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Phenotypic Characterization of Short-eared Somali and Hararghe Highland Goat Breeds at Haramaya University

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Abstract: The study was conducted to describe and document the phenotypic characterisation of Short-eared Somali and Hararghe Highland goat breeds reared at Haramaya University goat farm based on their morphological characteristics assessment. Both primary and secondary sources of data were collected on phenotypic characteristics of Short-eared Somali and Hararghe Highland goat breeds. Ten qualitative and twelve quantitative traits were evaluated from 40 goats (10 males and 10 females) from each breed. Based on linear live body measurements The Hararghe Highland and Short-eared Somali Goat breeds have a strong positive relationship between body length and heart at wither, but a weak positive relationship between ear length and pelvic width. They also have a strong positive relationship between body weight and height at wither (r = 0.933), body length (r = 0.863), and ear length (0.996). They also have a moderate positive relationship between body weight and heart girth (0.350) and chest width (0.223). The pelvic width. Haramaya University managed the Short-Eared Somali and Hararghe highland goat breeds through an extensive (free range) production system, keeping the flocks whole together without any age or sex separation

.**Keywords:** Characterization, Correlation, Linear Body Measurement, Phenotypic

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1. INTRODUCTION

Livestock are an important section of agriculture in Ethiopia and provides milk, meat, draught power, transport, manure, hides, skins (Funk *et al.,* 2012). Ethiopia is home to genetically diverse goat populations that are widely distributed across all agro-ecologies (Halima *et al.,* 2012). Goats contribute significantly to the livelihood of resource-poor farmers in Ethiopia due to their short reproductive cycle hence high multiplication rate as compared to large ruminants, which is ideal for poverty alleviation providing income, meat, milk, skin and manure, as a living bank against the various environmental hazards (crop failure, drought and flooding) and have serve for socio-cultural values for

diverse traditional communities (Tesfahun *et al.,* 2017, Hirpa and Abebe, 2008).

Ethiopian goats are classified in to eight genetically diverse breeds which are adapted to a range of environments from arid lowlands to the humid highlands (Tucho and Tesfaye, 2004). Ethiopia has about 32.74 million goats, of which about 70.49% are females and 29.5% are males and with respect to breed, almost all of the goats are indigenous breeds, which account about 99.97 % (CSA, 2018).Identification, characterization and understanding of local breeds, as well as associated contexts of their development and utilization, is the first step in making well informed decisions pertaining to genetic/breed improvement interventions.

Despite being indigenous goat breeds with unique characteristics, there is a lack of comprehensive phenotypic characterization and documentation of Short-Eared Somali and Hararghe Highland goats. Therefore, there is a need to conduct a detailed study to document and compare the phenotypic traits of these two goat breeds to contribute to their conservation, genetic improvement, and sustainable utilization. The study of the phenotypic characterization of Short-Eared Somali and Hararghe Highland goats at Haramaya University goat farm aimed to make significant contributions on conservation of indigenous goat breeds by documenting with easily understandable unique phenotypic characteristics of these indigenous goat breeds.

2. Materials and Methods

2.1. Description of the Study Site

The study was conducted at Haramaya University sheep and goat farm, which was located 525 km from Addis Ababa. The site was situated at an altitude of 1980 millimeters above sea level, 9 0 26 ' N latitude, and 42 0 3' E longitude. The area has an average annual rainfall of 741.6 millimeters. The mean annual minimum and maximum temperatures are 8.25 0 C and 23.4 0 C, respectively (Central Statistical Authority, 2005).

2.2. Data Management

2.2.1 Sources of Data

Both primary and secondary sources of data were collected on phenotypic characteristics of Short-eared Somali and Hararghe Highland goat breeds available at Haramaya University. The primary data were recorded directly by visual observation and measuring the live animal while secondary data were generated from the office of Haramaya University sheep and goat farm manager.

2.2.2 Sampling Method

Purposive and stratification sampling techniques were used to select the breeds (Short-eared Somali and Hararghe Highland goats) from the farm. The breeds were selected purposively and stratified based up on their age and as sex (adult does and bucks and male and female). Data for live body weight and linear body measurements were taken from all experimental animals in the morning.

2.2.3 Experimental Animals (Goats)

A total of 40 (20 goats from each of Short-eared Somali and Hararghe Highland) were selected by excluding sick and kids early morning. The experimental animals were identified by their individual identification numbers (ID No.).

2.2.4 Data Collection Method

2.2.4.1 Questionnaire

Structured and semi-structured questionnaires were employed to collect information on the currently existing the Short-eared Somali and Hararghe Highland goat breeds population, their management practices at Haramaya University sheep and goat farms.

2.2.4.2 Qualitative traits

Qualitative traits like coat color pattern, coat color type, head profile, back profile, presence/absence of wattles, ear orientation, horn (presence, absence and orientations), hair type and length, presence/absence of ruff; beard of goats were identified by visual observation for male and female based on breed description list of FAO, (2012).

2.2.4.3 Quantitative traits

The selected quantitative traits such as live body weight (LBW) and linear body measurements (LBM) like height at wither (HW), body length (BL), heart girth (HG), ear length (EL), pelvic width (PW), chest depth/width (CD) were measured by weighing balance and length measuring tape scaled in centimeter (cm) respectively.

Live body weight of each animal was taken in the morning using weighing balance at a constant time of day to obtain accurate weight. Linear body measurements (LBM) like height at wither (HW), body length (BL), heart

girth (HG), ear length (EL), pelvic width (PW), and chest depth (CD) for each individual male and female animal were taken using measuring tape. Height at withers (HAW) was measured by taking the distance from the surface of a plat form on which the animal stands to the withers. The measurement was made with special measuring stick/tape which was held vertical and the other at right angles to it sliding firmly up and down to record height.

Body length (BDL) was measured from the distance of the base of the shoulder to the base of the tail (where it joins the body). Heart Girth (HG) or Chest circumference was measured the circumferential measure taken around the chest just behind the front legs and withers. HG was a highly repeatable measure though it does vary somewhat with extremes of posture and perhaps as the animal breaths. Chest depth was measured the distance from the backbone at the shoulder (standardize on one of the vertical processes of the thoracic vertebrae) to the brisket between the front legs. Pelvic width (pin bone width) (PW) is the distance between the outer edges of the major hip bones on the right and left side. The hipbones are easily located and the distance between them easily measured with a pair of large, half round or oval shaped calipers.

2.3 Statistical Analysis of data

After data collection was completed, the data was adjusted for suitable data analysis software.

2.3.1. Descriptive Statistics

The qualitative data collected from observation was analyzed for male and female goat of the sample by using Statistical Package for Social Science (SPSS version 26, 2022).The quantitative data on live body weight and linear body measurement of HH and SS goat computed by descriptive statistics such as range, minimum, maximum, mean, variance and standard deviation.

2.3.2 Multivariate Analysis

The quantitative traits (body weight and linear body measurements) were analyzed using the General Linear Model (GLM) procedures of the Statistical Package for Social Science (SPS version 26, 2022) by taking sex as fixed effects to determine the existence of multiple variations for each breed and sex. Person Correlation Analysis was used to indicate the association of live body weight and linear body measurement traits for male and female. The model used to analyze the body weight and other linear body measurement traits was as follow:

$Yijkl = \mu + wi + Sj + eijkl$

Where:

Yijkl = the observed l (body weight or linear body measurement traits) in the ith weight, jth sex

μ= overall mean,

wi = the effect of ith weight

Sj = the effect of jth sex (j = female and male)

Eijkl= random residual error

3. RESULT AND DISCUSSION

3.1 Management of Short-Eared Somali and Hararghe Highland Goat reared at Haramaya University Goat farms

The two breeds were managed by semi-extensive production system and the flocks were kept whole together without any separation by age or sex. According to the response of the Haramaya University sheep and goat farm manager, the Short-Eared Somali and Hararghe goat breeds were mainly kept for the research, teaching purpose, community service and maintained for breed conservation (breeding stock) in the farm. The manager also mentioned that locally available feed resources such as natural pasture and concentrate feeds were used for the breeds. On-farm phenotypic characterization can contribute valuable information on the characteristics, performance, and management of Short-eared Somali and Hararghe Highland goats, ultimately supporting their conservation, sustainable utilization, and livelihood benefits for local communities.

3.2 Phenotypic Qualitative Characterization of Hararghe Highland Goats

The qualitative traits of indigenous Hararghe highland (HH) goat breeds reared at Haramaya University are given in Table 3. The breeds found at the farm mainly have spotted (65%), and plain (35%) coat color pattern for both female and male goats. The HH goats have coat color type of mainly mixture of white, black, grey (100%). The coat color was deviated from the previous studies on this goat breed and it was reported that the Hararghe highland goat were dominated by white (41%) and followed by brown (23%) coat color (FAO, 2011).

The majority of the HH goat has a concave and straight head profile; the present study revealed a decreasing trend the majority (75%) of the goat had strait and slightly concave (25%). The HH goat had straight (65%) and slope to ward to wither (35%) of back profile. The majority of HH goat had no wattles (75%) and which

had wattles (25%). The major HH goat had erect (75%) and semi pendulous (25%) of ear orientation for both female and male goats. The majority HH goat had straight (75%) and curve (25%) of horn orientation; and the HH goat are polled (60%) and horned (40%) naturally. The present study is in agreement with the earlier report 37% goats were polled (Alemayehu, 1993). The indigenous goat breeds found in the university have mainly smooth hair(65%) and curly rough(35%) of hair type. the majority HH goat had ruff (75%) and had no(25%) of ruff and beard for both male and female goats respectively, the scrotal shape of HH goat had elongated(40%) and cleavage(60%) of male goat. The udder shape of HH goat were flat attached to the body (60%) and pendulous '(40%) of female goat.

3.2.2 Qualitative Phenotypic Characterization of Short-eared Somali-Goats

The qualitative traits of short eared Somali goat breeds reared at Haramaya University goat farm were given in Table 4. Most of the breeds had spotted (50%), plain (25%) and patchy (25%) coat color pattern for both female and male goats. The majority of the breeds had mixture of white, black and grey (100%) color type. The goat had straight (50%), concave (25%) and slightly concave (25%) of head profile and they had straight (50%) and slope to ward to rump (50%) of back profile. The majority of short eared Somali goat had no wattle (75%) and the rest 25% have no wattles under their neck. Inclined wit characterization of the FAO (2012) reported that only 5% of short-eared Somali goat had wattles.

The majority of short eared Somali goat had erect (90%) and horizontal (10%) of ear orientation for both female and male goats. The majority of short eared Somali goat had straight (75%) and backward curved (25%) horn orientation. The short eared Somali had mainly glossy hair(50%) and curly rough(50%) of hair type and this goat are polled(30%) and 70% are horned goats, the scrotal shape of short eared Somali goat is elongated (50%) and cleavage(50%) of male goat. The udder shape for short eared Somali female goat breed were characterized as flat (50%) and pendulous (50%) of female goats.

3.3 Quantitative Characterization of Hararghe Highland and Short eared Somali Goats

The quantitative data on live body weight and linear body measurement of HH and SS goat were analyzed by person correlation analysis and indicated in Table 5.The relationship of live body weight and linear body measurement were analyzed by person correlation. The body length and heart at wither strongly correlated but ear length and pelvic width have low correlation.

The strong positive association were found between body weight and height at wither (r=0.933), body length (r=0.863) and ear length (0.996)and the moderate positive association with body weight and heart girth (0.350) and chest width (0.223).The Pelvic width showed negative correlation with body weight(r= -0.349) were recorded in male goats. In females also chest girth (r=0.94), body length (r=0.763), height at wither (r=0.780), and ear length (r=0.931) showed strong positive correlation with body weight. Pelvic width(r=0.258) and heart girth (r=0.673) had moderate and positive correlation with body weight. Among the body measurements ear length was the most strongly correlated trait with body weight (r= 0.996) for male (r= 0.993) for female.

The average live body weight and linear body measurement of HH and SS goats were illustrated in the following figure 1. The linear body measurements were highly affect body weight hence, used for prediction of live body weight of the animal. As depicted by the following figure the height at wither (HW) and body length (BL) of female showed a significant difference over male goats.

4. CONCLUSION AND RECOMMENDATION

4.1. Conclusion

From the current study it would be concluded that the Short-Eared Somali and Hararghe highland goat breeds reared at Haramaya University were managed by extensive (free range) production system and the flocks were kept whole together without any separation by age or sex and/or breed. The breeds were mainly kept for the research, teaching purpose, community service and maintained for breed conservation (breeding stock) in the farm. The breeds were also adaptable to utilize the locally available feed resources such as natural pasture and supplemental feed such as concentrate feeds. This study revealed that the on-farm phenotypic characterization of these breeds can contribute valuable information on the characteristics, performance, and management practices and used to an ultimate clue for supporting their conservation, sustainable utilization, and livelihood benefits for local communities. The phenotypic characterization of Short Eared Somali and Hararghe Highland goats reared at Haramaya University showed distinctive characteristics. The study found that the Short Eared Somali goats have shorter ears, a smaller body size, and a higher reproductive performance compared to the Hararghe Highland goats. These differences in phenotypic characteristics can be attributed to the

genetic makeup and environmental conditions of each breed.

4.2. Recommendations

Selecting the best breeds based on body size and growth traits and culling un-wanted buck in the flocks a good mechanism that needs to be considered in the study area. The producers' perception about their goats' adaptability and morph metric trait differences and similarities are suggested to be supported with further genetic analysis studies and steps need to be taken to conserve these animal genetic resources under their production environment. The Short-Eared Somali and Hararghe highland goat breeds reared at Haramaya University were managed by extensive (free range) production system and the flocks were kept whole together without any separation by age or sex. This management practices were difficult to maintain breeding stock because there was condition the two breeds interbreed each other and difficult to identify and conserve the pure breed. From this research we recommended that there should be a flock separation practices to control inter breeding of the two breeds.

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