

Morphological Variation of West African Dwarf Goat Population in Awka, Anambra State Nigeria

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Abstract:- This study was carried out in Awka, a town in Anambra State Nigeria. The study aimed to evaluate the morphological variations in West African Dwarf (WAD) goat. 43 matured WAD goats were picked from representative samples from the villages in Awka, 20 male WAD goats and 23 female WAD goat was selected and their morphological measurements recorded while noting their coat colour and texture. The morphometric parameters taken are – Body length (BL), Neck girth (NG), Height at withers (HW), Chest girth (CG), Ear length (EL), Rump width (RW), Height at rump (HR), Head length (HL), Horn length (HnL), Leg length (LL), and Tail length (TL) using a tailor’s tape. The body weight (in kilogramme) was measured using shaffeur’s formula, while the coat colour pattern was virtually observed and the texture by feeling. Data on morphometric measurements were subjected to descriptive statistic using frequencies and percentile (SPSS, 2010). The results obtained showed that the black/white coat colour was predominant (34.88%) in both sexes, the predominant coat colour in male is black/white and black (16.28%), and black/white (18.60%) in females. The predominant coat colour type is the short and smooth coat type. Possession of horn is not sex linked, but the size is affected by sex as the males generally had high values of horn length. The males had higher morphometric parameters except for Leg length, Neck girth, Tail length, Rump width, and ear length. In conclusion, a mature male WAD goat weighs about 22kg, while a mature female WAD goat weighs about 18kg. Morphometric characters are affected by sex.

Keywords: Morphology, Variation, WAD Goat, Coat Colour, Coat Type.

I. BACKGROUND INFORMATION ON WEST AFRICAN DWARF GOAT

West African Dwarf goat (*Capra hircus*) is a breed of domestic goat native to West Africa, found in countries such as Nigeria, Togo, Ghana and Benin. They are achondroplastic, and are a relatively small breed with the males weighing 20-25kilogrammes and the females weighing 18-22kg (Wilson, 1991; Awobajo *et al*, 2016). Nigeria is one of the largest goat producing countries in Africa with estimated population of over 34million (Achoja, 2012). It is one of the most traded

livestock in Nigeria making it a veritable resource for economic development and livelihood security, forming special delicacies in different regions and also serving purposes in traditional, religious, social and other purposes in the country (Oseni, Yakubu, & Aworetan, 2017).

The West African Dwarf Goat are adapted to various agro-ecological zones in West Africa and so can be seen almost in all regions of West Africa. They are known for their hardiness, adaptability, and ability to thrive in diverse environmental conditions, including marginal lands with limited forage resources. They are resistant to several diseases and parasites in the region, making them a first choice for small holder farmers (Chiejina & Behnke, 2011).

The West African Dwarf Goat is reported to exhibit morphological variations within its population, these variations are observed in several aspects of their physical appearance including coat colour and pattern, horn shape and size, body conformation, and ear length and shape (Ofori, Hagan, Kyei, & Etim, 2021; Ekugba & Ogundu, 2018; Rotimi, Egaghi, & Adeoye, 2017; Nguluma, 2016;)

Breed characterization plays a vital role in identifying and preserving the breed, it is also essential for the long-term survival and adaptation of a breeding population to changing environmental conditions and also provides the raw material for natural selection and breeding programmes. Morphological characterization helps to define a breed’s identity and will support the efforts to maintain and manage the WAD breed as a distinct breed. Indigenous breed characterization is important in order to forestall the risk of genetic erosion and decline in population due to crossbreeding, urbanization, introduction of exotic breeds, genetic manipulations and agricultural practices. Characterization of indigenous breeds will enable the identification of desirable traits that can be improved through selective breeding, it will also provide the foundation for breeding programmes which will improve productivity and sustainability (Haliu & Geto, 2015; Toro, Fernandez, & Caballero, 2009). Breed characterization is one of the priorities of the Food and Agriculture Organisation (FAO). Breed characterization is crucial for the maintenance of native phenotypes, cross-breeding may offer quick benefits in the area of improving some traits that aid the animal to adapt to changing local environmental conditions, but in the

long run it may be difficult to these benefits and it could also induce loss of important indigenous and localized traits (Phocas *et al* 2016). Classically, breed characterization is made on the phenotype because an animal’s phenotype is basically the manifestation of its genotype and complementary to the biotechnological techniques for determining genetic diversity in the genome (Williams, 2005). There is consumer preference in Nigeria for indigenous breeds, some markets value specific breed characteristics for cultural, environmental and quality reasons.

Sequel to the call for characterization of indigenous breeds, this work is justified in that it will aid to make important futuristic predictions and contribute to policies on conservation. This work therefore seeks to identify the West African Dwarf goat in Awka to ascertain the morphometric

characters and contribute to records in conservation of animal resources.

II. METHODOLOGY

This study was carried out with WAD goat measurements taken from representative samples from Awka, Anambra State considering different locations. Awka is the capital of Anambra State and situated in the South Eastern Nigeria, the climate is the tropical wet and dry type with a distinct cycle of seasons. The mean annual rainfall according metrological station is about 1600mm with a relative humidity of 80%, highest and lowest mean annual temperature is 28.18°C and 27.40°C (Omaja, Okpalaku, Uchekukwu, & Obiekezie, 2020).

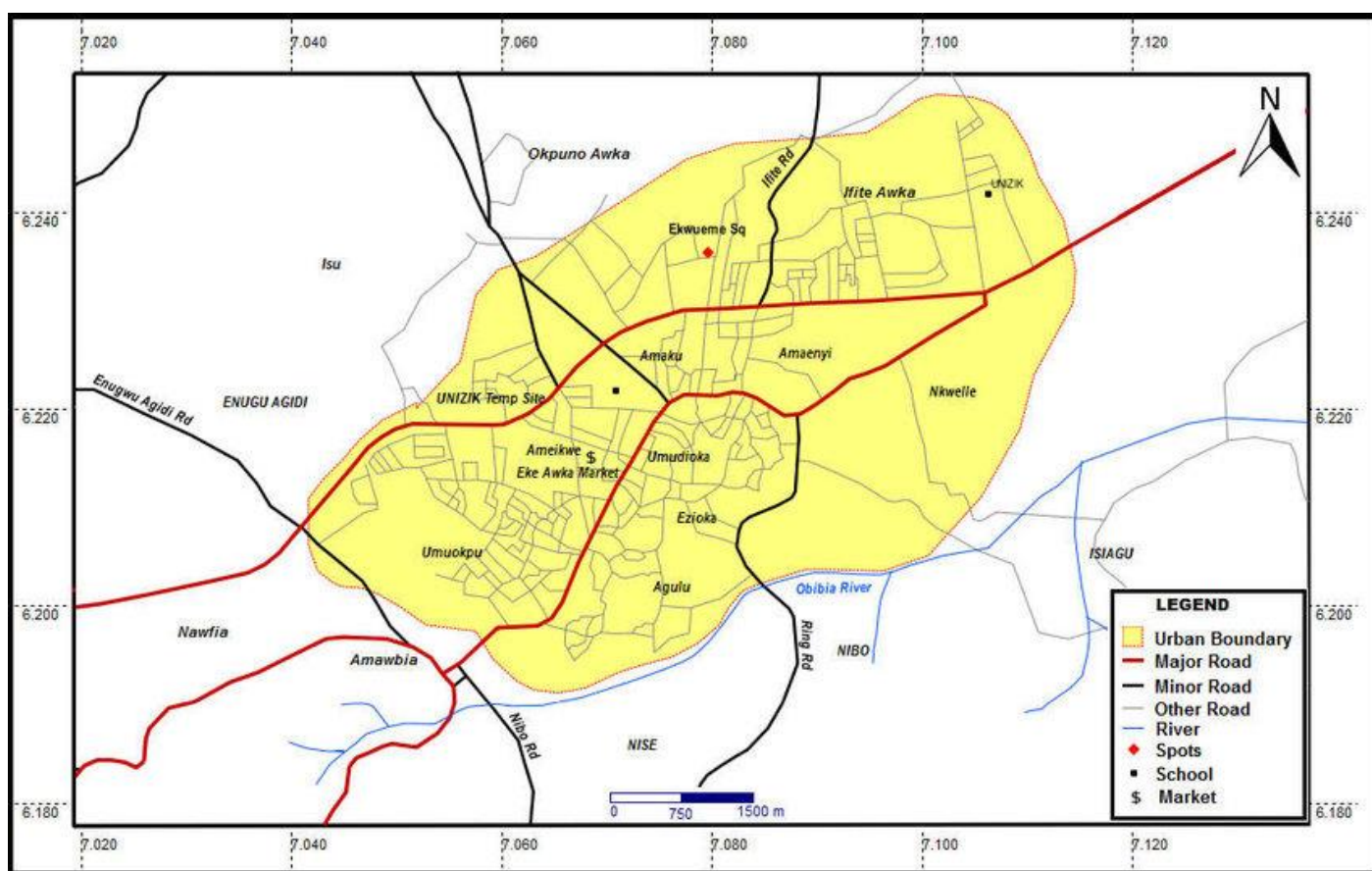


Fig 1: Map of Awka showing the study area.
Source: Awka Town Planning Authority, 2017.

III. DATA COLLECTION

Fifty (43) mature adult WAD goat comprising twenty (20) males and twenty-three (28) females with different coat colours were randomly selected at different locations where WAD goats are kept. Each of the animals selected for measurement was restrained and calmed before measurements

were taken to ensure that they were not unnecessarily stressed in line with ethics in handling animals.

The morphometric parameters taken were:

- Body Length (BL): The horizontal distance (centimeters, cm) from shoulder to the pin bone.
- Neck Girth (NG): The circumference of the neck is to be measured as neck girth in cm

- Height at Withers (HW): is the (vertical) height (cm) from the bottom of the front foot to the highest point of the shoulder between the withers.
- Chest Girth (CG): is the circumference of the body (cm) immediately behind the shoulder blades in a vertical plane, perpendicular to the long axis of the body.
- Ear Length (EL): This was measured from the point where the ear is attached to its tip.
- Rump Width (RW): measured in cm from one side of the hip bone to the other side of the hip bone.
- Height at Rump (HR): is the (vertical) height (cm) from the bottom of the hind leg to the highest point of the rump.
- Head Length (HL): distance in cm between the highest points of the parietals to the middle of the rostral margin of the incisive bone.
- Horn Length (HnL): The point of attachment of the horns to the head up to its tips.

- Leg Length (LL): The leg length was measured as the distance from the tips of the hoofs to the point where the tarsal joined to the tibia and fibula.
- Tail Length (TL): This was measured as the distance between the beginnings of the caudal vertebrae to its tip.
- Body weight (BW): This was gotten using shaffeur’s formula by calculating the heart girth multiplied by the body length divided by 300. $(HG*HG*BL)/300$. The body weight is in (kg).
- The coat colour pattern was visually observed.

IV. STATISTICAL ANALYSIS

Data on morphometric measurements were subjected to Descriptive Statistic using frequencies and percentages (SPSS 2010).

V. RESULTS

Table I: Descriptive Statistic of Coat Colour and Coat Type of WAD Goat.

Parameter	Male	Female	Overall
Coat colour pattern			
Black	7(16.28)	3(6.98)	10(23.26)
Brown	–	2(4.65)	2(4.65)
Brown/black	5(11.63)	3(6.98)	8(18.60)
Black/white	7(16.28)	8(18.60)	15(34.88)
White/black	1(2.33)	6(13.95)	7(16.28)
Coat hair type			
Short and smooth	17(39.53)	23(53.49)	40(93.02)
Short and coarse	3(6.98)	–	3(6.98)
Horn			
present	20(46.51)	23(53.49)	43(100)
absent	–	–	–

Key: Figure outside the parenthesis are frequencies, while those inside the parenthesis are percentages (%).

Table II: Descriptive Statistics of the Morphometric Measurements of the WAD Goat.

Parameter	Male	Female
Body weight	13.00(±2.51)	13.02(±2.31)
Head length	6.55(±0.51)	6.50(±0.50)
Body length	20.35(±0.99)	18.04(±1.82)
Height at withers	17.55(±1.00)	15.91(±1.07)
Chest girth	22.15(±1.93)	21.78(±1.45)
Height at rump	19.75(±1.52)	17.24(±2.06)
Leg length	10.60(±0.50)	10.61(±0.58)
Neck girth	10.35(±0.49)	10.44(±0.77)
Tail length	4.50(±0.51)	4.83(±0.39)
Rump width	5.90(±0.72)	6.07(±0.43)
Ear length	3.93(±0.81)	4.00(±0.15)
Horn length	3.50(±0.15)	2.61(±0.50)

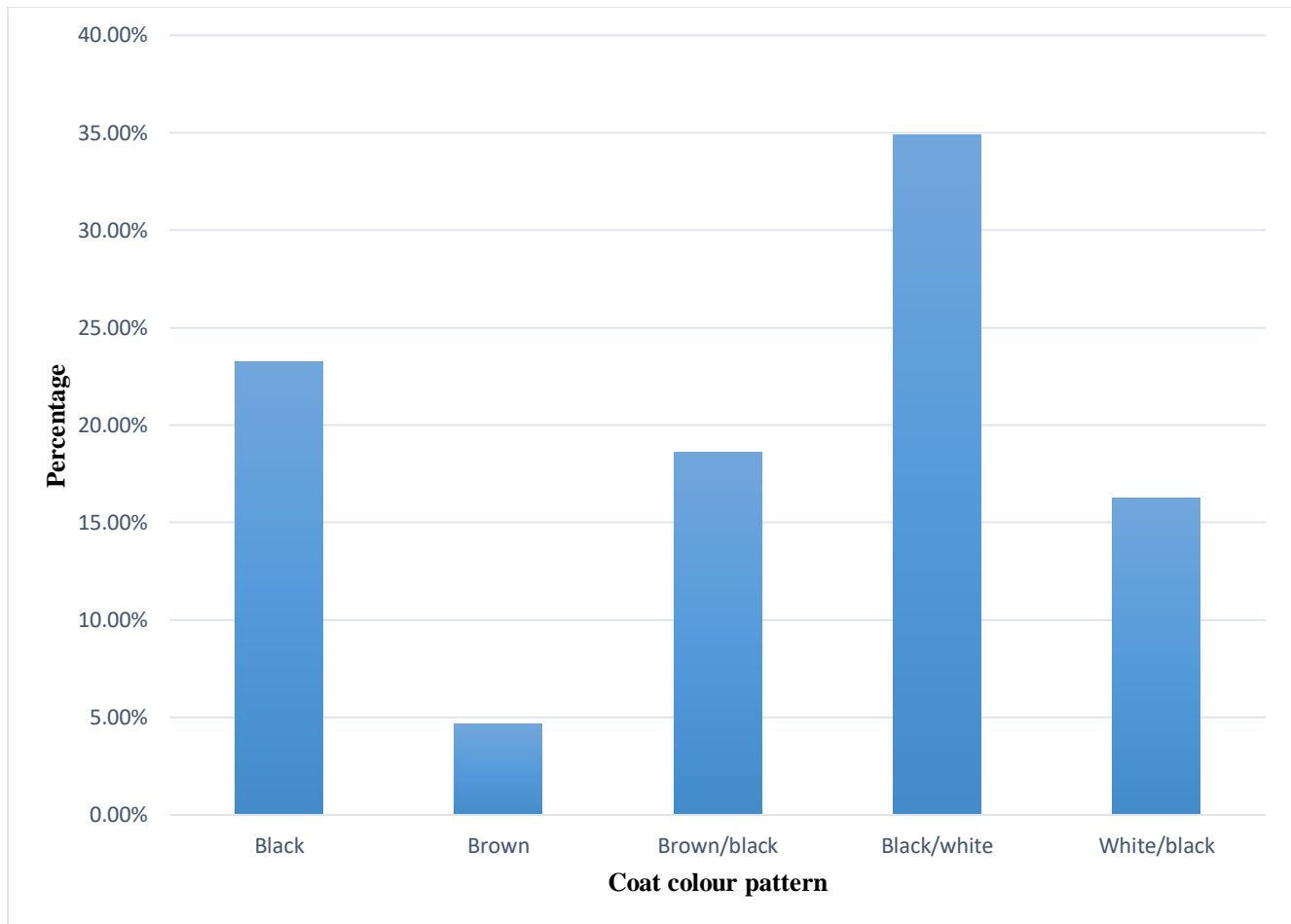


Fig 2: Distribution of Coat Colour of the WAD Goat in the study area.

VI. DISCUSSION

Morphometric variation of coat colour pattern and type are presented in Table I, and the percentage distribution of the coat colour pattern is represented in Figure II. The coat colour pattern varied in the studied population. The black/white coat colour pattern was predominant (34.88%), followed by the black pattern (23.26%), brown/black (18.60%), white/black (16.28), and brown (4.65%). The colour variation was not uniform for both sexes, for the male – the black/white (16.28%) and black (16.28%) was predominant and tallied, followed by the brown/black (11.63%), white/black (2.33%), and no representation for the brown colouration. In the female, the black/white (18.60%) was predominant, followed by white/black (13.95%), black/black (6.98%), and brown (4.65%). The distribution of coat colour is shown in figure II.

Morphometric measurements of WAD goat from the studied population (Table II) showed that the males had higher morphometric parameters except in leg length, neck girth, tail length, rump width, and ear length. The male WAD goats weighed more than the females, had higher values in head length, body length, height at withers, chest girth, height at rump, and horn length.

The short and smooth coat type was predominant (93.02%) in the studied population, the short and coarse hair type was also observed (6.98%). There was no pattern of differentiation in coat type as regards to sex.

Both the male and the female WAD goat have horns, sex did not determine presence/absence of horn rather the males had more pronounced horns and higher values of horn length.

Ofori, Hagan & Kyei, (2020) reported that morphometric variation exist in WAD goat populations of Ghana. Ekugba & Ogundu (2018) reported colour varieties and slight variability in the genetic structure of WAD goat which will affect the morphometric parameters (phenotypic expression of characters). In the same light, Ofori, Haga, Kyei & Etim (2021) and Nguluma, Msalya & Chenyambuga, (2016) reported phenotypic variation in WAD goat populations. Rotimi, Egaghi, & Adeoye, (2017) observed variations in the phenotypic parameters of WAD goat and noted that sex had a significant effect on the body parameters. Adedeji *et al.*, (2011) reported variations in the coat pigmentations of WAD goat and that it affected haematological characteristics.

The above statements are in conformity with the findings of this research, morphometric variations in WAD goat could be affected by genetic and environmental factors, management practices, age and sex, and crossbreeding. Breeders can purposely alter morphometric characters for choice or other reasons.

VII. CONCLUSION

- There exists colour variants in the WAD goat population studied.
- The short and smooth coat type is predominant in the studied population.
- Morphometric characters are affected by sex.
- The WAD goat generally possess horn, but the size of the horn is affected by sex.
- A mature male WAD goat weighs about 22kg, while a mature female WAD goat weighs about 18kg.
- Pattern of differentiation in coat type is not sex dependent.

REFERENCES

- [1]. Achoja, F. (2020). Adoption of Smart Strategies for Enhancing Productivity and Income of West African Dwarf (WAD) Goat Farmers in Southern Nigeria. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 57(3), 343-350.
- [2]. Adedeji, T. A., Ozoje, M. O., Peters, S. O., Sanusi, A. O., Ojedapo, L. O., & Ige, A. O. (2011). Coat pigmentation and Wattle genes effect on some haematological characteristics of heat stressed and extensively reared West African Dwarf goats. *World J. Life Sci. Med. Res*, 3, 48-55.
- [3]. Awobajo, O. K., Salako, A. E., Akinyemi, M. O., & Osaiywu, O. H. (2016). Analysis of genetic structure of West African Dwarf goats by allozyme markers. *Small Ruminant Research*, 136, 145-150.
- [4]. Chiejina, S. N., & Behnke, J. M. (2011). The unique resistance and resilience of the Nigerian West African Dwarf goat to gastrointestinal nematode infections. *Parasites & vectors*, 4, 1-10.
- [5]. Ekugba, C.U., & Ogundu, U. E. (2018). Genetic structure of the West African Dwarf Goat in South East Nigeria Using Inter-Simple Sequence Repeat Markers. *The 43rd annual conference of the nigerian society for animal production* (p. 75).
- [6]. Hailu, A., & Getu, A. (2015). Breed characterization: Tools and their applications.
- [7]. Nguluma, A. S., Msalya, G., & Chenyambuga, S. W. (2016). Phenotypic variation among four populations of small East African goats of Tanzania. *Livestock Research for Rural Development*, 28(8), 2016.
- [8]. Ofori, S. A., Hagan, J. K., & Kyei, F. (2020). Morphometric characterization and differentiation of West African Dwarf goat populations in Ghana. *Tropical Animal Health and Production*, 53, 1-14.
- [9]. Ofori, S. A., Hagan, J. K., Kyei, F., & Etim, N. N. (2021). Phenotypic and genetic characterization of qualitative traits in the West African Dwarf goat of Ghana. *Scientific African*, 13, e00857.
- [10]. Omoja, U. C., Okpalaku, B. N., Uchekwue, U. N., & Obiekezie, T. N. (2020). Trends of Variability of Temperature in Awka, Anambra State Nigeria.
- [11]. Oseni, S. O., Yakubu, A., & Aworetan, A. R. (2017). Nigerian west african dwarf goats. *Sustainable Goat Production in Adverse Environments: Volume II: Local Goat Breeds*, 91-110.
- [12]. Phocas, F., Belloc, C., Bidanel, J., Delaby, L., Dourmad, J. Y., Dumont, B., ... & Brochard, M. (2016). Towards the agroecological management of ruminants, pigs and poultry through the development of sustainable breeding programmes. II. Breeding strategies. *animal*, 10(11), 1760-1769.
- [13]. Rotimi, E. A., Egahi, J. O., & Adeoye, A. A. (2017). Body characteristics of West African Dwarf (WAD) goats in Bassa local government area of Kogi State. *World Scientific News*, (69), 179-189.
- [14]. Toro, M. A., Fernández, J., & Caballero, A. (2009). Molecular characterization of breeds and its use in conservation. *Livestock Science*, 120(3), 174-195.
- [15]. Williams, J. L. (2005). The use of marker-assisted selection in animal breeding and biotechnology. *Revue Scientifique et Technique-Office International des Epizooties*, 24(1), 379.
- [16]. Wilson, R. T. (1991). *Small ruminant production and the small ruminant genetic resource in tropical Africa* (Vol. 88). Food & Agriculture Org.