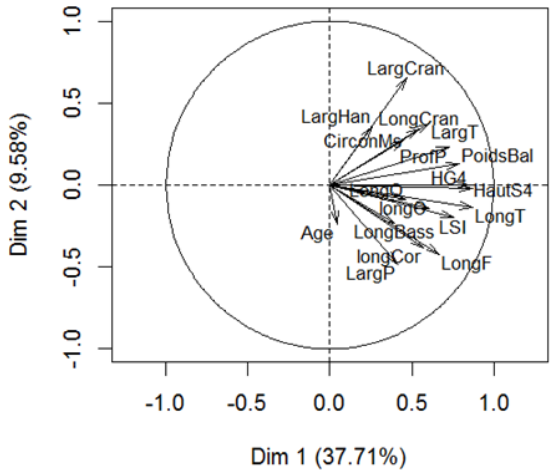

Figure 2 : Principal component projection on factorial Axes

II.3. Ascending Hierarchical Classification (AHC)

Ascending Hierarchical Classification (AHC), based on the Principal Component Analysis (PCA) data, facilitated the grouping of animals. The results of individual-level AHC were projected into a two-dimensional space and summarized by population in Figure 3. It illustrates the distribution of individuals into three groups: Group 1 in black, Group 2 in red, and Group 3 in green.

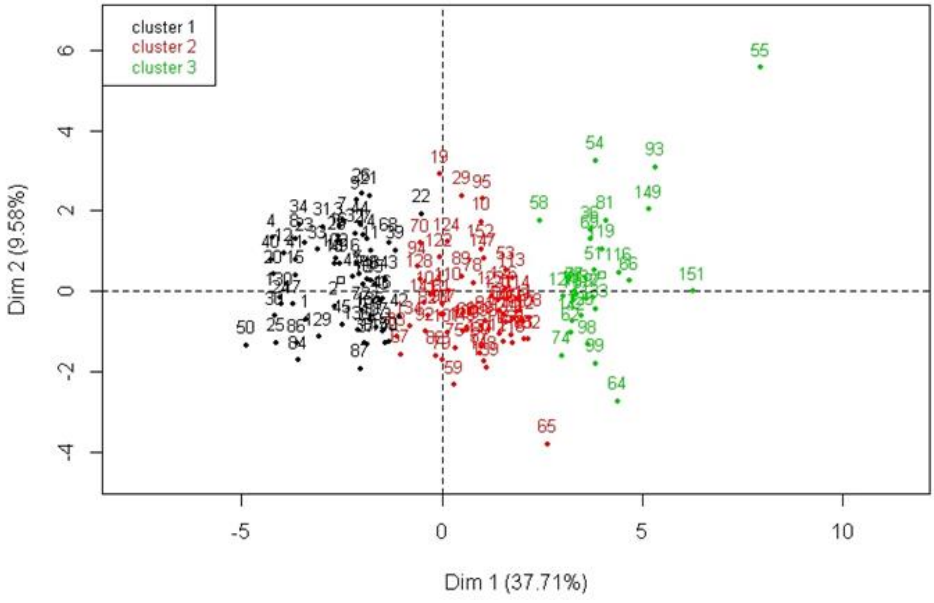

Figure 3: Graph illustrating groups on the two axes.

The percentages of the three populations' (Central-West Gourounsi, Lobi and Central-South Gourounsi) distribution in the groups have been calculated and presented in Table 3. It comes out that Group 1 is primarily composed of Lobi, while the Gourounsi are distributed in Groups 2 and 3. Regarding populations, 92% of Lobi are in Group 1, while 48.98% of Central-South Gourounsi and 64.15% of Central-West Gourounsi are in Group 2, and 34.69% of Central-South Gourounsi and 18.87% of Central-West Gourounsi are in Group 3. When considering the groups, it becomes apparent that Group 1 comprises 63 individuals, with 73.01% being Lobi, Group 2 consists of 61 individuals, 95.08% of which are Gourounsi, and Group 3 includes 28 individuals, with 96.43% being Gourounsi (Table 3).

Table 3: Distribution of Individuals in Groups (in percentage).

Populations	**Groups (samples size)**					
	Group 1(63)		Group 2 (61)		Group 3 (28)	
	Clas/mod	Mod/clas	Clas/mod	Mod/clas	Clas/mod	Mod/clas
GourCS (49)	16.33	12.70	48.98	39.34	34.69	60.71
GourCW (53)	16.98	14.29	64.15	55.74	18.87	35.72
Lobi (50)	92	73.01	6	4.92	2	3.57

Clas: group; mod: population; GourCS: Gourounsi from the Central-South; GourCW: Gourounsi from the Central-West **;**

The average characteristics of the groups have been calculated and presented in Table 4, along with their standard deviations. This table demonstrates that individuals in Group 1 have significantly lower means than the overall mean for 17 evaluated quantitative variables. They are characterized by their small size. In contrast, individuals in Group 3 have significantly higher means, distinguishing them by their large size. Group 2, situated between these two groups, consists of individuals with significantly higher means compared to Group 1 but significantly lower means compared to Group 3 (Table 4).

Table 4: Characteristics of the three population groups defined by HCA (in cm, except for live weight in kg)

Quantitative traits	Group 1	Group 2	Group 3
Sacrum height	96.68 ±3.41[a]	104.54 ±4.36[b]	112.16 ±3.88[c]
Head length	39.06 ±1.35[a]	42.52 ±1.68[b]	44.75 ±1.63[c]
Withers height	93.80 ±3.28[a]	100.51 ±3.94[b]	107.40 ±4.27[c]
Live weight	161.56 ±20.21[a]	183.96 ±30.39[b]	223.28 ±22.51[c]
Scapulo-ischial length	110.96±5.20[a]	119.28 ±5.84[b]	126.14 ±5.68[c]
Chest Depth	48.60 ±1.88[a]	50.48 ±2.85[b]	54.05 ±1.96[c]
Facial length	18.73 ±1.47[a]	20.88 ±2.10[b]	22.46 ±1.52[c]
Horn length	14.37 ±4.52[a]	20.81 ±6.35[b]	23.96 ±6.52[c]
Ear length	12.88 ±1.63[a]	14.59 ±1.42[b]	15.41 ±1.44[c]
Head width	17.51 ±1.21[a]	18.39 ±1.63[b]	18.85 ±2.38[c]
Cranial length	20.33 ±1.21[a]	21.47 ±1.15[b]	22.28 ±1.80[c]
Cranial width	15.22 ±1.13[a]	15.67± 1.36[b]	16.96 ±1.40[c]
Tail length	91.36 ±7.97[a]	96.15 ±11.52[b]	105.32 ±19.34[c]
Chest width	12.53 ±2.12[a]	14.92 ±2.69[b]	15.14 ±2.90[c]
Muzzle circumference	34.23 ±1.35 [a]	34.88± 2.18[b]	36.78 ±2.24[c]
Pelvic length	31.57 ±3.95[a]	34.27 ±3.32[b]	35.39 ±4.22[c]
Hip width	28.31 ±2.69[a]	27.72 ±1.61[b]	30.03 ±2.92[c]

([a, b,c]) Means with the same letter on the same line do not significantly differ at $p<0.05$

II.4. Qualitative traits

The frequencies of occurrence of qualitative traits evaluated per population for the 159 sampled individuals have been calculated and presented in table 5. From this table, it is evident that head profiles are straight in all individuals across the three sampled populations. The backlines are straight for all sampled individuals. The ears are held horizontally, hair is short and dewlaps are slightly developed.

Regarding coat characteristics, concerning the general appearance, it is observed that 61.1% of coats are uniform in Central-West Gourounsi cattle, 47.2% in Lobi and 38.5% in Central-South Gourounsi. They are spotted in 44.2% of the latter, 24.5% in Lobi and 20.4% in Central-West Gourounsi. The frequency of piebald coats is 28.3%, 18.5% and 17.3%, respectively among Lobi, Central-South Gourounsi, and Central-West Gourounsi. Regarding coat coloration, fawn, piebald and black coats are encountered among Lobi at 47.2%, 28.3% and 24.5%, respectively. Among Gourounsi, coats come in 5 colorations: fawn, sandy, black, piebald, and white, with percentages of 48.4%, 25.9%, 14.8%, 9.3% and 1.9%, respectively, in Central-West area, and 28.8%, 17.3%, 17.3%, 17.3% and 19.2%, respectively, in Central-South (Table 5). As for peculiarities, they show that animals are generally non-speckled (90.6%). There is the presence of Dark pigmentation patches (33.1% among Gourounsi and 17% among Lobi), white spots (approximately 17% among Lobi and Gourounsi) and speckling's (13.1% among Gourounsi cattle and only 1.9% among Lobi one). There is also a low presence of belly discoloration in fawn coats, namely 13.2% among Lobi and 1.9% among Central-South Gourounsi and 5.6% among Central-West Gourounsi. The inverted mule stripe is also noted (3.8% among Lobi and 5.6% among Gourounsi). Black pigment coloration of the muzzle, eyelids and hooves predominates in the sampled populations, with proportions of 94.3% among Lobi, 92.3% among Central-South Gourounsi and 100% among Central-West Gourounsi. Regarding mammary development, it is observed that 91.1% of female Lobi have small mammary glands. In contrast, among Gourounsi, mammary glands are mostly moderately developed (92.2% in Central-South and 66% in Central-West).

Table 5 : Frequencies of qualitative traits (in percentage)

Qualitative traits	Definition	Populations		
		GourCS	GourCW	Lobi
N		52	54	53
Cephalic profile	Straight	100	100	100
Ear carriage	Horizontal	100	100	100
Muzzle pigmentation	Pigmented	92.3	100	92.5
	Non-pigmented	7.7	0	7.5
Eyelid pigmentation	Pigmented	92.3	100	92.5
	Non-pigmented	7.7	0	7.5
Hoof pigmentation	Pigmented	92.3	100	94.3
	Non-pigmented	7.7	0	5.7
Horn colour	Black	34.6	31.5	35.8
	White	3.8	1.9	7.5
	Grey	5.8	5.6	0
	Bicolored	55.7	61.1	56.6
Head spot	Yes	13.5	11.1	7.5
	No	86.5	88.9	92.5
Dewlap size	small	100.0	100	100
Horn presence	Yes	100.0	100	100
Horn shape	Cut	13.5	22.2	9.4
	Crescent	71.1	57.4	73.6
	Crown	15.4	14.8	15.1
	Wheel	0	5.6	1.9
Back profile	Straight	98.1	100	100
	Concave	1.9	0	0
Coat appearance	Uniform	38.5	61.1	47.2
	Piebald	17.3	18.5	28.3
	Spotted	44.2	20.4	24.5
Hair type	Short	100	100	100
Coat colour	Black	17.3	9.3	24.5
	Piebald black	17.3	14.8	28.3
	White	19.2	1.9	0
	Fawn	28.8	48.4	47.2
	Sandy	17.3	25.9	0
Dark pigmentation patches	Absence	82.7	83.4	83
	Slightly brindled	7.7	9.3	0
	Moderately brindled	1.9	1.9	3.8
	Heavily brindled	7.7	5.6	13.2
White spots	Absence	86.5	96.3	83
	Irregular	13.5	3.7	15.1
	Lateral coloration	0	0	1.9

Speckling	Presence	0	3.7	5.7
	Absence	100	96.3	94.3
Brindle patterns	Absence	98.1	88.9	98.1
	Slightly brindled	1.9	3.7	1.9
	Moderately brindled	0	5.6	0
	Heavily brindled	0	1.9	0
Inverted mule stripe	Absence	100	94.4	96.2
	Presence	0	5.6	3.8
Belly coloration	Presence	98.1	94.4	86.8
	Absence	1.9	5.6	13.2
Mammary size	Moderately developed	95.2	66	8.9
	Small	4.8	34	91.1

GourCS: Gourounsi from the Central-South; GourCw: Gourounsi from the Central-West**,** N : population size.

III. **Discussion**

Although the assessment of morphological traits in animal breeds is quite common, especially in small ruminant breeds (TRAORE *et al.,* 2008), studies of this kind are relatively rare in bovine breeds. Such studies are often conducted with the objective of providing a morphological and geographical characterization of breeds at the sub-regional level within West Africa (TRAORE *et al*., 2015, 2016). The animal populations investigated in this study belong to the subgroup of taurine's, which are humpless cattle. These animals are primarily characterized as having short horns and are found in West Africa. This shared characteristic explains the uniformity observed among all sampled individuals in certain qualitative parameters evaluated in this study, such as head profile (straight), backline (straight), ear carriage (horizontal) and coat type (short). Similar observations were made by Traore *et al*. in 2015 regarding taurine breeds in West Africa. Quantitative parameters prove to be the most effective in distinguishing among the three taurine populations under study. These parameters are related to the size and proportions of the individuals, specifically involving the ratios of length, width and weight. Notably, the same parameters were employed by TRAORE *et al*. (2015) for the morphobiometric characterization of bovine breeds in West Africa. An analysis of body measurements reveals significant differences for most of the analysed traits between Gourounsi and Lobi cattle. These two breeds examined in this study exhibit substantial morphological differences: the Lobi cattle are smaller in size compared to the taller and slenderer Gourounsi cattle. Notable differences are observed in key parameters such as shoulder height, thoracic girth, scapulo-ischial length and live weight. These descriptive format parameters are typically employed in breed and genetic type characterization. They have been instrumental in identifying various beef cattle and dairy cow types in regions such as Abidjan, Bouaké, Gagnoa, and Korhogo in Côte d'Ivoire (SOKOURI *et al.,* 2007;

N'GORAN *et al.,* 2008). Based on the ranking and the percentage distribution of the different populations, the Lobi genetic type appears to be a more homogeneous population. Furthermore, the characteristics of the groups show a similarity between the two Gourounsi populations, as they are predominantly classified in group 2. These two populations could belong to the same genetic type. The individuals in group 3, constituting 18.42% of those individuals in the ranking, but mostly Gourounsi (96.43%), may be descendants of various crosses involving the Gourounsi genetic type and other genetic types, with a dominant Gourounsi phenotype. Similarly, the Gourounsi individuals found in group 1 (26.99%) and the Lobi classified in group 2 (4.92%) could be products of crosses involving both the Lobi and Gourounsi genetic types.

The results obtained from the analysis of qualitative parameters do not provide enough informations that allows for the differentiation of the three studies populations. For instance, regarding the overall appearance of the coats, uniform, spotted and piebald coats are observed in all three populations, although the percentages of occurrence may vary. However, distinctions are notable in terms of coat colour, with three variations observed in the Lobi (fawn fauve, black, piebald) and five variations in the Gourounsi (fawn, sandy, black, piebald, white). The primary differentiation is observed in the development of udders in females, with Lobi having small udders and the Gourounsi having moderately developed udders. This difference aligns with observations of teat length. The variation in teat length ranges from 1.17 to 1.35 cm in Lobi cattle and from 2.06 to 2.40 cm in Gourounsi cattle. This offers potential for improving dairy production and ease of milking in Gourounsi cows. The present study suggests that the distinction between the studied populations is primarily related to quantitative body parameters rather than qualitative traits. Among the animal populations analysed in this study, the Lobi cattle are considered a distinct breed, also known as Baoulé mostly in Côte d'Ivoire areas. The observed variations in withers height and live weight in all populations fall within the intervals described by NIANOGO *et al*. in 1996 as characteristic of the Baoulé breed in Burkina Faso. Therefore, these populations could be considered as part of the same Baoulé breed, with the different names simply reflecting the ethnic groups that raise them. However, based on the observed variations, they could also be classified into two genetic types: the Gourounsi taurine cattle and the Lobi taurine cattle.

Conclusion

The aim of this study was to evaluate the morphobiometric parameters of taurine breeds in Burkina Faso.

The results obtained from the analysis of these parameters revealed differentiation between the sampled Lobi population in the South-West region and the Gourounsi populations sampled in the Central-West and Central-South regions. Quantitative parameter averages were generally lower in Lobi cattle and higher in Gourounsi cattle,

with statistically significant differences. However, between the two Gourounsi populations, there was a similarity, as no significant differences were observed in the calculated averages.

Typology through hierarchical cluster analysis allowed for the separation of these populations into three identifiable groups. The first phenotype comprises the Lobi, characterized by their smaller size and lighter weight. The second phenotype consists of the Gourounsi cattle, characterized by their larger size and higher weight. This classification indicates that the Lobi constitute a more homogenous population compared to the Gourounsi populations. Among the latter, there is significant variability in the measured traits. However, the observed variations do not deviate from the defined ranges of the Baoulé breed, to which the Lobi taurine cattle of Burkina Faso are identified.

The results obtained from the analysis of qualitative parameters did not provide enough informations to differentiate the three studied populations. The variations observed in the general appearance of coats, their colorations and characteristics were present in all three populations. Nevertheless, a difference was noted in the development of udders in females.

Based on the morphological variations observed, the taurine breeds studied can be classified into two genetic types: Gourounsi taurine cattle and Lobi taurine cattle. The variability in body traits observed within the Gourounsi genetic type suggests that selection and improvement crossbreeding within these populations would be possible. The differences in udder development offer potential for improving dairy production and ease of milking in Gourounsi cows. These variations could also be the result of absorption crossbreeding with other genetic types, particularly zebus. This may pose a threat to the genetic integrity of taurine breeds and the risk of losing specific adaptive characteristics, such as trypanotolerance.

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