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Morphological Indices for Assessment of Ethnological and Functional Traits in West African Dwarf Goats Population in Nigeria

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Abstract

This study was conducted to assess the morphological indices for assessment of ethnological and functional traits in West African Dwarf Goats (WAD) population in Nigeria. Data were collected on morphometric traits of 150 WAD goats sampled. The morphological data collected were used to estimate body indices of the goats. Data were also collected on dentition (Pair of Permanent Incisor), prolificacy and parity of the goats. Data were analysed using the general linear model (GLM) procedure. The results revealed that WAD goat is a robust, short-legged, balanced with good thoracic and marked signs of adaptation to its environment. Its compact index suggests the goats as dual purpose type animal although it is used for meat production. Most of the ethnological and functional traits were significantly affected ($p<0.05$) by age of the goats while most of the ethnology and functional traits were not significantly affected ($p<0.05$) by parity and prolificacy of the goat. In conclusion, the ethnological and functional traits as obtained in this study for WAD goats revealed potentials of the goats for type and production performance, this will serve the purpose for designing appropriate conservation, breeding, selection and sustainable utilization strategies for WAD goat population.

Keywords: Body indices, ethnology, functional, goats, traits

الملخص

في نيجيريا .تم جمع (WAD) أجريت هذه الدراسة لتقييم المؤشرات المورفولوجية لتقييم السمات العرقية والوظيفية في سكان غرب أفريقيا القوارب الماعز .تم استخدام البيانات المورفولوجية التي تم جمعها لتقدير مؤشرات الجسم WAD من عينات 150 morphometric البيانات على سمات وتكافؤ الماعز .تم تحليل البيانات باستخدام إجراءات النموذج prolicacy للماعز .كما تم جمع البيانات عن طب الأسنان)زوج القطع الدائم (، و الماعز هو قوية وقصيرة الساق ومتوازنة مع علامات الصدر والعلامات الملحوظة على التكيف WAD كشفت النتائج أن .(GLM) الخطي العام مع بيئتها .يشير مؤشره المدمج إلى الماعز باعتبارها حيوانًا مزدوجًا من نوعه على الرغم من أنه يستخدم لإنتاج اللحوم .تأثرت معظم الصفات من خلال ($p<0.05$) حسب عمر الماعز في حين لم تتأثر معظم السمات العرقية والوظيفية بشكل كبير ($p<0.05$) العرقية والوظيفية بشكل كبير الماعز كشفت إمكانات WAD للماعز .في الختام، السمات العرقية والوظيفية كما تم الحصول عليها في هذه الدراسة لـ prolicacy التكافؤ و الماعز لأداء النوع والإنتاج، وهذا سيخدم الغرض من تصميم استراتيجيات الحفظ المناسبة، تربية، اختيار، والاستفادة المستدامة لسكان الماعز WAD

الكلمات المفتاحية: مؤشرات الجسم، الإثنولوجيا، الوظيفية، الماعز، الصفات

Introduction

The West African Dwarf (WAD) goat is commonly found in the rainforest region of Southern Nigeria. These goats are known for their ability to provide food, nutrition, and financial security to poor households. They are relatively small in size, require low feed, and can adapt to different systems of raising (Missohou *et al*. 2016). They are highly productive animals, with the ability to breed all year round; they can have up to three parturitions in two years (Oseni et al., 2017). The WAD goats are also hardy, able to thrive and survive in harsh environmental conditions of heat and humidity. They can digest a wide range of diets and are resistant to high-humidity pathogens. These goats are tolerant of gastrointestinal nematodes and trypanosomiasis (Chiejina et al., 2010), making them a popular choice for farmers and households in the region.

Characterization of local genetic resources depends on the knowledge of the variation of

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morphological traits, which have played a very fundamental role in the classification of livestock based on size and shape (Leng *et al*., 2010). Morphological traits of animals play important roles in the identification of breeds with desirable characteristics. Morphological measurements have been traditionally used for characterization of local sheep and goat breeds by many researchers in Nigeria (Yakubu *et al*., 2011; Okpeku *et al*., 2011). However, several authors have reported their preference for morphological indices over morphological measurement because of its ability to capture animal's conformation better, it also gives better objective assessment of the animal from its type point of view (Salako, 2006; Popoola 2015; Popoola and Adekanbi, 2017; Putra and Ilham, 2019).

There are two types of morphological indices as reported by Equivelzeta *et al*. (2011); ethnological and functional indices. According to the authors, ethnological indices provide general information about the characteristics of livestock breeds, describing their structure and proportions while functional indices describe the type, aptitude and production performance of the animal. This study was conducted to investigate the type and functional traits of Nigerian WAD goats as affected by non-genetic factors to harness the potential of these goat populations for efficient utilization

Materials and Methods

The study was conducted in Oyo and Ogun states, Southwestern Nigeria. The region has a tropical climate with distinct wet and dry seasons. The temperature ranges from 21°C to 34°C, and the annual rainfall varies between 1500mm and 3000mm. During the wet season, the Southwest monsoon wind from the Atlantic Ocean brings heavy rainfall, while the dry season is associated with the northeast trade wind from the Sahara Desert. The vegetation in Southwest Nigeria includes freshwater swamps and mangrove forests along the coast, lowland forests stretching inland to Ogun and parts of Ondo state, and secondary forests towards the northern boundary where derived and southern savannah exist.

A longitudinal survey was conducted to describe the morphological characteristics of WAD goats in the study areas. The states were purposely selected based on the abundance of WAD goat flocks under smallholder systems. A total of 150 adult goats were randomly sampled for morphological characterization. The age of each goat was obtained from the owners and confirmed by examining their teeth as per the FAO (2012) guidelines. All the individual animals sampled were considered as a subpopulation of the WAD goat population.

Table 1. Definition of morphological indices calculated for each WAD goat

Indices	***Type traits**	****Estimation of indices**
CFI	Functional	$(CW)^2/SH$
DTI	Functional	CW/HG
CPI	Functional	•••Weigth/SH
OII	Functional	RH /WH
Height index	Ethnological	(WH /BL)*100
Height slope	Ethnological	RH – WH
Length index	Ethnological	(BL / CG)*100
Depth index	Ethnological	CD /WH
Fore leg length	Ethnological	WH – CD
Body index	Ethnological	(BL /CG)*100
Body ratio	Ethnological	WH / RH
Cephalic index	Ethnological	(HW / HL)*100
Thoracic development	Ethnological	CG / WH

*OII- Over increase index, HS- Height slope, LI- Length index, DI-Depth index, FLI- Fore leg length, BI- Body index, BR- Body ratio, CI- Conformation index, TD- Thoracic development, DTI- Dactyl thorax index, CPI- Compact index, PI- Pelvic index, CFI- Conformation index, HG- Heart girth, CD-Chest depth, CW-Chest width, SH-Sternum height, HW-Head width, HL-Head length, NL-Neck length, NW-Neck width, WH-Wither height, BL-Body length, RH-Rump height, RW-Rump width ; *Type traits - Ethnological indexes contributed general information about breed characteristics whereas functional indexes contributed information about the type, purpose and performance of the breed. ** Esquivelzeta et al., (2011); Popoola (2015) ; ••• Weigth = HG *80 (Chacon et al., 2011)*

The morphological measurements that were taken include heart girth, chest depth, chest width, sternum height, head width, head length, neck length, neck width, wither height, body length, rump height, rump width, the measurements were taken as previously described (Yakubu *et al*. 2010; Chacón *et al*. 2011; Popoola and Adekanbi 2017). The linear body measurements were taken using a metric tape early in the morning before the animals were fed to avoid biases on certain traits due to feed intake. The morphological traits measured were used to estimate the functional and ethnological indices (Table 1) of individual animals (Chacón *et al.* 2011; Khargharia *et al.* 2015).

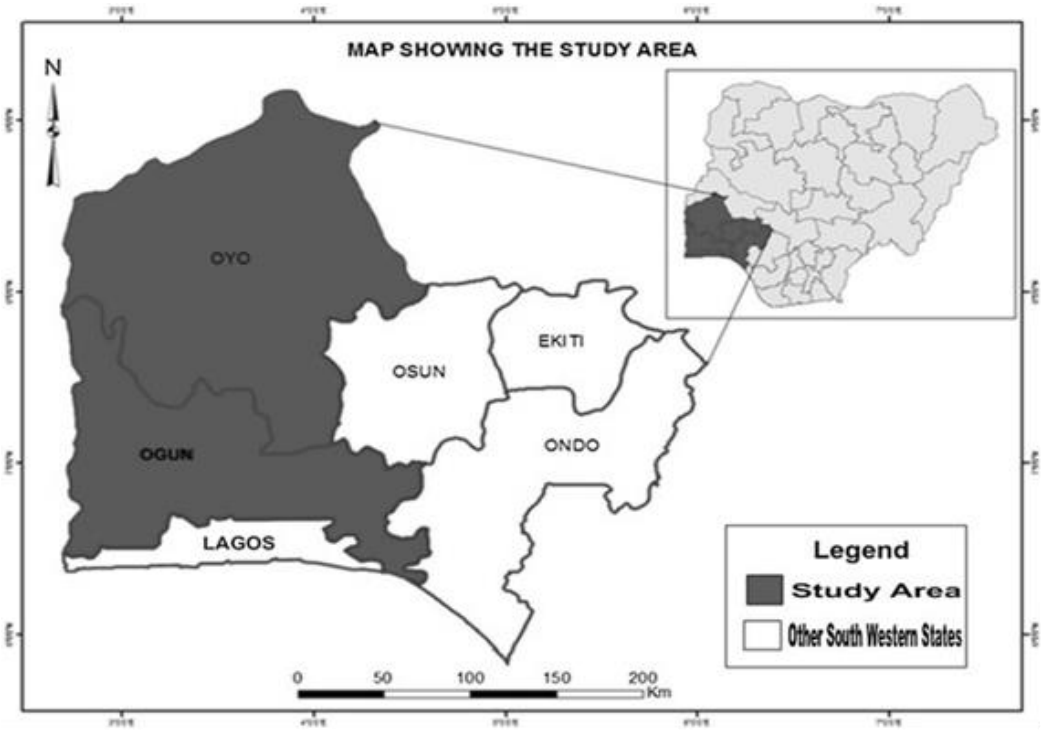

Fig. 1 Map of the sampling areas (Oyo and Ogun), Southwest, Nigeria (Akinbobola and Akinagbe, 2022)

Data were also collected on prolificacy (single, twins and triplet), types of parity (primiparous, multiparous) and age of the goats. Data were subjected to the PROCMEANS procedure of SAS version 9.4 software (SAS Institute Inc., Cary, NC, USA). All indices were analysed using the following linear model:

$y_{ij} = \mu + \alpha_i + e_{ij}$ where;
y_{ij} - the morphological indices,
μ - overall mean,
α_i - effect of parity, age, prolificacy (ith = 4, for parity, age, prolificacy)
e_{ij} - residual error of null average and a constant variance.

Results

The overall descriptive statistics of morphological traits of WAD goats is presented in Table 1. The results revealed that lowest mean values was obtained in neck width (9.90 ± 1.97cm) while the highest value of mean was obtained in body length of the goats (72.26 ± 7.14cm). There were relatively low variabilities as indicated by the coefficient of variation ranging between 9.49% and 26.19% with the lowest obtained in body length and the highest obtained in chest width.

The result of the descriptive analysis of the body indices of WAD goats is presented in Table 2. The height index of the goats revealed that height at withers is more or less similar to their body length. The over increase index indicates that the goats' hind region (rump) is higher than the front region (wither). The height slope indicates that the rump is approximately 25% of the whole body of the goats. The length index indicates that WAD goat is longiline (>0.9) type. The foreleg length is a type of trait indices derived from measurements more closely related to bone growth; the result obtained indicates appropriate foreleg length. For body index, the body length is higher than the heart girth and

the body index value showed that the animals are longline. Result of body ratio reveals that height at withers is slightly lower than height at rump. The cephalic index reveals that the head length predominated over the head width which implies that WAD goat is long-headed (dolicocephalic). The findings pertaining to the thoracic development show that heart girth is slightly lower than the height at withers. The dactyl thoracic index of the goats shows that WAD goat is an heavy meat type goat. The compact index of WAD goats indicates the aptitude of the goats, the result shows that WAD goat is suitable for dual purpose. The findings pertaining to the thoracic development indicate that the heart girth is lower than the height at withers. The WAD goat possesses high conformation index which implies that the goat is a robust animal.

Table 1: Descriptive statistics of body morphology of WAD goats

Traits (cm)	Mean	Min	Max	SD	Var.	CV
HG	61.99	20.00	89.00	7.75	60.07	12.50
CD	27.07	6.00	44.00	5.63	31.64	20.78
CW	12.01	4.50	27.00	3.15	9.89	26.19
SH	30.71	12.00	52.50	4.94	24.41	16.09
HW	10.11	6.00	19.00	1.66	2.76	16.42
HL	17.91	7.50	26.00	2.18	4.74	12.15
NL	15.28	9.00	29.00	3.59	12.91	23.52
NW	9.90	6.00	18.00	1.97	3.87	19.87
WH	46.45	8.00	87.00	6.51	42.40	14.02
BL	72.26	52.00	94.00	7.14	50.99	9.49
RH	48.88	33.00	80.00	5.84	34.13	11.49
RW	15.23	9.00	25.00	2.97	8.76	19.47

HG- Heart girth, CD-Chest depth, CW-Chest width, SH-Sternum height, HW-Head width, HL-Head length, NL-Neck length, NW-Neck width, WH-Wither height, BL-Body length, RH-Rump height, RW-Rump width, Min-Minimum, Max- Maximum, SD –Standard variation, Var –Variance, CV- Coefficient of variation

Table 2: Descriptive statistics on body indices of WAD goats

Indices	Mean	Standard Deviation	Variance	Coefficient Of Variation
Functional traits				
CFI	75.15	12.97	8.84	57.76
DTI	12.20	3.05	7.01	27.65
CPI	9.10	1.27	2.07	30.17
OII	107.67	27.51	37.01	25.57
Ethnological traits				
HI	62.09	9.43	89.93	15.19
HS	2.42	6.38	40.67	22.99
LI	1.67	0.57	0.32	34.08
DI	0.60	0.17	0.03	28.08
FLL	19.38	7.63	58.19	39.36
BI	123.60	24.97	23.44	20.20
BR	0.96	0.13	0..02	14.00
CI	57.49	14.00	17.48	25.06
TD	1.37	0.45	0.20	32.62

HI- Height index, OII- Over increase index, HS- Height slope, LI- Length index, DI-Depth index, FLI- Fore leg length, BI- Body index, BR- Body ratio, HG- Heart girth, CI- Conformation index, TD- Thoracic development, DTI- Dactyl thorax index, CPI- Compact index, CFI- Conformation index

The correlation analysis of morphological traits of WAD goats is presented in Table 3. The result shows significant relationship ($p<0.05$) in most of the traits. Significant, medium and positive correlation were obtained between heart girth and head length, heart girth and body length, chest depth and chest width, chest depth and rump height, chest width and head width, chest width and neck

width, chest width and rump height, chest depth and rump width, sternum height and neck length, head width and neck width, head width and rump height, head width and rump width, head length and rump height, neck width and rump width, wither height and rump height,rump height and rump width. However, some traits were also negatively correlated

Table 3: Correlation on body morphology and indices of WAD goats

Variables (cm)	HG	CD	CW	SH	HW	HL	NL	NW	WH	BL	RH	RW
HG		0.13	0.32*	0.30*	0.21	0.44*	0.27*	0.29*	0.30*	0.48*	0.31*	0.22
CD			0.40*	0.12	0.30*	0.02	-0.14	0.33*	0.22	-0.10	0.45*	0.26*
CW				-0.01	0.60*	0.13	-0.04	0.58*	0.30*	0.23	0.47*	0.44*
SH					-0.11	0.37*	0.42*	0.05	0.16	0.28*	0.14	-0.09
HW						0.11	-0.03	0.51*	0.25*	0.26*	0.41*	0.49*
HL							0.34*	0.11	0.23	0.44*	0.26*	0.07
NL								0.04	-0.01	0.34*	-0.07	-0.16
NW									0.15	0.26*	0.36*	0.53*
WH										0.26*	0.47*	0.23
BL											0.31*	0.25*
RH												0.42*
RW												

*HG- Heart Girth, CD- Chest Depth, CW- Chest Width, SH- Sternum Height, HW- Head Width, HL- Head length, NL- Neck Length, NW- Neck Width, WH- Wither Height, BL- Body Length, RH- Rump Height, RW- Rump Width; * - Significant at p<0.05*

Table 4: Effect of age on body indices of WAD goats

Variables	1PPI	2PPI	3PPI	4PPI	p-value
Functional Traits					
DTI	0.22±0.01	0.21±0.00	0.19±0.01	0.23±0.01	ns
OII	108.31±1.33	108.31±1.33	120.68±5.66	117.29±9.69	*
CPI	0.67±0.03	0.89±0.03	0.96±0.04	1.09±0.15	*
CFI	4.92±0.28	5.68±0.21	5.48±0.51	7.51±1.38	*
Ethnological traits					
FLL	16.89±0.79	17.39±0.62	13.56±1.95	13.17±4.47	ns
BI	126.33±5.23	123.49±2.29	115.94±3.29	116.35±4.71	ns
BR	0.96±0.01	0.93±0.01	0.86±0.03	0.88±0.097	*
HI	65.99±1.19	63.37±0.70	60.56±3.63	54.82±3.68	*
TD	1.25±0.04	1.31±0.02	1.54±0.09	1.62±0.13	*
CI	60.74±1.22	59.22±0.94	61.28±3.72	54.47±3.75	ns
DI	0.62±0.01	0.64±0.01	0.73±0.05	0.74±0.09	*
LI	1.53±0.03	1.60±0.02	1.78±0.12	1.88±0.17	*
HS	2.13±0.68	3.51±0.45	7.37±1.57	6.33±3.55	*

*OII- Over increase index, HS- Height slope, LI- Length index, DI-Depth index, FLI- Fore leg length, BI- Body index, BR- Body ratio, CI- Conformation index, TD- Thoracic development, DTI- Dactyl thorax index, CPI- Compact index, PI- Pelvic index, CFI- Conformation index; 1PPI-1 to 1.5 years; 2PP1 - 1.5 to 2 years ; 3PPI - 2.5 to 3 years ; 4PPI - 3.5 to >4 years; (PPI – Pair of permanent incissors); *: significant (p<0.05); ns: not significant (p>0.05).*

The effect of age on the body indices of WAD goats is presented in Table 4. The result shows significant effects (p>0.05) of age on all functional traits of the goats except the dactyl thoracic index. Goats with four permanent pairs of incisors (PPI) recorded the highest values of dactyl thoracic index, compact index and conformation index while the highest over-increase index was obtained in goats with three PPI. Similarly, all ethnological traits were significantly affected (p<0.05) by the age of the

goats except foreleg length and body index. Goats with four PPI recorded the highest values of thoracic development, depth index and length index. The highest values of height slope and cephalic index were obtained in goats with three PPI. Goats having two PPI had the highest values of foreleg length, body index and body ratio. The highest height index was obtained in goats with one PPI.

Table 5: Effect of prolificacy on body indices of WAD goats

Indices	Single	Twins	Triplets	p-value
Functional traits				
DTI	0.21±0.07	0.21±0.00	0.21±0.01	ns
CFI	4.86±0.25	5.93±0.22	5.93±0.89	ns
OII	106.65±1.29	111.33±1.89	111.13±6.18	ns
CPI	0.74±0.28	0.93±0.27	0.93±0.09	*
Ethnological Traits				
BI	125.09±3.59	121.36±2.26	123.03±3.87	ns
FLL	16.65±0.62	16.49±0.76	17.28±2.85	ns
BR	0.94±0.01	0.92±0.01	0.92±0.04	ns
HI	64.49±0.84	62.64±1.06	60.50±3.40	ns
TD	1.28±0.03	1.37±0.29	1.39±0.11	ns
DI	0.63±0.01	0.66±0.02	0.66±0.06	ns
LI	1.56±0.02	1.65±0.04	1.71±0.13	ns
HS	2.86±0.51	4.42±0.58	4.33±2.14	ns
CI	60.23±0.82	59.40±1.25	58.05±3.11	ns

*OII- Over increase index, HS- Height slope, LI- Length index, DI-Depth index, FLI- Fore leg length, BI- Body index, BR- Body ratio, CI- Conformation index, TD- Thoracic development, DTI- Dactyl thorax index, CPI- Compact index, PI- Pelvic index, CFI- Conformation index; *: significant (p<0.05); ns: not significant (p>0.05)*

Table 6: Effect of parity on body indices of WAD goats

Indices	Multiparous	Primiparous	p-value
Functional Traits			
DTI	0.21±0.00	0.22±0.01	ns
OII	110.69±1.53	105.62±1.69	ns
CFI	5.69±0.18	5.11±0.42	ns
CPI	0.91±0.02[a]	0.68±0.04[b]	*
Ethnological Traits			
BI	122.50±1.88	123.41±5.60	ns
BR	0.92±0.01	0.95±0.01	ns
FLL	16.45±0.63	17.25±0.85	ns
HI	62.34±0.84 [a]	66.77±1.24 [b]	*
CI	59.47±0.06	60.14±1.27	ns
TD	1.36±0.02	1.27±0.04	ns
DI	0.66±.0.01	0.62±0.01	ns
LI	1.65±0.03[a]	1.51±0.03[b]	*
HS	4.24±0.48	3.38±0.69	ns

*OII- Over increase index, HS- Height slope, LI- Length index, DI-Depth index, FLI- Fore leg length, BI- Body index, BR- Body ratio, CI- Conformation index, TD- Thoracic development, DTI- Dactyl thorax index, CPI- Compact index, PI- Pelvic index, CFI- Conformation index; *: significant (p<0.05); ns: not significant (p>0.05)*

The effects of parity on the body indices of WAD goats is presented in Table 6. The result revealed no significant effects (p>0.05) of parity on all the functional traits except the compact index. Goats with more than one parity (multiparous) had higher values of overall increase index, conformation index and compact index than primiparous (one parity) goats. While primiparous goats possessed higher value of dactyl thorax index. Similarly, all ethnological traits were not significantly affected (p>0.05)

by parity of the goats except height index and length index. Goats with many births recorded higher values of thoracic development, depth index, length index and height slope while higher values of body index, body ratio, foreleg length, height index and cephalic index was obtained in primiparous goats.

Discussion

The summary statistics shows mean, standard deviation, and coefficient of variation of each morphometric traits. Mean values obtained in this study for wither height, chest width, chest depth, and body length were higher than those reported by Yakubu *et al*. (2011) for WAD goats. Chest width was the most variable body morphometric trait while body length was the least variable trait. This implies that genetic improvement of these traits through selection is possible. The coefficient of variation obtained in this study agrees with result of previous studies on goats (Khargharia *et al*., 2015; Getaneh *et al*.; 2022; Ilham *et al*. 2023).

Estimation of various body indices gives room for ethnological classification and functional classification of livestock breeds, particularly ruminants (Esquivelzeta *et al*., 2011); ethnological indices give general information about livestock breed characteristics in terms of describing structure and proportions which are morphological characteristics of an animal while functional indices provide information about the type, aptitude and production performance of the animal. In the present study, ethnological and functional indices were estimated from the morphometric traits to assess the size and proportion of WAD goats as well as to provide information on the type and production abilities of WAD goats. Observations of functional indices were indicated by the conformation index, compact index, over-increase index and dactyl thoracic index. The conformation value indicated that WAD goat is a robust animal; the value obtained in this study is greater than conformation value reported for Hararghe highland goat populations (Alefe *et al*., 2022) but lower than that of Etawah Crossbreed, Local Gorontalo and Kacang goats reported by Ilham *et al*., (2023). The dactyl thoracic index (DTI) indicates that WAD goat is an heavy meat type animal according to Chacón *et al*. (2011); the DTI value is greater than 11 which implies that WAD goat is hypermetric that is, it possesses meat phenotype. According to Barragan (2017), DTI indicates the degree of fineness of the skeleton, classifying the animals as hypermetric (large format), eumetric (medium format), elipometric (small format), in dairy (<10) and meat (>11) animals. Lower values of DTI have been previously reported for various goat breeds; Cuban goats (Chacón *et al*.2011); indigenous goats of Ethiopia (Getaneh *et al*., 2022); Hararghe highland goat (Alefe *et al*., 2022). The compact index indicates the aptitude of the animal. The compact index value obtained in this study for WAD goats is 9.10 which implies that the goats are suitable for dual purpose (Dauda 2018). Results obtained for over increase index show that the hind region of these animals are higher than the front, this implies that WAD goats are balanced. According to Chacón *et al*. (2011), a balanced animal is known to have better production and health especially in uneven terrains.

Similarly, Table 1 presents results of ethnological indices of the goats. It can be inferred from the results of the height index that, height at wither is 62% of the body length of the goat. The height slope indicates that the slope of the goats is backwardly aligned. Ilham *et al* (2023) reported a higher height slope for Etawah Crossbreed goats and a lower height slope for Local Gorontalo and Kacang goats. The length index shows that WAD goats are longiline type having a length index of values greater than 0.90 Chacón *et al*., (2011). The length index of goats reported in this study was higher than that of other reported breeds of goats (Chiemela *et al*., 2016; Dea *et al*., 2019; Hankamo *et al*., 2020; Chacon *et al*., 2011; Putra and Ilham, 2019). A depth index of >0.5 was categorized as short-legged goats, and <0.5 was long-legged goats. The result of the depth index obtained in this study confirmed that WAD goats are short-legged goats which suggests the name given to the breed along with their origin. The foreleg length obtained in this study was lower than that reported for some breeds (Ilham *et al*. 2023). The body index indicated that WAD goat is a longiline breed of goat having a body index greater than 90. A similar result was reported by Popoola and Adekambi (2017). The body ratio indicates that WAD goat is low in the front having withers lower than the rump. The cephalic index indicates that WAD goat has braquicephalic tendency (short-headed). An individual that is short-headed is said to be braquicephalic or brachycranial (Schlueter *et al*., 2009). The thoracic

development indicate that the heart girth is slightly higher than the height at withers of the WAD goat. The value for thoracic development of WAD goats obtained in this study is higher than the recommended value (1.2) for good thoracic development (Concepta *et al*. 2008). Khargharia *et al*., (2015) reported that thoracic development is an essential indicator of good fitness and the respiratory system, especially for breeds that adapt to higher altitudes. Lower thoracic development was reported for Cuban creole goats (Chacón *et al*. 2011).

In general, correlations between the linear traits were medium, significant and positive, except for some traits. This is expected as animals that were large for one trait tend to be large for others. Similar results of phenotypic correlations among body measurements of goats have been reported in earlier studies (Sowande *et al*., 2010; Nafti *et al*., 2014; Popoola and Adekambi, 2017).

The effects of age on ethnological and functional attributes of WAD goats were also assessed in this study. Results revealed that the functional traits of the goats increased with their ages, this may be due to the fact that these traits are production performance traits which are dependent on age. Similarly ethnological traits were also affected by age of these animals which suggests that age is an important factor in structural attributes of an animal as most of these traits are related to bone growth as reported by Dauda (2018). Salako (2006) also reported variabilities in indices across age group of Yankasa and WAD sheep.

The type of birth by WAD goats had no effect on both ethnological and functional traits of the goats. However compact index was affected by prolificacy of the animal; goats with single birth recorded lowest value while close value of the index was obtained in WAD goats with twins and triplets. This suggests that prolificacy enhances production performance of WAD goats with respect to milk production particularly for suckling by the kids.

Similarly, compact index of WAD goats were affected by parity, while other ethnological traits of the goat were not affected. Multiparous goats recorded higher compact value which may probably due to development of physiological processes with increase in parity of the doe as suggested by Navin *et al*., (2019). Height index and length index were the ethnological traits affected by the parity of does.

Conclusion

West African Dwarf goats is a short-legged and short-shaped body frame goat with good thoracic and marked signs of adaptation to its environment. Its morphology based on the functional traits corresponds to dual purpose type animal although it is used for meat production. There were observed variabilities in type, aptitude, production performance and structure of the goat by their age. However, most of the indices were not affected by prolificacy and parity of the goats. The ehtnological and functional traits as obtained in this study for WAD goats reveal potentials of the goats for type and production performance, this will serve the purpose for designing appropriate conservation, breeding, selection and sustainable utilization strategies for WAD goat population.

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Data availability

Data will be provided based on request

Author's Contributions

Popoola Moshood Abiola was the Principal investigator, he designed the project, was involved in field work for data collection and manuscript preparation while Adeoye Mukhtar Adedayo, Mufutau Omotolani Islamiyat, Busari Taiwo Ameen, Kuponiyi Samuel Olumide and Quadri Olanrewaju Azeez were involved in field work for data collection and manuscript preparation

Ethics

Author declares that there are no ethical issues that may arise after the publication of this manuscript

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