RESEARCH ARTICLE

Current population size and risk status of the indigenous endangered Sheko cattle breed in south-west Ethiopia

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Abstract

This study assessed the current population size and risk status of the indigenous endangered Sheko cattle breed in four zones of South West Ethiopia. The Sheko cattle breed, known as the last remnants of Africa's original *Bos taurus* cattle and the only trypanotolerant breed in Ethiopia, is facing a decline in their effective population size. The estimated population size of Sheko cattle is approximately 7252, with varying levels of genetic purity based on physical observations. The distribution of genetic purity levels of Sheko cattle indicates that there are approximately 4073, 2934, and 1145 individuals at the 1st (>80% pure), 2nd (>60% pure), and 3rd (>40% pure) levels, respectively. The breed is at risk due to factors such as aggressive behavior, interbreeding with zebu breeds, lack of pure Sheko bulls, and lack of awareness creation. To conserve the Sheko cattle breed, measures such as backcrossing to purebreds, genetic monitoring and evaluation, molecular characterization, assessment of genetic admixture and inbreeding, and collaboration among stakeholders are essential. Overall, this research emphasizes the urgent need for coordinated efforts to safeguard the genetic diversity and population size of the Sheko cattle breed.

Keywords: Sheko cattle, Population size, Risk status, Genetic purity, Conservation.

Introduction

Sheko cattle breed is a trypanotolerant (Alberro, 1982, Taye, T, 2007) cattle breed in Ethiopia (DAGRIS. 2004) and represents the last remnants of Africa's original *Bos taurus* cattle, which were probably the first breed to be developed in eastern Africa (Hanotte, Oliver,2000). This breed exhibits small humps, small body size and short or no horns, which makes them much easier to manage with suitable for milk production (Rege, 1999). The current distribution of the breed in the breeding tract coupled with the declining tendency for controlled pure breeding of the animals suggests genetic erosion of the breed at an alarming state (Elias Bayou. 2008). Unfortunately, information available on this population has been based on sampling surveys

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(DAD-IS, 2000; Hanotte, Oliver, 2000; Taye Takele, 2007). Even though these few works were able to provide some information on the Sheko population and distribution, they are lowly reliable and do not cover the entire breeding tract in the south-west of Ethiopia. Updating of the previous results and/or producing new data is vital since genetic resources and production systems are not static. Thus, routine inventories and ongoing monitoring is needed (Sölkner, J, 1998). Furthermore, reliable statistical information is needed to guide the design and implementation of breed development programs that should be carried out in the rebuilding of this endangered breed. This study was aimed at evaluating the status, population size, and distribution of Sheko cattle in the entire breeding tract of southwestern Ethiopia to produce data that can be used for development, planning and policy formulation regarding the breed.

Objective

The aim this study was to assess the population size and the risk status of the Sheko cattle breed in different zones and districts, to identify major breeding tract for Sheko cattle breed and their associated risk status in south-western Ethiopia, to identify physical, morphological and behavioral characteristics associated with Sheko cattle breed

Materials and Methods

The research was conducted in the Bench-Sheko, West Omo, Sheka, and Kaffa zones of south-west Ethiopia,
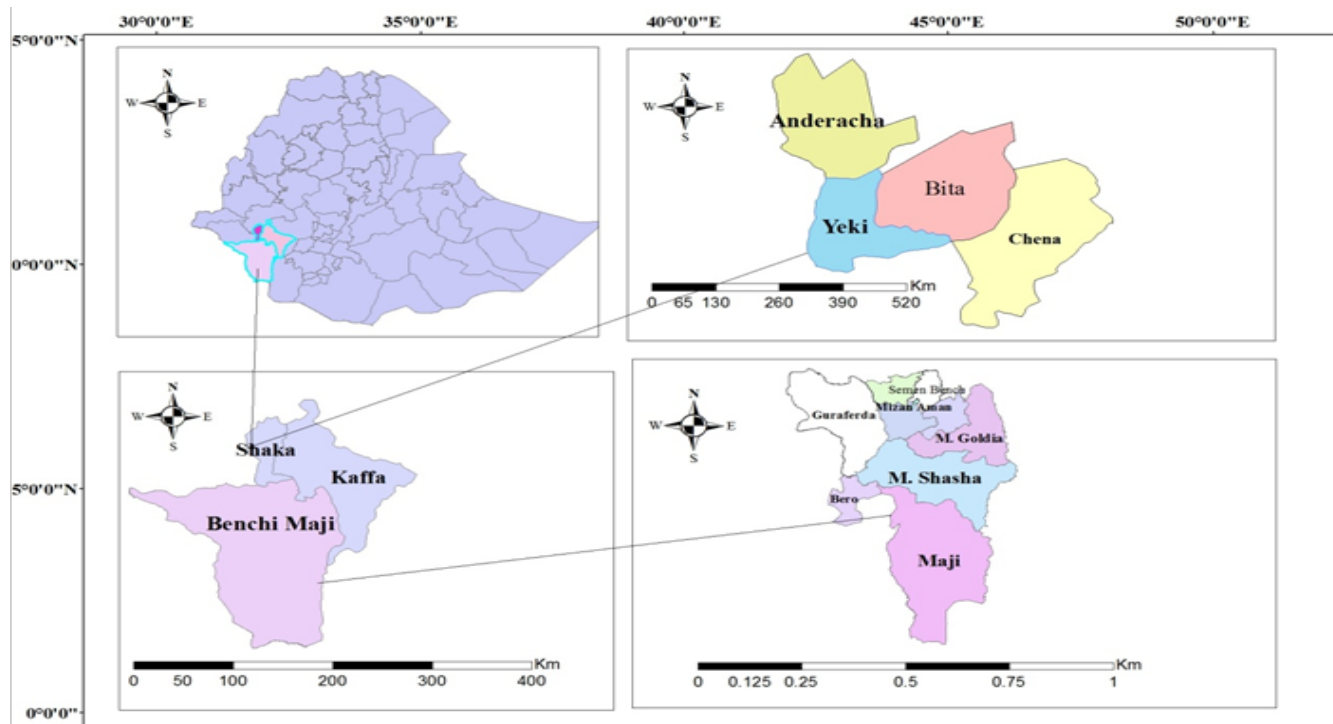
Figure 1: Map of study area

Table 1: The risk status of Sheko cattle breed

Description	Zone			Overall	Risk status (FAO, 2007; Ganding, 2005)	Categorize for risk status results
	BMZ	Kaffa	Sheka			
Breeding females	2893	260	259	3412	>500	
Breeding males	708	76	43	827	>20	Endangered
Total	3601	336	302	4239		

focusing on the livestock farming practices of the Sheko cattle breed (Figure 1). The study utilized a combination of rapid appraisal techniques, field surveys, and focus group discussions involving farmers and relevant stakeholders. Morphological, behavioral, and performance characteristics of the Sheko cattle were assessed, and comprehensive breed characteristics and photographs were documented from each zone. For the morphological study, a total of 250 animals (198 females and 52 males) were randomly sampled from each of the study zones. Additionally, door-to-door censuses were conducted in each district of the four zones. Furthermore, 202 households were interviewed using a structured questionnaire to gather data on breeding and husbandry practices, production constraints, farmer preferences for the Sheko breed, and the breed's risk status. The information on breed characteristics obtained from group discussions and photographs was compared and ranked against a developed breed descriptor list. Data collected from the questionnaire and morphological records were analyzed using descriptive statistics through the statistical analysis system (SAS). Chi-square tests were conducted using the same software to assess associations among categorical variables. A general linear model was employed to examine the impact of agro-ecology and districts on the proportions of the Sheko breed within the study area.

Results And Discussion

Distribution and Status of Sheko Cattle Breed
The findings of this research indicated that the population size of the Sheko cattle breed currently stands at approximately 7252 individuals, consisting of 3412 breeding females and 827 breeding males (Table 1). This estimation falls within the range of previous studies, which reported figures such as 31,000 (source (Dadi, 2009, Rege, J. E. O, 1999), 4,040 (source (Taye, T, 2007), and 2,400 (source (Dadi, 2008). Discrepancies in these numbers could be attributed to variations in data collection methods and sources. However, the current research suggests a trend of increasing population size. This growth could be a result of improved conservation

efforts, such as the distribution of breeding males for natural mating, implementation of estrus synchronization practices, mass artificial insemination programs for Sheko cattle, and increased awareness among farmers.

The Genetic Purity Level of *Sheko* Cattle Breed

As indicated in Table 2, the distribution of genetic purity level of Sheko cattle based on physical observation was estimated to be about 4073, 2934 and 1145 for 1st (>80% pure), 2nd (>60%) and 3rd (>40%) levels of Sheko breed, respectively. Because of interbreeding with zebus, it is hard to find pure Sheko cattle. Cattle in the 1st level of purity have no horns, are humpless, long-polled, and have a rectangular face and long, broad muzzle. Cattle at the 2nd level have small horns and hump, are medium polled, and have a rectangular face and medium, broad muzzle. The 3rd level cattle are those with medium-size horns and hump, are small-polled, and have a rectangular face and small, broad muzzle.

Reasons for Endangerment

The research paper analyzed the reasons behind the endangerment of a specific breed, with aggressive behavior being the primary contributing factor in 78.5% of cases. Interbreeding with zebu cattle was also identified as a significant issue, accounting for 6.5% of the cases. In addition, factors such as high feed efficiency (3%), the absence of horns (1.5%), difficulty in managing the breed, the lack of a pure bull for mating, and problematic husbandry practices were reported in 1.5% of instances.

Lack of awareness (3.5%) and diseases (1.5%) were also noted as reasons for endangerment. The study's detailed breakdown of reasons for endangerment provides valuable insights for breed conservation efforts. These findings are consistent with previous reports on endangered breeds (Taye, T, 2007, Dadi, 2008, Elias B, 2008). The study also highlighted concerns regarding the use of regular artificial insemination (AI) with Holstein Friesian and Jersey breeds, further exacerbating the endangerment of the breed. Table 3 the reasons for endangered

Breeding Practice

Out of the total interviewed, 47, 27 and 26% was primarily used natural bull with uncontrolled mating, natural control with uncontrolled mating and artificial insemination service, respectively (Table 4). Among the respondents in all districts, 59.5% had a breeding bull in their herd; the remaining proportion used either a neighboring bull (27.5%) or a bull from a far community (13%). Getting bull service at marketplace with some amount of payment was mentioned by some respondents as an example for the later. Currently control mating system of sheko cattle breed is the some parts of at study areas used to by bull keeper free service.

Similarity, the studies in our country reported that natural mating was most of the farmers and pastoralists reported by (Taye, Takele, 2007). The mating system found is this study is in agreement with the results reported by (Taye, and Takele, 2007). He reported that 47% of respondents in south-west Ethiopia in breeding practice uncontrolled mating and not agreement reported by Taye, Takele (2005). Also, control breeding was practiced by a few (27%) farmers, meaning free bull service at selection areas. However, currently Awassa Environmental Protection Office and Federal Biodiversity Institute is on the way to disseminating to the farmer pure sheko cattle bull for control mating service and some area is start artificial insemination (AI) service in some selected areas of Bench and Sheko districts to upgrade sheko cattle with Sheko semen local cattle.

Table 2: The blood level of Sheko cattle breeds

Sex	Level of Sheko cattle breed			
	1st level	2nd level	3rd level	Total
Female	3100	1614	800	
Male intact	815	307	303	
Male castrated	158	113	42	
Total	4073	2034	1145	7252

Table 3: The reason for endangered

Reasons for extinct	Andracha (N = 10)		Chena (N = 21)		Guraferda (N = 31)		Maji (N = 10)		Sheko (N = 63)		Shibench (N = 65)		Over all
	N	%	N	%	N	%	N	%	N	%	N	%	%
Aggressive	9	90	17	80.9	30	96.7	10	100	51	80.9	40	61.4	78.5
Interbreeding	1	10	2	9.5	1	3.2	0	0	4	6.3	5	7.6	6.5
High feed efficiency	0	0	2	9.5	0	0	0	0	1	1.5	3	4.6	3
No horn	0	0	0	0	0	0	0	0	0	0	3	4.6	1.5
Lack of bull	0	0	0	0	0	0	0	0	0	0	3	4.6	1.5
Management problems	0	0	0	0	0	0	0	0	1	1.5	5	7.6	3
No need market	0	0	0	0	0	0	0	0	1	1.5	1	1.5	1
Lack of awareness	0	0	0	0	0	0	0	0	3	4.7	4	6.1	3.5
Diseases	0	0	0	0	0	0	0	0	2	3.1	1	1.5	1.5

Table 4: Breeding practice Sheko cattle at the study areas

Breeding practice		Andracha (N = 10)		Chena (N = 21)		Guraferda (N = 31)		Maji (N = 10)		Sheko (N = 63)		Shi Bench (N = 65)		overall
		Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	%
Mating system	Artificial insemination	3	30	5	23.8	9	29	1	10	14	22.2	20	30.7	26
	Natural control	2	20	6	28.5	7	22.5	3	30	21	33.3	15	23.	27
	Natural uncontrolled	5	50	10	47.6	15	48.3	6	60	28	44.4	30	46.1	47
Source of breeding bull	Own herd	6	60	12	57.1	18	58	4	40	36	57.1	43	66.1	59.5
	Neighbors herd	2	20	7	33.3	9	29	4	40	17	26.9	16	24.6	27.5
	Surrounding areas herd	2	20	2	9.5	4	12	2	20	10	15.8	6	9.2	13
Calving season	Year round	7	70	14	66.5	21	67.7	6	60	43	68.2	44	67.6	67.5
	Seasonal	3	30	7	33.3	10	32.2	4	40	20	31.7	21	32.3	32.5
Selection of breeding animal	Yes	6	60	12	57.1	18	58	7	70	39	61.9	41	63	61.5
	No	4	40	9	42.8	13	41.9	3	30	24	38.1	24	36.9	38.5

Table 5: Sheko cattle adaptability at the study area

Descriptors	Range	Andracha (N = 10)		Chena (N = 21)		Guraferda (N = 31)		Maji (N = 10)		Sheko (N = 63)		Shibench (N = 65)		Overall
		N	%	N	%	N	%	N	%	N	%	N	%	%
Longevity	High	7	70	14	66.6	24	77.4	7	70	51	80.9	53	81.5	78
	Medium	1	10	5	23.8	5	16.3	3	30	10	15.8	11	16.9	17.5
	Low	2	20	2	9.5	1	6.4	0	0	2	3.1	2	2.5	4.5
Feed shortage	High	9	90	17	80.9	26	83.8	8	80	53	84.1	53	84.6	84
	Medium	1	10	3	14.2	5	16.1	2	20	9	14.2	9	12.3	14
	Low	0	0	1	4.7	0	0	0	0	1	1.5	1	3	2
Internal parasite	High	7	70	17	80.9	25	80.6	8	80	45	71.4	48	73.8	75
	Medium	1	10	4	19.0	6	19.3	2	20	14	22.2	16	24.6	21.5
	Low	2	20	0	0	0	0	0	0	4	6.3	1	1.5	3.5
Heat stress	High	9	90	17	80.9	23	74.1	7	70	50	79.3	49	75.3	77.5
	Medium	1	10	3	14.2	7	22.5	3	30	10	15.8	15	23	19.5
	Low	0	0	1	4.7	1	3.2	0	0	3	4.7	1	1.5	3
Tick infestation	High	6	60	16	76.1	24	77.4	7	70	49	77.7	46	70.7	74
	Medium	3	30	3	14.2	6	19.3	3	30	13	20.6	18	27.6	23
	Low	1	10	2	9.5	1	3.2	0	0	1	1.5	1	1.5	3
Biting fly infestation	High	8	80	16	76.1	24	77.4	8	80	45	71.4	48	73.8	74.5
	Medium	2	20	4	19	5	16.1	2	20	12	19	15	23	20
	Low	0	0	1	4.7	2	6.4	0	0	6	9.5	2	3	5.5

N= Number of observations

The Most Adaptable Trait for Sheko Cattle Breed

The Sheko cattle breed has been observed to possess a number of adaptability traits that make them more resilient to various stressors, such as feed shortage, internal parasites, heat stress, tick infestation, and other environmental factors. Among these traits, adaptability output was consistently rated as the most preferred trait by Sheko cattle owners in the study area (Table 5). This suggests that the ability of Sheko cattle to perform well under various environmental conditions is highly valued by farmers. In addition to adaptability output, other important traits considered desirable by farmers included longevity, good mothering ability, and resistance to common diseases and pests. These traits are crucial for ensuring the overall health and productivity of the cattle herd, as well as for maintaining a sustainable breeding program. The preference for these adaptability traits highlights the importance of selecting and breeding animals that can thrive in challenging environments. By focusing on traits that enhance adaptability and resilience, farmers can improve their cattle herd's overall performance and efficiency, leading to increased productivity and profitability. In summary, the Sheko cattle breed appears to exhibit a high level of adaptability to the various stressors present in the study area. By prioritizing traits that enhance adaptability and resilience, farmers can ensure their cattle breeding programs' long-term success and sustainability. Further research and breeding efforts may help to further enhance the adaptability of the Sheko cattle breed, leading to even greater benefits for farmers in the region. This result was in agreement with the previous work reported by (Taye Takele, 2005).

Horn Size and Percentage for Sheko Cattle Breed

The research paper focuses on the horn size and percentage of the Sheko cattle breed. The Sheko cattle breed is described to have small horns, with some individuals having stumpy or curved floating horns, while many are polled or have small Jersey-like horns (Alberro, M., 1982). Further investigation into the horn size of Sheko cattle reveals that the overall mean horn size for males is 8.87 cm, and for females is 8.67 cm, with no significant difference in horn size between the sexes. However, conflicting findings have been reported with (Taye, Takele, 2007). Indicating a larger horn size of 14.8 cm for both male and female Sheko cattle. Moreover, age analysis of horn size in Sheko cattle shows that mature individuals have an average horn size of 8.44 cm, whereas younger animals have a larger average horn size of 8.18 cm. This increase in horn size in younger animals suggests a higher level of inbreeding as compared to mature animals. Table 6 presents a summary of the horn size of Sheko breed cattle, showing an overall mean horn size of 8.31 cm with a coefficient of variation of 65.68%. The R-squared value of 0.001234 suggests that there is minimal variation in horn size within the population. The sex-based analysis reveals that male Sheko cattle have a slightly larger horn size of 8.87 cm

Table 6: Sheko breed cattle horn size

Effects & level		N	Horn size (cm)
Overall		4767	8.31 ± 0.08
CV%		65.68	
R^2		0.001234	
		Ns	
Sex	Male	1195	8.87 ± 0.16
	Female	3572	8.63+0.09
		Ns	Ns
Age	Mature	3338	8.44 ± 0.10
	Young	1389	8.18 ± 0.14
			Ns

N, Number of observation

compared to females, who have an average horn size of 8.63 cm. On the other hand, the age-based analysis indicates that young Sheko cattle have a larger horn size of 8.18 cm compared to mature animals with an average horn size of 8.44 cm. In conclusion, the research findings highlight the variability in horn size among Sheko cattle, with conflicting results reported in different studies. Further research is needed to understand the underlying factors contributing to horn size variation in this breed.

Conclusion And Recommendation

The pure population of Sheko cattle is facing a serious decline, and the breed is currently categorized as critically endangered. Despite this, the total population size of mixed Sheko cattle is estimated to be approximately 7252, indicating a slightly higher number than previously reported. To effectively conserve the breed, involving and engaging farmers in a comprehensive breeding program is imperative. A conservation strategy must be implemented with a strong focus on farmer participation and collaboration with various stakeholders. It is recommended that molecular characterization techniques be employed to identify the pure line of Sheko cattle and assess the extent of genetic admixture and inbreeding within the population. Furthermore, semen collection from genetically pure bulls should be prioritized for artificial insemination purposes to preserve the breed's genetic diversity. Measures should be put in place to control free mating and prevent undesired genetic mixing. Establishing a Sheko breed cooperative society and engaging youth through school clubs can help create awareness and involvement in the conservation and development of the breed. These initiatives will play a crucial role in ensuring the long-term sustainability of Sheko cattle and safeguarding their genetic heritage for future generations.

Acknowledgments

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