Physical Characteristics of the Strains of West African Dwarf Goat in Ogun State, Nigeria

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Abstract

Six hundred and sixteen male and female West African Dwarf (WAD) goats comprising gold (135), black (111), buckskin (162), Chaimose (58), Swiss markings (25), white (20), Dalmatian (46) and chocolate (59) strains were used to determine the trend of inheritance for qualitative traits. The physical characteristics observed were: beard (Br^d), non-beard (Br+), wattle (Wa^W), non-wattled (Wa+), polled (Ho^P), horned (Ho+), blue *eye* (BL), gold *eye* (bl). Wattle, beard, pollness and blue *eye* are dominant physical characteristics. The possession of wattle was more in Swiss markings (72.0%), Chaimose (68.90%), chocolate (65.91%), white (65.0%) and gold (62.90%).while more of the strains possessed horns (>80%). The generated Hardy-Weinberg frequencies for wattle, beard, pollness and blue *eye* were low. The gene frequency of the recessive non-wattle allele was 0.79, 0.80, 0.77, 0.84, 0.85, 0.81, 0.78, 0.81 in the gold, black, buckskin, Chaimose, Swiss markings, white, Dalmatian and chocolate WAD goat respectively. The gene frequency of the recessive non- polled (horned) allele was 0.94, 0.95, 0.99 and 0.96 in Swiss markings, white, Dalmatian and chocolate respectively. The gene frequency of the recessive non-beard allele was 0.88, 0.96, 0.93 and 0.93 in gold, black, buckskin and Chaimose. The frequency of the dominant *eye* allele is 0.02, 0.02, 0.21, and 0.21 in the gold, black, buckskin and Chaimose. There is a need to conserve these adaptive features (horn, wattle) in the strains of WAD goat.

Keywords: WAD goat, Strains, allele, frequency, horn, wattle, bear

Introduction

There are about 300 breeds and types of goats widely distributed around the world with the majority found in the tropics and subtropics where they play very important role in agriculture and are used for various social obligations (Alaku, 2010). The diverse appearance is mostly superficial and established during the embryonic stages of development thereby limiting the size and complexity of the animal (Anon, 2015b). The diversity among breeds and the genetic variation within breeds contribute equally to the genetic variation found among animals within the species (ILRI, 2014). The variation within breeds is less vulnerable to loss but breeds are easily irretrievably lost when they are considered to be commercially non-competitive (ILRI, 2014).

The physical expression of a trait in an individual is the phenotype (Klug *et al.,*2006). These traits showing the simplest type of inheritance are a qualitative trait. The absence of horns is caused by the expression of a dominant allele (Ho^P) which is the polled allele while the horns presence is caused by (Ho^+) wild allele (Lauvergne *et al,* 1987). Animals utilize their horns in a variety of ways. They may be used in fighting, for defense from predators. Horns may be used in feeding such as to root in the soil or strip bark from trees. Some animals with horns use them for cooling, the blood vessels in the bony core allowing the horns to function as a radiator. Many animals use horns in displays during courtship (Anon, 2016). Wattles are part of chicken's heat regulation system. The wattles and combs are thick with capillaries and veins for the overheated blood to pass through. It is air cooled as it passes through these blood vessels. In turn, this cooler blood reduces the chicken's internal temperature (Chester, 2016). Wattles on Nigerian Dwarf goat are simple hair, covered appendages of flesh hanging from the throat area (Anon, 2014a). Wattle is dominant and the locus was named wattles (Wa) and has two alleles: wattled (Wa^w) and (Wa^+) wild or recessive allele (Lauvergne *et al.,* 1987). Wattles are due to a dominant autosomal locus with variable expression (Machado *et al.,* 2000). Sometimes,

wattles are placed somewhere other than the usual "under the jaw on the neck" (Anon, 2014a).

Asdell and Smith (1928) have shown that beard trait is controlled by an autosomal gene and it depends on sex. The trait is dominant in males and recessive in females (Lauvergne *et al,* 1987). Adedeji *et al* (2006) reported that some female WAD goats have beards which may result from the secretion of excess of male hormone (androgen) (Odubote, 1994). The locus is named Br and has two alleles: bearded (Br^d) and (Br^+) wild (Lauvergne *et al.,* 1987). Unlike in the case of humans, blue *eye* (BL) in goats are dominant and the gold *eye* (bl) is recessive. Blue *eye* does not cause any health issues. In a very rare case, there have been reports of Nigerian goats having one blue *eye* and one brown *eye* (Anon, 2014b). The Nigerian dwarf goat has blue *eyes* but the gold colour/brown (recessive) is occasionally encountered (Anon, 2010).

The ability of the WAD goat to survive under adverse environmental conditions with low inputs and disease risk is attributed to the possession of adaptive traits, which have a positive effect on the genetic superiority or adaptability of the breed (Odubote, 1994). Characterization of WAD goat population for these adaptive features is important for its genetic improvement and the conservation of its genetic resources. Some studies have been carried out on the adaptive features of WAD goat population and that characterization for qualitative traits at various times in the humid zone of Nigeria both on-farm and free range (Odubote, 1994; Ozoje, 1998; Adedeji *et al,* 2006; Yakubu *et al,* 2010). However, there is a need to further characterize the breed of WAD goat in which several strains have emerged. The aim of this study is to characterize the strain of WAD goat populations based on their physical body characteristics.

Materials and Methods

The study area is the entire Ogun State, Nigeria which comprises of twenty local government areas located in Ijebu, Remo, Egba, and Yewa Divisions. Each local government area represented a stratum in which three towns were purposively selected. WAD goats within each town were used for the experiment. The sample size was 616 male and female WAD goats on which four physical characters were observed: presence (Br^d) or absence (Br^+) of beard, presence (Wa^W) or absence (Wa^+) of wattle, presence (Ho^+) or absence (Ho^P) of horns and blue (BL) or gold (bl) or blue-gold *eye* colour. The data were analyzed using simple descriptive statistics of percentages and frequency distribution; the frequencies of the recessive alleles were calculated using Hardy-Weinberg equilibrium (Falconer and Mackay, 1996).

Table 1:Frequency of a particular allele in gold, black, buckskin and chaimose WAD goat

Variables	Gold			Black			Buckskin			Chaimose		
	FC	FPA	%	FC	FPA	%	FC	FPA	%	FC	FPA	%
		135			111			162			58	
Wattled	50	0.21	37.04	44	0.20	39.64	67	0.23	41.36	18	0.16	31.03
Non-wattled	85	0.79	62.96	67	0.80	60.36	95	0.77	58.64	40	0.84	68.07
Horned	117	0.95	86.58	100	0.95	90.09	142	0.94	87.65	53	0.97	91.38
Polled	18	0.05	13.32	11	0.05	9.91	20	0.06	12.35	5	0.03	8.62
Beard	32	0.12	23.70	9	0.04	8.11	25	0.07	15.43	7	0.07	12.07
Non-beard	103	0.88	76.30	102	0.96	91.89	137	0.93	84.57	51	0.93	87.93
Eye colour												
Blue	6	0.02	4.44	6	0.02	5.41	16	0.05	9.88	4	0.04	6.90
Gold	129	0.98	95.56	105	0.98	94.59	146	0.95	90.12	54	0.96	93.10
Blue and gold	0	0	0	0	0	0	0	0	0	0	0	0

FC = Frequency, FPA= Frequency of a particular allele, % =Percent

The frequency of the dominant wattle allele in gold, black, buckskin and chaimose is 0.21, 0.20, 0.23, and 0.16 respectively. Swiss markings, white, Dalmatian and chocolate is 0.15, 0.19, 0.22, and 0.19 respectively. The frequency of a dominant polled allele in gold, black, buckskin and chaimose is 0.05, 0.05, 0.06, and 0.03. In the Swiss markings, white, Dalmatian and chocolate, the frequency of a dominant polled allele is 0.06, 0.05, 0.01 and 0.04. In the gold, black, buckskin and Chaimose, the frequency of dominant beard allele is 0.12, 0.04, 0.07, and 0.07. The frequency of the beard allele in Swiss markings, white, Dalmatian and chocolate is 0.02, 0.08, 0.14, 0.03. The frequency of the dominant *eye* allele (blue *eye*) in gold, black, buckskin and Chaimose is 0.02, 0.02, 0.21, and 0.21.

Table 2:Frequency of particular allele in Swiss markings, white, Dalmatian and chocolate WAD goats

Variables	**Swiss markings**			**White**			**Dalmatian**			**Chocolate**		
	FC	**FPA**	**%**	**FC**	**FPA**	**%**	**FC**	**FPA**	**%**	**FC**	**FPA**	**%**
		25			20			46			59	
Wattled	7	0.15	28.00	7	0.19	35.00	18	0.22	39.06	20	0.19	33.80
Non-wattled	18	0.85	72.00	13	0.81	65.00	28	0.78	60.76	39	0.81	65.91
Horned	22	0.94	88.00	18	0.95	90.00	45	0.99	97.65	54	0.96	91.26
Polled	3	0.06	12.00	2	0.05	10.00	1	0.01	2.17	5	0.04	8.45
Beard	1	0.02	4.00	3	0.08	15.00	12	0.14	26.04	4	0.03	6.76
Non-beard	24	0.98	96.00	17	0.92	85.00	34	0.86	73.78	55	0.97	92.95
Eye colour												
Blue	3	0.06	12.00	3	0.08	15.00	2	0.02	4.34	4	0.03	6.76
Gold	22	0.94	88.00	17	0.92	85.00	44	0.98	95.48	55	0.97	92.95
Blue and gold	0	0	0	0	0	0	0	0	0	0	0	0

The frequency of the dominant *eye* allele (blue *eye*) in the Swiss markings, white, Dalmatian, chocolate is 0.06, 0.08, 0.02, and 0.03. Wattle, beard, pollness, and blue *eye* are dominant physical/qualitative characteristics. The generated Hardy-Weinberg frequencies for these traits are low which agrees with the findings of Yakubu*etal.,* (2012) that the frequencies of both WAD and Red Sokoto goats for wattle, beard and pollness were quite lower than the expected Mendelian value of 0.75. The low values may be due to inbreeding that keeps occurring within the small population (households) and random mating that takes place in the larger populations (between towns within the local governments in Ogun State) without a consistent selection and culling of undesired characters. However, this large population isalsounder the influence of migration and selection which aid the introduction of new genes into larger population but these new genes are often in favour of the recessive genes coming from the various strains of WAD goats. One advantage of inbreeding when carried out for a period of time within the small population is that it tends to create lines or strains of animals that are uniform in type or in some other desirable characteristics and genes which can be transmitted with greater uniformity. However, the known shortcoming is that it increases the chances that recessive genes will appear during the early generation before the attainment of homozygosity.

Conclusion

Horn and wattle are the adaptive physical features in the strains of WAD goat. This study has determined the frequency of the dominant and recessive qualitative alleles in the strains of WAD goat. The presence of horn and wattle was more in >80% the strains of WAD goat. Further studies should be carried out on the effect of these adaptive features in the production and reproductive performance of these strains of WAD goat.

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