

Provided for non-commercial research and education use.

Not for reproduction, distribution or commercial use.



This article was published in an Sjournals journal. The attached copy is furnished to the author for non-commercial research and education use, including for instruction at the authors institution, sharing with colleagues and providing to institution administration.

Other uses, including reproduction and distribution, or selling or licensing copied, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Text form) to their personal website or institutional repository. Authors requiring further information regarding Sjournals's archiving and manuscript policies encouraged to visit:

<http://www.sjournals.com>

© 2022 Sjournals Publishing Company

Contents lists available at Sjournals
Scientific Journal of Animal Science
Journal homepage: www.sjournals.com



Original article

Phenotypic characterization of Sudanese desert goat

Ahmed Abi Abdi Warsame^{a,*} and Benson Turyasingura^b

^a*Faculty of Agriculture and Environmental Sciences, Gulu University, Uganda.*

^b*Faculty of Agriculture and Environmental Sciences, Kabale University, Uganda.*

*Corresponding author: aaydid3@gmail.com

ARTICLE INFO

Article history,

Received 18 December 2021

Accepted 22 January 2022

Available online 30 January 2022

iThenticate screening 19 December 2021

English editing 20 January 2022

Quality control 28 January 2022

Keywords,

Phenotypic

Characterization

Desert goat

Breeding program

Sudanese breeds

ABSTRACT

The goal of this research was to define the phenotypic characteristics of Sudanese desert goats, as well as the morphological traits of desert goats, in order to develop community-based breeding programs. Weight tape was used to take phenotypic measures of 60 desert goats on the college animal production farm. Coat color (black 31.6 percent, white 10%, brown 18.33 percent, mixture 40 percent), head profile (exerted shape 100 percent), back shape (straight 80 percent, curve 11.6 percent), ear form (drop 100 percent), horn orientation (backward 97.67 percent, polled 3 percent), beard (presence 71.6 percent, absence 28.33 percent), toggle (presence 8.33 percent, absence 91.6 percent), muzzle (pigment 38.3 percent, absence 91.6 percent) (absence 100 percent). Body weight (mean body weight 24.24), height at withers (mean height at withers 66.43), body length (mean body length 56.98), heart girth (mean heart girth 68.45), ear length (mean ear length 19.28), rump width (mean rump width 14.33), and tail length (mean tail length 13.35) variables were among the quantitative traits were processed and documented. Desert goats were first discovered in the north Kordofan state, in the village of Abu Zabad. Significant variances in phenotypic measurements were found among all indigenous desert goats, and the findings of this study add to the phenotypic data of indigenous Sudanese desert goats.

© 2022 Sjournals. All rights reserved.

1. Introduction

More than million goats are currently in use around the world, producing more than 4.5 million tons of milk and million tons of meat, as well as various byproducts (Lu and Miller, 2019). Sudan is mostly an agricultural nation with a sizable cattle population. According to the Sudan Ministry of Animal Resources' most recent estimate (2013), Sudan's animal population is over 138 million heads, with 41 million cattle, 50 million sheep, 43 million goats, and 4 million camels. The majority of this population is owned by nomads (Ali, 2019). Goats are a popular domestic dual-purpose animal in Sudan, and they play a crucial role in the country's economy and in the lives of many Sudanese families (milk and meat).

Desert goats are primarily raised for meat production, particularly in rural areas, in Sudan and other arid places (Escareño et al., 2012). They also offer milk for household requirements and a variety of fiber (Farrington et al., 2005). Goats are also an important source of animal protein and family cash revenue for small-scale farmers in various nations (Alabi et al., 2019). Desert goats exhibited much higher carcass weight and dressing a hundred percent than other goats, which could be related to their bulkier body components. According to Ahmed (2019), desert goat meat has excellent processing qualities. Estimates of genetic and phenotypic parameters are limited in goats raised in dry environments.

The replacement of indigenous goats with imported goat breeds and uncontrolled crossbreeding might result in genetic erosion, loss of genetic variety, and a reduction in adaptive value as well as prospects for optimal usage of existing indigenous goats hence, a need for the study.

1.1. Economic importance of desert goats

Wilson (2018) states that Goat production is important in Sudan because goats have been raised successfully with very limited feed resources. Consequently, consideration of meat production from goat in Sudan has been encouraged because of the prospective meat shortage especially in other developing countries, according to World bank (1983) Goats contribute to the human food supply as dairy animals and are often named the (poor man's cow). And are utilized for their milk supply potential, especially for those who live in remote arid and semi-arid areas of the sudan. Although goats, compared to sheep, are lean animals which deposit their fat around their viscera, it is reported that the estimated percentage (72%), of edible meat from the desert goat carcass (Yagoub and Babiker, 2016) is higher than that reported for desert sheep (70%), still much more detailed and extensive investigation are needed to evaluate the efficiency and the economy of meat production from the desert goat under different system management.

1.2. What is phenotypic characterization?

According to Fadlelmoula et al. (2014), the terminology "phenotypic characterization of AnGR" refers to the process of identifying and defining unique breed populations and their exterior and production features within a specific production environment. The concept, however, has been enlarged to encompass the specifics of the manufacturing environment. The phrase "producing environment" is used here to refer to not just the "natural" environment, but also management techniques and animal uses, as well as socio-economic variables like market orientation, niche-marketing prospects, and gender difficulties. In this study, the geographical distribution of breed populations is considered a significant part of phenotypic evaluation. Chebii et al. (2020) concedes that Molecular genetic categorization is a set of complementary approaches for deciphering the genetic basis of traits and their patterns of inheritance from one generation to the next, as well as establishing breed links. In essence, AnGR phenotypic and molecular genetic characterization is used in this study to assess and describe genetic variety in these goats as a foundation of planning, improving and management of Sudanese desert goat in the future and also for understanding and production sustainability of using them.

2. Materials and methods

2.1. Experimental materials

The animals of this study were collected from three different markets in North Kordofan: Abu Zabad, Tayba, and Mahfour. This area is very popular areas for goat rearing and goat utilization (figure 3.1). The goats were then sent to the University of Bahri's College of Animal Production farm.

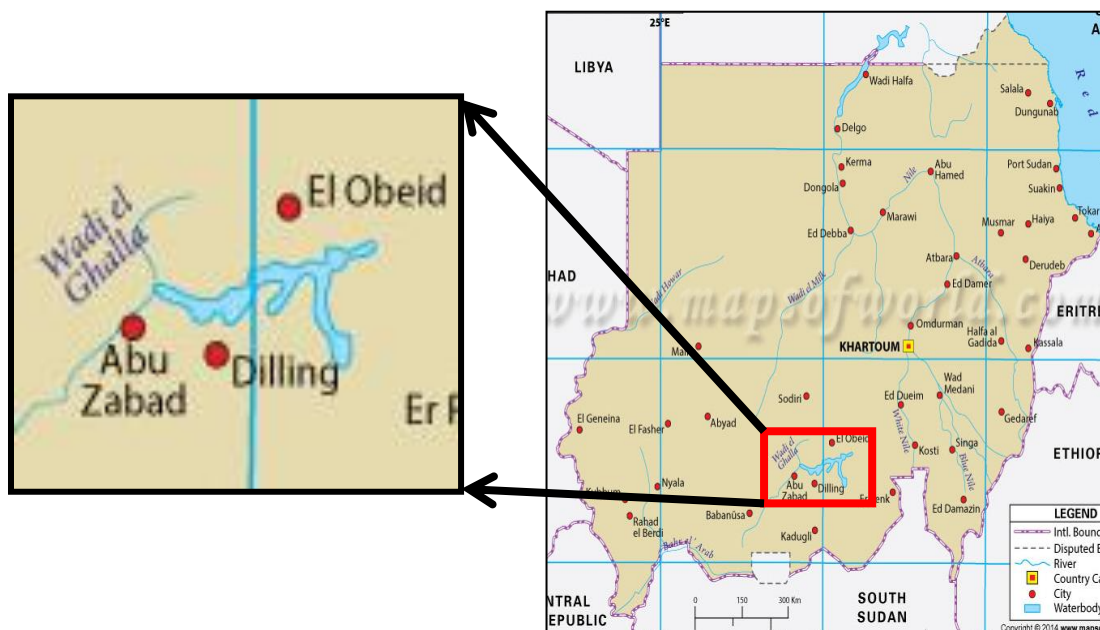


Fig. 1. Location of the goats used in this study.

2.2. Sample and data collection

The data of this study was collected randomly from 60 adult female desert goats in the farm of College of Animal Production. The data was divided into two groups; qualitative and quantitative data, the qualitative data included: coat color, head profile, back shape, ear orientation, horn shape, beard, toggle, muzzle, and wattle, while the quantitative data included the body parts measures as described by FAO descriptor tool (2008) such as; body weight; height at withers (HW), calculated as the distance between the anterior ends of the shoulder and the posterior extremities of the pin bone (Appendix 1); body length (BL), calculated as the distance between the anterior ends of the shoulder and the posterior extremities of the pin bone, with the animal standing with its feet placed squarely on the level ground (Appendix 2); ear length (EL), tail length (TL), measured from the base of the tail to the end of the coccygeal vertebrae (Appendix 4); and horn length (HL), measured from the temple of the head to the tip of the horn (Appendix 5); and tail length (TL), measured from the base of the tail to the end of the coccygeal vertebrae (Appendix 6). (Appendix 5) A tailor's measuring tape was used to obtain the length measurements (cm), while the body weight measurement (kg) was done with a scale weight measurement. To avoid between-individual variances, all measurements were taken by the same person.

2.3. Statistical analysis

All data gathered from this study were entered in Excel Spread Sheets (Ms Excel -2007) and analyzed using descriptive statistics in order to classify the data into means and percentages.

3. Results and discussion

3.1. Qualitative characteristics

The physical body characteristics of indigenous desert goats discovered in this study. The findings reveal distinct physical differences between and within these desert native goats. Figure 1.1 illustrates the coat colors found in the Sudanese indigenous desert goats. In general, the Mix coat color (Black or White with or without spots or patches) were more frequent (40%), followed by Black color (31.6%), Brown color (18.33%), and white color (10.00%). There were different coat pattern types in Sudanese desert goats, in which predominantly plain (60.33%), and patchy (22.67%), and spots (18.33%), of various colors (figure 1.2). Ethiopian local goat types were found to have matching coat colors and patterns (Abdalla et al., 2012).

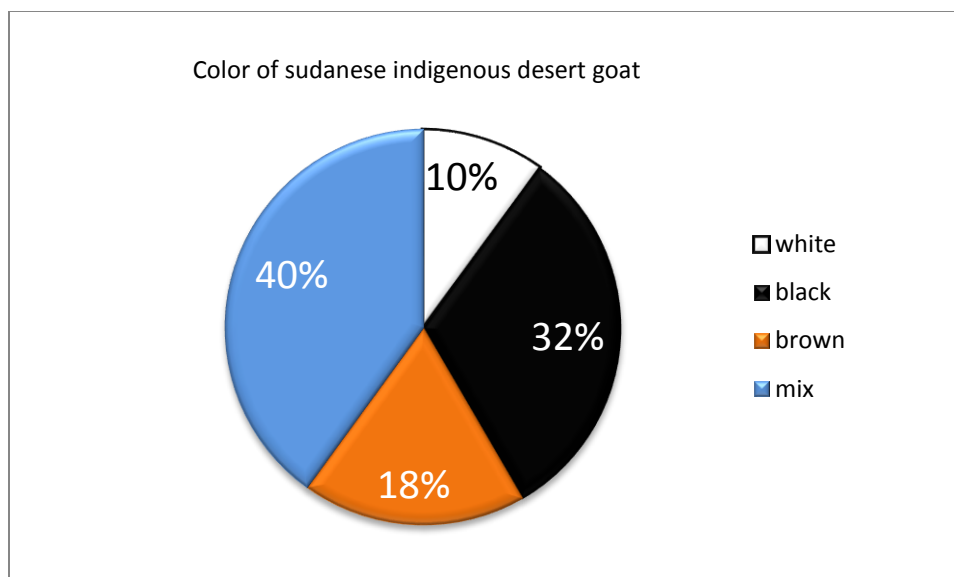


Fig. 1.1. Coat colors of Sudanese desert goat in the farm of College of Animal Production, University of Bahri-Sudan.

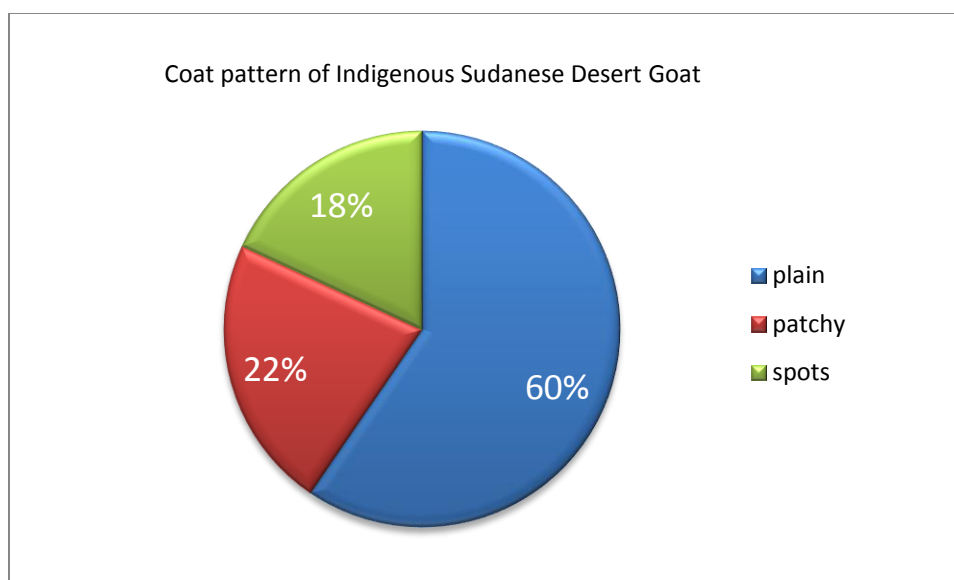


Fig. 1.2. The indigenous Sudanese desert goat's coat pattern.

The high frequency of plain colors in Sudanese Desert Goats could be attributed to inter se mating, which intern could lead to formation of specific ecotypes. This study backs up the findings of (Gatew et al., 2017), who found that coloration might be an adaptive characteristic or a product of a farmer's choice for a certain coat hue. For example, according to Rahmatalla et al. (2017), black-colored animals are better adapted to seasonal cold weather or cold nights because the dark pigment allows them to heat up faster than other coat colors. Regarding head profile, most of Sudanese indigenous desert goats have exerted head (nearly 100%) (figure 1.3), and drop ear form, straight horn shape. About the shape of the animal back, more than 80% of the Sudanese desert goats have a straight back shape (figure 1.4).



Fig. 1.3. Head profile 100%.

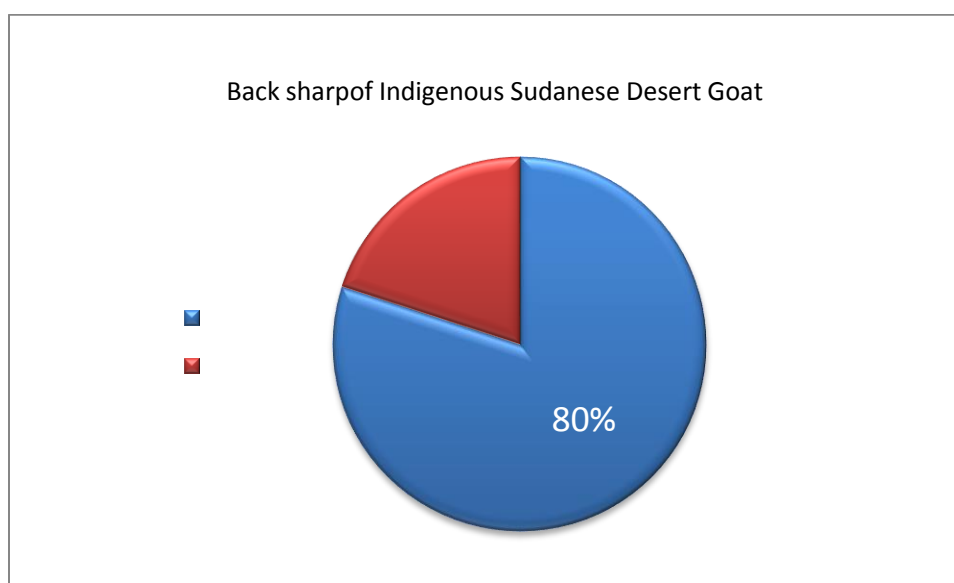


Fig. 1.4. Back shape 80%.

Also the study confirmed that curved backward horn orientation were (11.6%) and polled horns (3%) (figure 1.5).

Majority of indigenous Sudanese desert goat had (100%) straight rump shape (figure 1.6). Regarding the presence of horn, 97% (figure 1.7) of studied goats were horned. the Horns in animals are thought to aid blood outflow through the cavernous sinus, which serves as a thermal homeostasis control mechanism (El Hag, 2020).

As shown in Figure most of indigenous desert goats in this studied had no wattle (100%) and were bearded (71.6%) Despite the various advantages of having wattles and a beard in goats raised in hot and humid conditions. The thermoregulatory effects of beard and wattle, as well as the correlation of these features with reproduction, such as better prolificacy, higher milk yield, larger litter size, fertility index, and conception rate, are among the most notable advantages (Nguluma et al., 2021) of 8.33% were toggled (figure 1.8), which are observed in the farm. Dairy and pygmy goats, as well as Spanish goats, are more likely to have toggles (Navarro-Ríos et al., 2011).

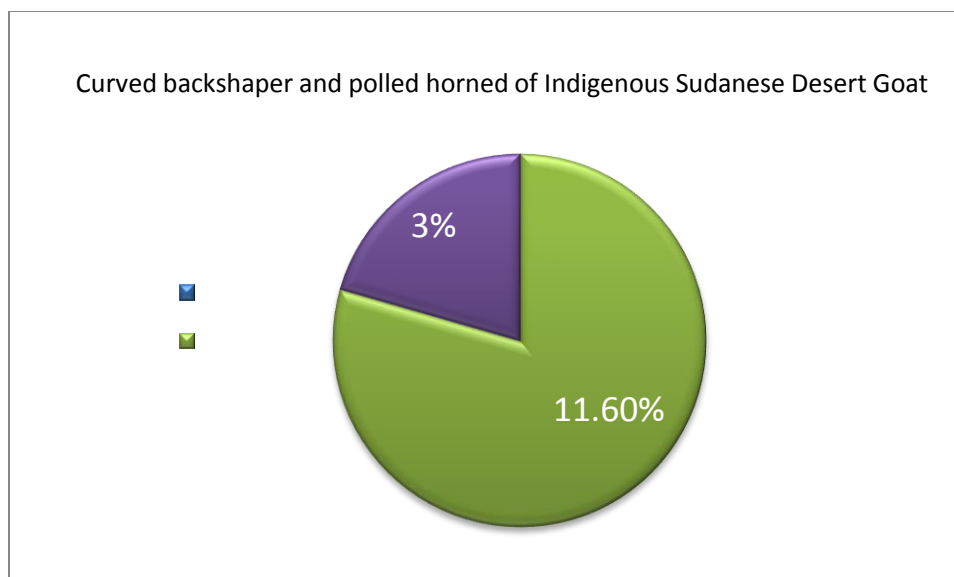


Fig. 1.5. Curved back shape 11.6%, polled horned 3%.

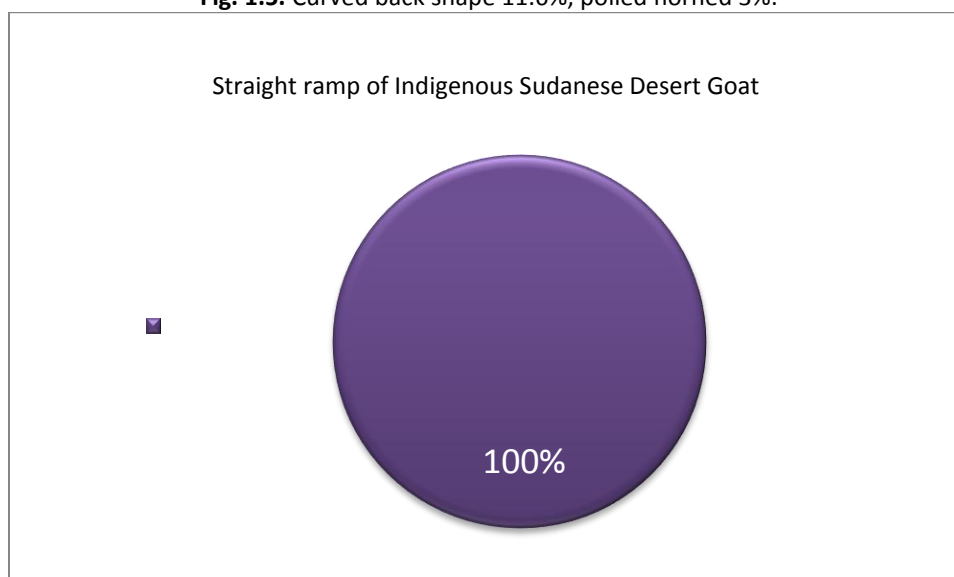


Fig. 1.6. Straight rump 100%.

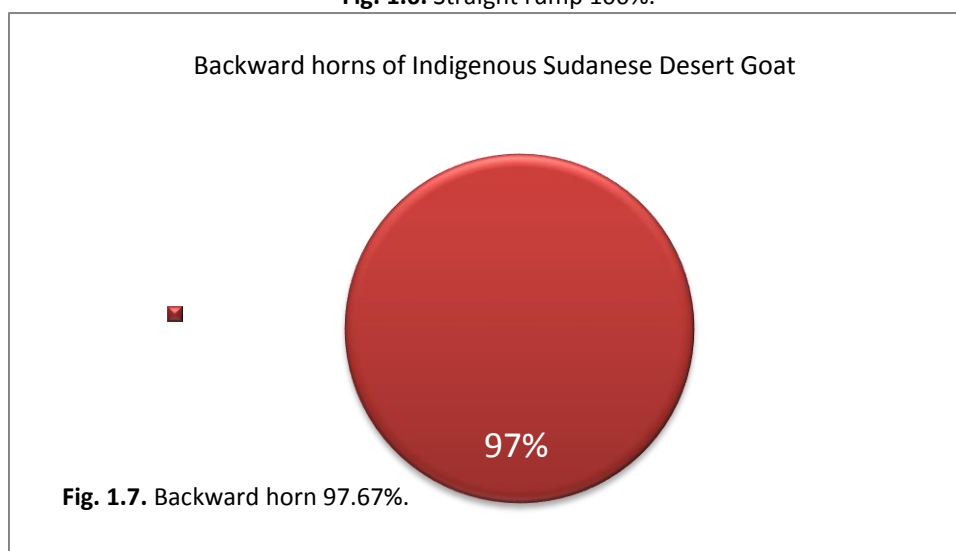


Fig. 1.7. Backward horn 97.67%.

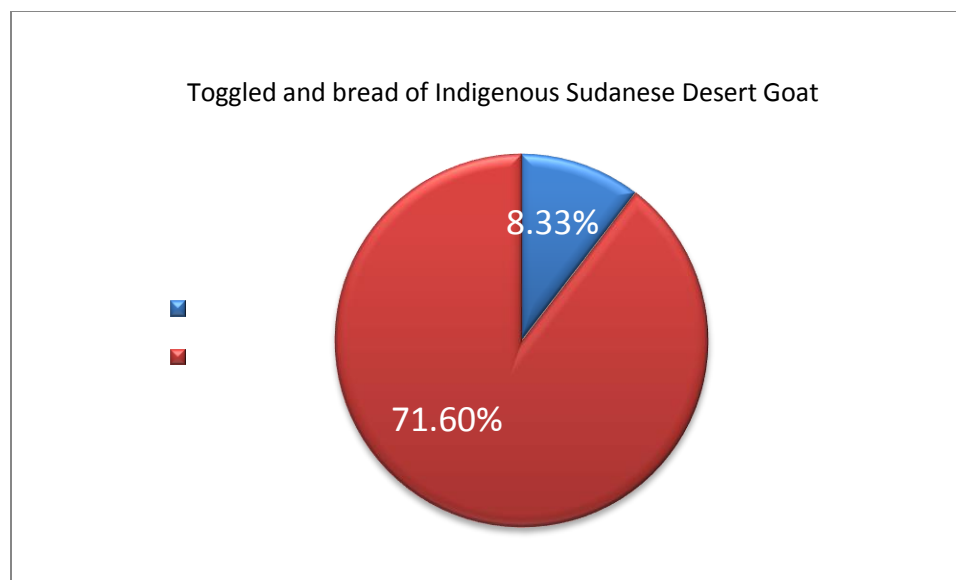


Fig. 1.8. Toggle 8.33, beard 71.6%.

3.2. Quantitative characteristics

According to Nicolazzi and Sayre (2021), the animal's production state and breed features can be roughly described using morphometric data. Table 1 shows the measurement of the quantitative characteristics of Sudanese desert goats. The body weight of adult indigenous Sudanese desert goats varied significantly among studied animals, the heavier body weight was found 40.6kg and the lighter was 16.2 with an average of 24.24 Kg. Regarding heights at withers, the indigenous Sudanese desert goats have average of 66.43 cm height. According to Leng et al. (2010), body size is an appropriate criterion for categorization because it includes signals about efficiency.

Knights and Garcia (1997) categorize tropical goats as large (> 65 cm at the withers), small (51 to 65 cm), or dwarf (less than 50 cm) (2012). Sudanese people had an average body length of 56.98 cm. the average of Horn length was 11.61 cm, it is an important self-defensive mechanism, a sign of their capacity to protect oneself and thrive in the harsh surroundings in which they are raised. The average chest girth of indigenous Sudanese desert goats was 68.45 cm, and longer ears 19.28cm.

Table 1

Body weight, Withers height, Body length, Heart girth, Rump height, and Tail length of Sudanese indigenous desert goats.

Variables	Indigenous desert goat	
Body weight (kg)	Min	16.2
	Mean	24.24
	Max	40.
	Se	0.87
Height at withers (cm)	Min	58
	Mean	66.43
	Max	72
	Se	0.47
Horn length (cm)	Min	7
	Mean	11.61
	Max	21
	Se	0.65
Face length (cm)	Min	9

	Mean	9.88
	Max	11
	Se	0.25
Body length	Min	51
	Mean	56.98
	Max	70
	Se	0.35
Chest length	Min	60
	Mean	68.45
	Max	79
	Se	0.23
Ear length	Min	14
	Mean	19.28
	Max	22
	Se	0.35
Neck length	Min	22
	Mean	26.51
	Max	32
	Se	1.06
Rump length	Mean	14.33
	Min	13
	Max	16
	Se	0.12
Tail length	Mean	13.35
	Max	19
	Min	9
	Se	0.16

4. Conclusion

The basic insights into the production system and phenotypic traits are provided in this research. Phenotypic characterization of this study indicated high variation within and between the studied breeds in qualitative and quantitative traits. Sudanese desert goats are on an average is 56.98% this shows considerably higher genitive imprudent for future genetic improvement through selection and breed conservation.

The indigenous goat is a large to medium-sized breed with a varied coat color and pattern (Rahmatalla et al., 2017) and an expended facial profile. straight back shape, drop ear orientation, presence of beard, presence of toggle, and absence of wattle. In spite of the wide variety of quantitative traits observed, traits like height at withers (which are good for adaptation in the hot and humid environment and also have positive impact on performance). Because the breed has been used to the local environment, it is critical to preserve it and use it in future breeding programs.

Acknowledgments

All praise is due to Allah, after that I would like to express my sincere gratitude to my thesis super visor Dr. Haytham Hago, senior lecture in faculty of animal production, university of Bahri who has consistently inspired me in this study provided me precious suggestions and advice. I have also acquired valuable insights through his instructions. Not only in academic studies but also enthusiasm and vigor in life.

My heartfelt gratitude goes especially to Dean Dr. Raja, and Mr. Adam Mohamed Adme Abdullah, Mr. Tariq Mohamed Badri Aro, for their unconditional support, patience and guidance throughout this study. I appreciate the labors of goat unit in the farm of college of animal producton,during their assistance during the measurement processing and making available the animals for me. I am deeply giving my most gratitude and appreciation to all my lecturers and professors who are educated me all the time and not get bored.

Last but not least, I am kindly appreciate my parents, and my relatives, who were always supporting me through this study. It is their love and support that were always encouraged me to stick on to the difficult task of writing the thesis.

References

- Abdalla, S.A., Ishag, I.A., Ahmed, M.K.A., 2012. Goat production system in peri-urban areas of Khartoum state, Sudan. *Sci. J. Anim. Sci.*, 1(June 2018), 183-191.
- Ahmed, T.A.H., 2019. Phenotypic and performance characteristics of Nubian goats in the Gezira State, Sudan. University of Gezira.
- Alabi, O.O., Shoyombo, A.J., Ajala, A.O., Ogunjimi, S.I., 2019. Animal agriculture: A viable tool for rural women empowerment and redemption from poverty. *Int. J. Civil. Eng. Technol.*, 10(2), 2365-2373.
- Ali, A.M., 2019. Prevalence of Tick Infestation in domestic ruminants and associated risk factors in Omdurman Locality-Khartoum State-Sudan. Sudan University of Science and Technology.
- Chebii, V.J., Oyola, S.O., Kotze, A., Domelevo Entfellner, L.B., Musembi Mutuku, J., Agaba, M., 2020. Genome-wide analysis of nubian ibex reveals candidate positively selected genes that contribute to its adaptation to the desert environment. *Anim.*, 10(11), 1-14.
- El Hag, F.M., 2020. Goat breeding objectives in relation to agroecological zonation under dryland farming conditions of North Kordofan, Sudan. *World J. Agr. Soil Sci.*, 5(1), 1-7.
- Escareño, L., Salinas-González, H., Wurzinger, M., Iñiguez, L., Sölkner, J., Meza-Herrera, C., 2012. Dairy goat production systems. *Trop. Anim. Health Prod.*, 45(1), 17-34.
- Fadlilmoula, A.A., Yousif, I., Ismail, A., 2014. Genetic and phenotypic parameter estimates of morphometric traits in Sudan desert goats. *Online J. Vet. Res.*, 15(2), 106-111.
- Farrington, D.W., Lunt, J., Davies, S., Blackburn, R.S., 2005. Poly (lactic acid) fibers. *Biodegradable and Sustainable Fibres*, 6, 191-218.
- Gatew, H., Hassen, H., Kebede, K., Haile, A., Lobo, R.N.B., Yetayew, A., Rischkowsky, B., 2017. Husbandry practices and phenotypic characteristics of indigenous goat populations in Ethiopia. *Afr. J. Agr. Res.*, 12(36), 2729-2741.
- Knights, M., Garcia, G.W., 1997. The status and characteristics of the goat (*Capra hircus*) and its potential role as a significant milk producer in the tropics: A review. *Small Rumin. Res.*, 26(3), 203-215.
- Leng, J., Zhu, R.J., Zhao, G.R., Yang, Q.R., Mao, H.M., 2010. Quantitative and qualitative body traits of longling yellow goats in China. *Agr. Sci. China*, 9(3), 408-415.
- Lu, C.D., Miller, B.A., 2019. Current status, challenges and prospects for dairy goat production in the Americas. *Asian-Austr. J. Anim. Sci.*, 32(8), 1244.
- Navarro-Ríos, M.J., Fernández, G., Perezgrovas, R., 2011. Characterization of Majorera goat production systems in the Canary Islands. *Economic, social and environmental sustainability in sheep and goat production systems*, 100, 205-210.
- Nguluma, A.S., Kyalo, M., Loina, R., Chenyambuga, S.W., Pelle, R., 2021. Typology and characteristics of indigenous goats and production systems in different agro-ecological zones of Tanzania. 1-19.
- Nicolazzi, E.L., Sayre, B.L., 2021. Assessment of production traits for the different African goat breeds. https://www.researchgate.net/publication/349203982_Assessment, (February), 1-12.
- Rahmatalla, S.A., Arends, D., Reissmann, M., Said Ahmed, A., Wimmers, K., Reyer, H., Brockmann, G.A., 2017. Whole genome population genetics analysis of Sudanese goats identifies regions harboring genes associated with major traits. *BMC Genet.*, 18(1), 1-10.
- Wilson, R.T., 2018. Livestock in the Republic of the Sudan: Policies, production, problems and possibilities. *Anim. Husb. Dairy Vet. Sci.*, 2(3), 1-12.
- World bank, 1983. Sheep and goats in developing countries: their present and potential role. World Bank Technical Paper.
- Yagoub, Y.M., Babiker, S.A., 2016. A study on goat meat production in Sudan. 2(3), 21-26.

How to cite this article: Abdi Warsame, A.A., Turyasingura, B., 2022. Phenotypic characterization of Sudanese desert goat. *Scientific Journal of Animal Science*, 10(1), 716-725.

Submit your next manuscript to Sjournals Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in DOAJ, and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.sjournals.com

Sjournals
where the scientific revolution begins