Original Research Article

Zootechnical Index Analysis of West African Dwarf Rams in Southwestern Nigeria

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Abstract

The study was conducted to evaluate the zootechnical index analysis of West African Dwarf (WAD) rams. Twenty body measurements were taken on 100 WAD rams of average ages of 18-24 months. Data collected were subjected to PROCMEANS procedure of the SAS (2004) package. The average body weight of the animals was 39.20 ± 0.95 kg, the coefficient of variation indicated variability between 1.45% (head width) and 12.90% (body weight) which were the lowest and highest variability, respectively. Thus, a moderate variability of coefficient of variation ranging between 8% and 12.90% in all morphological measures was considered. Also the variability between the rams with respect to the zootechnical indices is indicated by their coefficient of variation which ranged between 0.11% (length) to 10.80% (cephalic). There was a positive and significant correlation between body weight and other phenotypic traits ($P < 0.001$) except for ear width, chest girth, neck length, neck width, and also head width. The result obtained in this study revealed that the estimated zootechnical indices reinforced classification of WAD breed as a small-sized and short-shaped body frame suitable for the sporting activities as preferred by the users.

Keywords: Indices; morphology; ram; traits; body measurements.

INTRODUCTION

Livestock farming based on local breeds constitutes a very valuable animal industry from the economic, social and environmental points of view. Local breeds of animals have special characteristics like resistance to diseases, fertility, maternal ability, longevity, and adaptation to the environment. The Nigerian sheep population comprises of large number of flocks managed extensively under harsh environmental and traditional conditions with large variation in size of flock and individual animals. According to Groeneveld et al. (2010), numerous breeds of livestock may become lost germplasm in many third world countries due to crossing with exotics, which in addition to uncontrolled breeding in extensive management systems pose a great risk for the loss of valuable genes.

Morphometric measurements have been used to evaluate the characteristics of various breeds of animals, and could provide first-hand information on the suitability of animals for selection (Mwacharo et al., 2006; Yakubu, 2010) and for further characterization studies using modern molecular biology methods. Linear body measurements have become very useful in livestock research, as alternative body measurements and indices estimated from various combinations of conventional and non-conventional body parameters not only provide superior guide to weight but also serve as indicators of type and function in domestic animals (Salako, 2006).

Zootechnical indices are indices which give general information about livestock breed characteristics in terms of describing structure and proportions which are the ethnological characteristics as well as functional traits of

animals, providing information about the type, aptitude and production performance of the animal. The calculation and analysis of the different zootechnical indices give room for ethnological classification and functional classification of livestock breeds, particularly the ruminants (Esquivelzeta et al., 2011). Although body conformations score which is highly subjective and having low heritability have been widely used, with the introduction of indices from body measurements, objective assessment of body conformation from the stand point of type may be relatively easier. Thus, this study sought to evaluate the zootechnical index of subpopulation of West African Dwarf (WAD) sheep.

MATERIALS AND METHODS

The study was conducted in Ibadan, the capital city of Oyo state, Southwest, Nigeria. Ibadan is made up of eleven local government areas. Fifty percent of the local government areas were randomly selected; households in the selected local government areas were then stratified to those raising WAD sheep and those raising only WAD rams. Households raising WAD rams were purposively selected for this study. The reason is that in recent times in Nigeria, farmers tend to raise more rams than ewes due to the fact that they are more comfortable slaughtering rams rather than ewes. Moreover, rams are used for different sporting activities and they play more sociocultural roles than ewes. Thus, in Nigerian flocks of sheep rams predominate.

A total number of 100 WAD rams were used for the experiment. Twenty body measurements were taken on

Figure 1. West African dwarf sheep in its grazing environment. Photo: M. A. Popoola

Figure 2. West African dwarf sheep in its grazing environment. Photo: M. A. Popoola

the animals of average age of 18 to 24 months. A platform weighing scale with specification of 100 kg by 50 g was used to determine the weight of individual animals. Meter-rule

was used to measure the height of the ram; both the height at withers and at rump while other linear body measurements were taken using a measuring tape.

In order to evaluate the morphological characteristics of the WAD ram, zootechnical indices were calculated as reported by Alderson (1999). The definition of these indices is as presented in Table 1: cephalic, thoracic, pelvic and corporal indices were considered as morphological traits, which gave general information about the breed characteristics in terms of describing the structure and proportions that is compactness, height, length and weight. The remaining indices were considered as functional traits which provide information about the type, aptitude and production performance of the animals.

Data collected were subjected to PROCMEANS procedure of the SAS (2004) to determine the mean, standard deviation, and coefficient of variation for each body measurement, as well as for the zootechnical indices estimated. Pearson correlation coefficients were calculated to determine the degree of association between the variables.

RESULTS AND DISCUSSION

The results of mean, coefficient of variation, minimum, maximum, and standard deviation of the morphological traits of the WAD rams are presented in Table 2. The average body weight of the animals used for this study was 39.20 ± 0.95 kg. This implies that the breed is elipometric since its body weight is lower than those of other known breed such as the Africander (Gatenby, 1991), the Awassi, Dubasi and Ossimi (Moral and Baligat, 2003), the Makooel from Iran (Abbasi and Ghafoari-Kesbi, 2011), the Sabi from Zimbabwe (Wilson, 1999), the Balami, Uda, and Yankasa from Nigeria as reported by Salako (2006). But it appears similar to Zimbabwe indigenous fat-tail sheep as reported by Pares-Casanova et al. (2013). The coefficient of variation indicated the lowest variability for the ram as 1.45% which was

Figure 3. Zoometric measures. HL: head length; HW: head width; EL: ear length; CD: chest depth; CW: chest width; CG: chest girth; WH: withers height; HB: height at the middle of the back; BL: body length; RL: rump length; RW: rump width; CC: Cannon circumference (Scheme after Esquivelzeta et al. 2011).

obtained for head width and the highest as 12.90% which was obtained for body weight; other values for variability obtained are as follows: chest width (10.7%), chest depth (11.2%), chest girth (12.62%), body length (10.14%), rump length (7.52%), rump width (6.34%) and tail length (5.13%).

The results of zootechnical indices of WAD rams are presented in Table 3. The variability of the rams with respect to the zootechnical indices is indicated by their coefficient of variation which ranged between 0.23% to 10.85%,

cephalic (10.85%), thoracic (5.29%), pelvic (7.19%) and corporal (3.65%). The high value obtained for the cephalic index for the WAD rams implies that it is a dolichocephalic breed, having the length of the head predominating over the head width. The thoracic index implied that the ram is short-shaped whereas, the pelvic index indicates that it is a concave breed, with the amplitude predominating in relation of its rump length, these results agreed with the visual valuation of Torre (1991). The thoracic index indicates the degree of skeletal fitness of the animal in

Table 1. Definition of zootechnical indices calculated for each WAD sheep.

Indices	Types/ Traits	Calculation
Cephalic	Ethnological	$HW/HL \times 100$
Thoracic	Ethnological	$CW/CD \times 100$
Pelvic	Ethnological	$RW/RL \times 100$
Corporal	Ethnological	$BL/CG \times 100$
Relative depth of thorax	Functional	$CD/WH \times 100$
Transversal pelvic	Functional	$RW/WH \times 100$
Longitudinal pelvic	Functional	$RL/WH \times 100$
Balance	Functional	$(RW \times RL)/(CD \times CW)$
length	Functional	BL/WH
Cumulative	Functional	$(W/u) + \text{balance index} + \text{length index}$

(Salako, 2006; Esquivelzeta et al., 2011)

HW - head width, HL - head length, CW - chest width,
 CD - chest depth, RL - Rump length, RW - Rump width,
 BL - Body length, CG - Chest girth, WH - Wither height

*Type - Ethnological indexes contributed general information about breed characteristics whereas functional indexes contributed information about the type, purpose and performance of the breed.

Table 2. Descriptive analysis of morphometrical traits of WAD ram

Morphometrical traits (cm)	Mean	CV	Min	Max	SD
Body weight (kg)	39.20	12.90	20.00	59.00	9.88
Head length	24.19	2.10	13.00	44.00	4.94
Head width	14.14	1.45	6.00	28.00	3.33
Ear length	14.25	4.62	6.00	28.00	4.40
Ear width	7.28	10.20	4.00	65.00	5.75
Chest depth	33.98	11.20	21.00	51.00	5.98
Chest girth	85.91	12.62	52.00	111.00	12.13
Chest width	42.95	10.10	26.00	55.00	6.07
Wither height	71.82	4.53	47.00	105.00	10.88
Back height	65.67	3.72	17.00	103.00	9.52
Body length	62.44	10.14	40.00	80.00	7.88
Rump length	29.79	7.57	18.00	45.00	6.66
Rump width	30.89	6.34	13.00	58.00	11.36
Horn length	30.02	2.75	12.00	60.00	1.41
Horn circumference	4.35	2.11	2.00	9.00	1.41
Tail length	38.69	5.13	17.00	59.00	10.22
Tail circumference	16.13	3.68	1.00	24.00	3.25
Scrotal length	21.22	2.04	11.00	38.00	5.43
Scrotal circumference	26.86	2.00	13.00	37.00	4.86
Neck length	24.09	2.05	16.00	42.00	5.15
Neck width	53.64	2.72	18.00	86.00	

Table 3. Descriptive analysis of zootechnical indices of WAD ram

Indices	Mean	SD	CV	Min	Max
Cephalic	59.18	12.56	10.85	30.00	28.00
Thoracic	128.49	26.08	5.29	50.00	236.36
pelvic	108.14	45.28	7.19	38.00	227.78
Corporal	73.83	12.28	3.65	46.23	121.78
Relative depth of thoracic	47.98	9.52	4.82	30.61	83.33
Transversal pelvic	43.33	15.39	6.17	19.40	87.27
Longitudinal pelvic	42.12	10.68	3.54	24.66	75.93
Balance	0.14	0.9	0.71	32.23	54.11
Length	0.87	0.15	0.11	0.10	1.26
Cumulative	0.14	0.9	0.23	3.2	

Table 4. Pearson correlation analysis between body weight and other coefficients morphological traits of the WAD ram

Var.	BW	HL	HW	EL	EW	CD	CG	CW	WH	BH	BL	RL	RW	NL	NW
BW		0.25*	0.11	0.37*	0.07	0.26*	0.14	0.14	0.50*	0.54*	0.30*	0.16	0.42*	-0.01	0.18
HL			0.47*	0.67*	0.03	0.40*	0.57*	0.57*	0.32*	0.14	0.47*	0.23*	-0.07	0.49*	0.19
HW				0.48*	0.04	0.20*	0.30*	0.20*	0.09	0.05	0.47*	0.29*	0.16	0.14	-0.14
EL					0.22*	0.43*	0.54*	0.54*	0.46*	0.05	0.48*	0.29	0.16	0.14	-0.14
EW						0.04	0.20*	0.20*	0.21*	0.06	0.14	0.01	0.09	0.25*	0.07
CD							0.46*	0.46*	0.29*	-0.01	0.38*	0.22*	0.09	0.38*	0.01
CG								1.00**	0.34*	0.07	0.41*	0.15	0.09	0.43*	-0.01
CW									0.34*	-0.07	0.41*	0.15	0.09	0.43*	-0.01
WH										0.70**	0.51*	0.22*	0.40*	0.07	0.45*
BH											0.22*	0.13	0.56	-0.05	0.48*
BL												0.20*	0.08	0.27*	0.05
RL													0.23*	0.27*	0.05
RW														0.02	0.40*
NL															-0.19
NW															-

**Significant at $p < 0.001$; *Significant at $p < 0.05$: BW- body weight, HL-head length, HW-head width, EL- ear length, EW- ear width, CD- chest depth, CG- chest girth, CW- chest width, WH – wither height, BH- back height, BL- back length, RL- rump length, RW- rump width, NL- neck length, NW- neck width

terms of leg length of the animal suggesting that the breed had good adaptation to the environmental conditions (Southwestern Nigeria) under which it is raised. The region is characterised as the forest region of the country; generally WAD sheep possess short legs as an adaptation to move in bush unlike breeds like Yankasa, Uda and Balami that possess long legs adapted for trekking a long distance.

As regards the functional indices of the animals, the results obtained were relative depth of thorax (4.82%), transversal pelvic (6.17%), longitudinal pelvic (3.54%), balance (0.17%), length (0.11%), cumulative (0.23%). The transverse pelvic and longitudinal pelvic indices provide information about the aptitude of the animal, implying and describing the WAD ram as a sheep breed suitable for meat production as reported by Cerqueira et al. (2011) which reinforced the results obtained from the calculation of the cumulative index.

Pearson correlations between bodyweight and morphometric traits of WAD sheep

The phenotypic correlations between the morphometric measurements were positive and generally significant. (see Table 4). The highest and lowest correlations were obtained for back height and head width with body weight, respectively. However, high correlation of heart girth with body weight was reported by Yakubu (2010). Also Afolayan et al. (2006) reported that heart girth accounted for 90 percent of total weight variance in Yankasa sheep (one of the indigenous sheep breed in Nigeria).

CONCLUSION

The result obtained in this study implied that the estimated zootechnical indices reinforced classification of WAD rams

as a small-sized and short-shaped body frame, with a marked orientation for meat production and with signs of adaptation to its environment.

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