

Original articles

Phenotypic and genetic categorization of qualitative traits in extensively managed local goat (*Capra aegagrus*) population of Niger State, Nigeria

P.S. Kolo*, S.S.A. Egena, D.N. Tsado, M. Adisa-Shehu

Department of Animal Production, Federal University of Technology, P.M.B 65, Minna, Niger State, Nigeria

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Abstract

A study on the distribution and frequencies of coat colour, wattle, beard, horn, and hair type using 375 extensively managed local goats was carried out in the three administrative zones of Niger state, Nigeria. The animals were scored for coat colour pigmentation pattern, presence or absence of wattle, beard, horn, hair type and extra teat. The study showed that light brown is the predominant colour in zones A (43.24%) and zone C (47.57%). Dark brown colour was predominant in zone B (37.82%) followed by light brown (31.09%). The observed frequencies for wattle (Wa^w) and extra teat (Et^e) were above ($p < 0.01$) the expected Mendelian value of 75% for a dominant gene in all the zones (90.34, 86.55, 87.39 percent for wattle and 91.73, 96.64, 98.21, percent for extra teat in zones A, B, and C, respectively). The gene frequency for beard (Br^b) were significantly lower ($p < 0.01$) than the expected Mendelian value of 75% for a dominant gene in zone A (66.20%) and zone B (55.46%), but was higher in zone C (83.78%). The gene frequency for polledness (Po^p) was 0.00% for all the zones. The gene frequency for soft hair.

was more than ($p < 0.01$) the expected Mendelian value of 75% for dominant genes in zone C (87.33%) but fell short in zone A (60.69%) and zone B (43.70%), respectively. It was concluded that coat colour variation exist in local goats reared extensively in Niger state.

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1. Introduction

The domestic goat (*Capra aegagrus*) is a subspecies of goat domesticated from the wild goat of southwest Asia and Eastern Europe. Goats have variety of coat colours ranging from pure white, cream, to red, black or gray sprinkled or pied, gray, brown or black [14]. Naturally they have two horns of various shapes and sizes which depend on the breed [4]. Like other ruminants goat are even-toed and the females have udders consisting of two teats [25]. Both male and female goats have beards, and many breeds of goat may have wattles. Goat tails are short and usually point upward which makes it different from that of sheep which usually hang down and are usually longer and bigger [2].

Goats have unique adaptive features that enable them fit into their environment. In drought prone regions, goats survive on thorny vegetation and even browse on three tops. This explains why goats survive in most arid areas under such conditions where cattle and sheep start dying in numbers. They can trek for long distances and require less frequent watering than sheep and cattle [2]. The expression of various qualitative traits may represent some adaptive mechanism developed for adaptation and survival in different ecological zones of the country [18]. This agrees with the report of Odubote [17] on the influence of certain qualitative traits on the genetic potential of the Nigerian goats. The conservation of these unique genes for the present and future use has therefore become very important. Since characterization of a breed is the first approach to a sustainable use of its animal genetic resource, more studies on diversity and variability between indigenous goat breeds on the basis of quantitative and qualitative evaluation needs to be carried out in the

* Corresponding author. Tel.: +234 7035071871.

E-mail address: kolo.philip@futminna.edu.ng (P.S. Kolo).

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Northern parts of Nigeria since the vast majority of indigenous goats are concentrated in this axis [27].

The objective of the study was to evaluate the distribution and frequencies (phenotypic and gene) of some qualitative traits in local goats extensively managed in Niger state.

2. Materials and methods

2.1. Location of study

The study was carried out in the three administrative zones of Niger state (zones A, B and C). The local governments that made up Zone A include: *Agaie, Bida, Edati, Gbako, Katcha, Lapai, Lavun* and *Mokwa*. Local governments in zone B include: *Bosso, Chanchaga, Gurara, Munya, Paikoro, Rafi, Shiroro, Suleja* and *Tafa* while those in zone C include: *Agwara, Borgu, Kontagora, Magama, Mariga, Mashegu, Rijau* and *Wushishi*. Niger state is located between latitude 9° 31' and 9° 42' North and longitude 6° 29' and 6° 41' East of the equator. The mean annual rainfall is between 1200 mm and 1300 mm, with average highest temperature in the month of March and lowest temperature in the month of August. The mean annual temperature is between 38 and 42 °C. Niger state is located within the guinea savannah vegetation belt of Nigeria and has two distinct seasons; wet from March to October and dry from November to March [16].

2.2. Experimental animals and sampling technique

Three hundred and seventy five goats reared extensively were sampled from the three administrative zones of Niger State. The sampling technique used was as described by Cameroon [7]. All the local governments in the three zones were numbered and the first three with even numbers were selected. A total of nine local government areas were therefore selected for the study. This includes *Bida, Lavun* and *Katcha* (zone A), *Chanchaga, Suleja* and *Gurara* (Zone B), while *Kontagora, Wushishi* and *Mariga* local government areas were selected from zone C. Houses with goats were identified and ten percent of the identified household flock in each of the selected local government areas were selected by randomization technique. Each household (farmer's) flock in the selected local government areas were given a number written on cards. The cards were shuffled and the card equivalents to ten percent of the households with goats in each local government area were randomly picked. Within each household, the systematic sampling technique as described by Puff et al. [20] was used.

2.3. Data collection

Data were collected on qualitative traits (coat colour pigmentation, hair type, extra teat, wattle and beard).

The coat colour pattern described by Lauvergne [11] and Machado et al. [13] were used as guideline. This include black colour, dark brown, light brown, red cheek, eumelanic and tan,

badger face, wild, anterior mantlet, posterior mantlet and Phaeomelanic.

2.4. Data analysis

Phenotypic frequencies were computed by direct count. The proportions (%) of individuals carrying the various traits were determined as follows:

$$= \frac{\text{Number of individual having the trait}}{\text{Total number of individual sampled}} \times 100$$

Hardy–Weinberg principle [9] was used to estimate gene frequency as given below:

$$q = \sqrt{m/t}$$

where q = frequency of the recessive or dominant gene, m = observed number of animals exhibiting the particular recessive or dominant trait and t = total number of animals sampled. Chi-square statistics was employed to test the observed number of goats having a trait against the expected Mendelian value (25 and 75%).

3. Results

Coat pigmentation pattern for goats in Niger state is presented in Table 1. The common pigments observed in the population sampled are black, dark brown, light brown, Barger face and white. The most common pigment in zones A and C was light brown (43.24 and 47.57%, respectively) followed by dark brown (21.62%). The most predominant pigment in zone B was dark brown (37.82%). The least observed pigmentation across the three zones was Barger face (0.90, 4.20 and 0% for zone A, B and C, respectively). Table 2 shows the phenotypic and gene frequency of wattle in goats in Niger state. The presence of wattle is low across the three zones with phenotypic and gene frequency of 9.66% and 0.05 (zone A), 13.45% and 0.07 (zone B) and, 12.61% and 0.07 (zone C).

Table 3 shows the phenotypic and gene frequency of beard in goats in Niger state. The presence of beard was low across the three zones with phenotypic and gene frequency of 33.80% and 0.19 (zone A), 44.54% and 0.26 (zone B) and 16.22% and 0.06 (zone C).

Table 4 shows that all goats in Niger state possessed horn with phenotypic and gene frequency of 100% and 1.00 in zones A, B, and C. Soft hair predominates in zones A and C (Table 5), the phenotypic and gene frequencies are 60.69% and 0.78 and 87.33% and 0.93, respectively while coarse hair predominates only in zone B with phenotypic and gene frequencies of 56.30% and 0.75, respectively. The occurrence of extra teat is low in the three Zones (A, B and C, Table 6). The phenotypic and gene frequencies for the occurrence is 8.27% and 0.04 (Zones A), 3.36% and 0.02 (Zone B) and 1.80% and 0.1 (Zone C). Goats without Extra teat were predominant with phenotypic and gene frequency of 91.73% and 0.96 (Zone A), 96.64% and 0.98 (Zone B) and 98.21% and 0.99 (zone C).

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