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Donkey production systems and breeding practices in selected districts of South Omo Zone, southern Ethiopia

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ABSTRACT

The study was conducted to understand the production system and breeding practices of Omo donkeys and provide baseline information for future production strategies. The data were collected through individual interviews, focus group discussions, and personal observation. A semi-structured questionnaire using 2012 Food and Agriculture Organisation guidelines was used to obtain respondent views. On the basis of donkey population, production potential, and road accessibility, 76 households from two districts were randomly selected and interviewed. Donkey growth performance and body size were given a higher priority in breeding selection. Most respondents selected their breeding donkeys based on growth performance, body size, and disease resistance. The criteria for culling were old age, body size, poor fertility, temperament, and colour. Variables that were given a higher priority in trait preference were disease resistance and pulling ability. Water shortage and disease were significant constraints to donkey production. Therefore, to address these constraints, the concerned bodies should invest in infrastructure to increase access to water and other services so as to support the livelihoods of donkey-dependent communities. Moreover, funding for animal healthcare and nutrition initiatives should be provided to ensure the health and well-being of animals.

Keywords: breeding, constraints, indigenous, marketing, production, purpose of keeping, selection criteria, trait preference.

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Introduction

Background and justification

Ethiopia has over 8 million donkeys, being second only to China, along with over 2 million horses and over 350,000 mules (FAOSTAT 2012). Animals, particularly equids, are essential for farm and rural transport, particularly transporting farm products to markets because an estimated 75% of Ethiopia's farms are more than a day and a half's walk from all-weather highways (Niraj *et al.* 2014). The equines are the most important animals for Ethiopia's farming and transportation networks. In the mountains, donkeys are used mainly for light transport and breeding mules (Gelaye and Fesseha 2020).

Many households in Ethiopia's rural and urban areas rely on donkeys (*Equus asinus*) to provide for their families by relieving them of tiresome, time-consuming duties. Donkeys provide social status, give the poor and other oppressed groups such as women more authority, and provide a sense of connection. According to Geiger *et al.* (2020), interviews with people from various geographical locations and backgrounds were used to gather information on their understanding of donkey welfare. It was found that people's perceptions of donkeys and their welfare appeared heavily influenced by geographical location and whether they were users of donkeys or people who were essential contributors to their care. Domestic donkeys have a contentious, long, and complicated history. Investigations into the domestication process and when and where donkeys were first domesticated have been inconclusive. It is believed that donkeys were first domesticated

in the Near East and North Africa between 4500 and 4000 BC (Garrido *et al.* 2019); however, domestic donkeys are among the least studied and most neglected mammals in the world (Befikadu *et al.* 2015). Even though donkeys are an integral part of the economy in Ethiopia, relatively little scientific research has been conducted to understand their role in the rural economy. Current breed-level characterization knowledge is insufficient and generates little research interest in the conservation of donkey genetic resources. The potential loss and decline of genetic diversity also poses a significant challenge for developmental interventions (Befikadu *et al.* 2015).

Mthi and Nyangiwe (2020) suggested that improper breeding management by communal farmers is the cause of animals' poor reproductive performance. Donkeys have gained popularity in recent years as an alternative to cattle because they are used as a source of draft power and tillage, especially in the Southern Nation Nationality and Peoples (SNNP) region (Harago *et al.* 2015). In addition to possessing strong draft power, donkeys have high disease resistance and stress tolerance (Tuaruka and Agbolosu 2019). Because of their body composition and low dry-matter intake requirements, donkeys require less water and maintenance in arid and semiarid regions, allowing them to survive on low-quality, minimally supplemented feeds and, apart from camels, make donkeys better suited to surviving drought conditions than are other livestock species (Deng *et al.* 2021). Both rural and urban areas in many developing countries rely heavily on donkeys for low-cost transportation of people and commodities, and donkeys continue to play a crucial role in other power-requiring activities (Koko and Shuiep 2016).

Studying donkey production and breeding practices is of great relevance in selected districts of the South Omo Zone for several reasons. Donkeys are widely used as beasts of burden for transport and in the agricultural sector, providing a vital livelihood for local people. Donkeys are also used as a source of meat and milk for the Dasenech community. In addition, donkeys provide a source of income for people who breed and sell them for a profit. Donkeys are also important for agricultural work, such as ploughing and carrying heavy loads. Finally, donkey breeding supports the local economy and provides a source of livelihood for people in the South Omo Zone. The tradition of donkey breeding practices in the South Omo Zone is also culturally important, and is therefore of great importance to the wellbeing of the local people and the livelihoods they depend on, and should therefore be supported and encouraged.

The South Omo Zone in southern Ethiopia is characterized by diverse agroecological and socio-economic settings, making it difficult to generalize donkey production systems and breeding practices. There is limited knowledge and understanding of the dynamics of donkey production systems and breeding practices in the region, making this research work important. Government service providers and policymakers in the region largely neglect donkeys as an important economic asset, even though local people recognize the donkeys' potential and breed them for sale. This has resulted in a lack of production systems and breeding practices necessary to ensure a healthy donkey population in the region. Without proper support, the regional donkey population is vulnerable to extinction, with serious consequences for local people who rely on donkeys for transport, agricultural work, or other purposes. It is therefore essential that government service providers and policymakers include donkeys among their priorities and invest in their production systems and breeding practices, so as to ensure their survival.

The complexity of the socio-economic and agroecological context of the south Omo zone makes it difficult to access and collect reliable data related to donkey production systems and breeding practices. Furthermore, the lack of resources and infrastructure in the region compounds the challenges in conducting research. The existing limited information on donkey production systems and breeding practices in the South Omo Zone makes it difficult to identify and analyze the existing problems related to donkey production and breeding. Thus, conducting research in the South Omo Zone to understand the dynamics of donkey production systems and breeding practices is an important but challenging task. The overall objective of this research was to gain an understanding of the donkey production systems and breeding practices in selected districts of South Omo Zone, southern Ethiopia. For the selected districts, the specific objectives included the following: (1) to identify and document traditional donkey production systems and breeding practices; (2) to assess the current condition of donkey production systems and breeding practices; (3) to assess the existing knowledge and attitudes of donkey owners and users towards donkey production systems and breeding practices; (4) to identify and prioritise the main constraints to donkey production systems and breeding practices; and (5) to generate evidence-based policy recommendations to promote donkey production systems and breeding practices.

Materials and methods

Description of the study area

The study was conducted in the South Omo Zone of SNNP in southern Ethiopia (Fig. 1). Two districts, Dasenech and Hamer, were selected as they are the Omo donkey breeds' distribution centre.

The South Omo Zone is one of the 13 administrative zones in SNNP and covers an area of 25 530 km^2 and is located at 4.430–6.46″N and 35.790–36.06″E, with an estimated human population of 472 977. The population

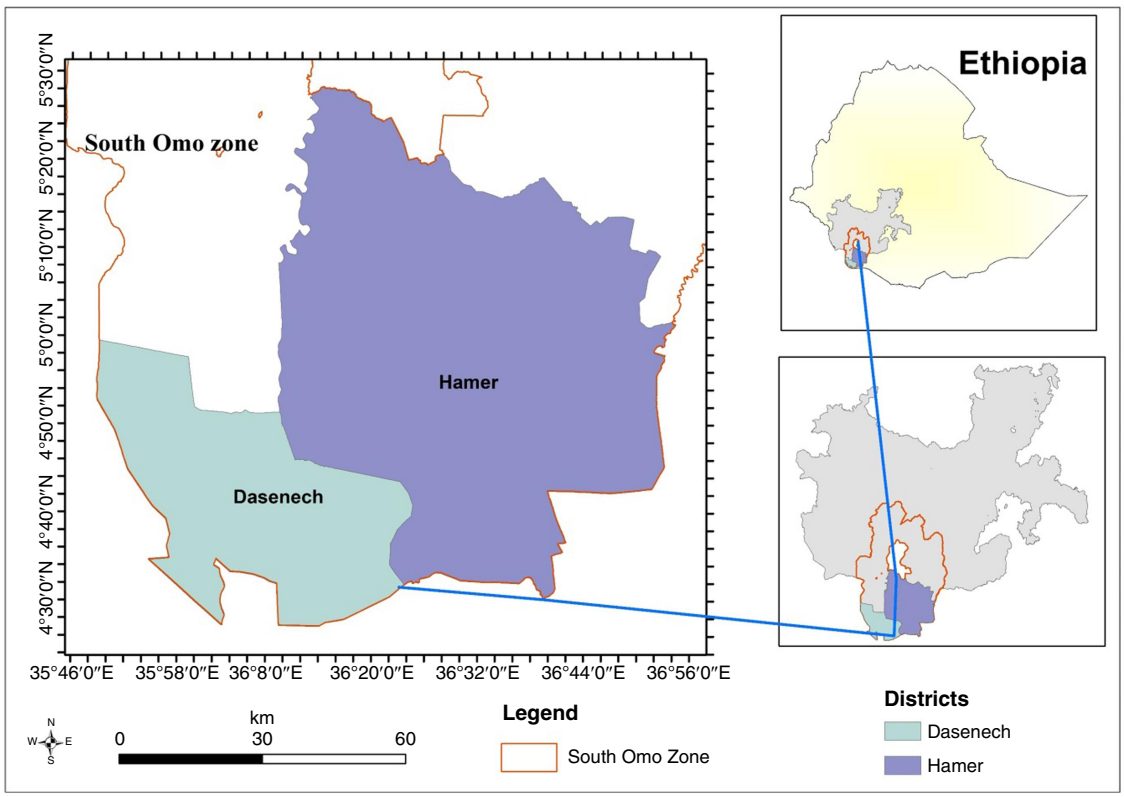

Fig. 1. Map of the study area.

density of the zone is 19 persons per square kilometer and it borders with Gamo Gofa Zone, Keffa Zone, Konta and Basketo Special Districts in the north, Kenya in the south, Konso and Derashe districts in the east, and Sudan and Bench Maji Zone in the west. The Zone is divided into eight districts and one city administration. Elevation generally ranges from 360 to 3500 masl. The traditional agroecology classification of the Zone is highland, midland, lowland, and semiarid, covering 0.5%, 5.1%, 60%, and 34.4% of the total area respectively. The rainfall pattern is bimodal, and mean annual rainfall ranges between 400 and 1600 mm. The mean annual temperature ranges between 10.1°C and 27°C (Alemayehu *et al.,* 2016).

Dasenech district

Dasenech lies roughly between 4°37′N and 4°48′N and between 35°56′E and 36°20′E. Elevation varies between 353 and 606 masl. According to the district's Agricultural and Natural Resource office, the climate is predominantly semiarid. The district has very low, erratic rainfall and high ambient temperatures. The rainfall pattern is bimodal, with a primary rainy season between March and May and a small secondary rain between September and December. The major livestock-rearing agro-pastoralists widely practice rain-fed flood runoff (nowadays very rarely), and irrigated agriculture, and grow predominantly sorghum, followed by maize and horticultural crops such as bananas.

Hamer district

Hamer district is located in the Omo Valley, Ethiopia, roughly at 5°09′60.00′N and 36°39′ 59.99′E. The district experiences a hot and dry climate, with precipitation mainly during a short rainy season from May to September. It is mainly composed of undulating hills and mountains, with elevations ranging from 890 to 2084 masl.

The district is located 650 km south of Addis Ababa, Ethiopia's capital, and 130 km north of Jinka, the capital of the South Omo Zone. The Hamer ethnic group is pastoralist and agro-pastoralist, with many traditional practices.

The Hamer people are the largest indigenous group in the administrative district of the same name. Three other distinct ethnic groups also live in the Hamer District, namely, the Erborie, Kara, and Tsemay. The smallest administrative unit in Ethiopia is the kebele. Hamer district has 35 kebeles. Of these, the Hamer community has 26 kebeles (15 agro-pastoralists, 11 pastoralists), Erborie has four, Kara has three, and the Tsemay community owns the remaining two.

Sampling procedure and data collection

Data were collected through interviews with 76 randomly selected donkey owners from Hamer and Dasenech districts and purposively selected key informants of the districts. The lowland agroecology of the various districts was purposively‘ selected on the basis of their donkey population and

accessibility. To assess the clarity of the questionnaire to respondents and the appropriateness of the questions, the questionnaire was pretested and modified prior to initial use. The questionnaire gathered information on household socio-demographic characteristics (age, gender, educational background, family size), livestock holding, donkey characteristics (number and composition), source of income, livestock and their importance, farming system characteristics, the purpose of keeping, selection criteria, culling criteria, reproductive characteristics, and constraints of donkey production.

The survey was conducted with the support of a local language interpreter. The Hamer community is an example of both pastoralism and agro-pastoralism, and the survey had to consider this. Despite the challenges posed by the combination of practices of pastoralism and agro-pastoralism, the survey was still able to be conducted successfully. Open and close-ended questions were prepared and tested before the actual data collection (survey).

Data analysis

The data were exported and analyzed using descriptive statistics of the statistical package for the social sciences (SPSS version 23.0, 2015). Frequency distribution, mean, chi-squared test, cross-tabulation, and other statistical measurements were used to analyze respondents' opinions.

An index was calculated to provide an overall ranking of the selection criteria of the respondents, culling criteria, and major constraints for donkey breeding, according to the formula: Index a = Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for particular qualitative variables divided by Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all qualitative variables. The rank was calculated by Microsoft Excel 2010. The study area was mapped with ArcGIS (ArcMap 10.8).

Compliance with ethical standards

Ethics, approval, and consent to participate: regarding ethics and integrity, the document complies with all regulations that may be relevant. This paper was submitted by the corresponding author and co-authors under their full responsibility and in accordance with all ethical standards. Furthermore, the paper does not contain any clinical studies or patient data.

Results

Individual and household characteristics of the respondents

Most donkey-owning households were headed by males (94.7%), the remainder by females (Table 1). The number of male and female respondents in the Dasenech district is not significantly higher than the number of respondents in the Hamer district. There was no significant ($P > 0.05$) difference between the districts. The educational status of the respondents was 15.8% illiterate, 43.4% informal education, 34.2% Grades 1–4, 3.9% Grades 5–8, and 2.6% Grades 9–12, with significant variation ($P < 0.05$) among the districts (Table 1).

Livestock holding and composition

The average reported livestock holding in the household is presented in Table 2. The mean (±s.e.m.) numbers of

Table 1. Household characteristics.

Variable		Hamer, *N* = 34		Dasenech, *N* = 42		Overall, *N* = 76		X^2	*P*
Family size		7.65 ± 0.517		6.81 ± 0.279		7.18 ± 0.280		13.599[A]	0.327
		Frequency	%	Frequency	%	Frequency	%		
Age	15–30	2	5.9	10	23.8	12	15.8	11.255[A]	0.024
	31–40	13	38.2	20	47.6	33	43.4		
	41–50	14	41.2	12	28.6	26	34.2		
	51–60	3	8.8	0	0	3	3.9		
	61–70	2	5.9	0	0	2	2.6		
Sex	Male	33	97.1	39	92.9	72	94.7	0.665[A]	0.415
	Female	1	2.9	3	7.1	4	5.3		
Education	Illiterate	26	76.5	41	97.6	67	15.8	11.645[A]	0.020
	Informal	2	5.9	0	0	2	43.4		
	1–4	0	0	1	2.4	1	34.2		
	5–8	4	11.8	0	0	4	3.9		
	9–12	2	5.9	0	0	2	2.6		

[A]No statistics were computed.

Table 2. Mean (±s.e.m.) livestock holdings.

Item	Livestock	Hamer	Dasenech	Overall	X^2	*P*-value
	Cattle	28.56 ± 5.694	38.93 ± 1.051	33.745 ± 3.373	29.143	0.085
	Sheep	20.44 ± 7.892	10.10 ± 1.650	15.27 ± 4.771	23.460	0.182
	Goat	10.31 ± 1.879	49.00 ± 11.253	27.62 ± 5.561	32.181	0.074
	Chicken	7.47 ± 1.249	6.84 ± 1.309	7.08 ± 0.933	14.044	0.446
	Donkey	4.18 ± 0.379	3.31 ± 0.235	3.70 ± 0.218	9.867	0.361
Donkey herd structure	F >4 years	1.67 ± 0.280	1.31 ± 0.095	1.44 ± 0.118	3.546	0.315
	M >4 years	1.30 ± 0.153	1.33 ± 0.188	1.32 ± 0.121	1.279	0.528
	F 1–4 years	1.29 ± 0.163	1.09 ± 0.091	1.20 ± 0.100	1.036	0.596
	M 1–4 years	1.29 ± 0.184	1.09 ± 0.091	1.17 ± 0.090	1.169	0.280
	Foal <1 year	1.10 ± 0.100	1.00 ± 0.000	1.04 ± 0.036	1.867	0.172
	Overall, M&F donkeys <2 years	1.00 ± 0.000	1.07 ± 0.071	1.05 ± 0.045	0.599	0.439
	Overall, M&F donkeys 2–4 years	1.27 ± 0.118	1.10 ± 0.100	1.20 ± 0.082	1.042	0.307
	Overall, M&F donkeys >4 years	2.12 ± 0.303	1.30 ± 0.105	1.75 ± 0.181	8.076	0.044

F, female; M, male.

Table 3. Division of labour as a percentage.

Item	Buying	Selling donkey	Disease treatment	Feeding	Rearing	Mating	Working	Transport
<18 years, M	–	–	1.5	12.5	23.2	22.2	8.8	13.1
<18 years, F	–	–	–	21.4	1.8	–	2.9	1.6
>18 years, M	94.3	93.2	79.1	39.3	55.4	55.6	35.3	36.1
>18 years, F	1.4	1.4	1.5	7.1	3.6	5.6	36.8	39.3
≤18 years, both sexes	–	–	–	3.6	3.6	3.7	–	–
≥18 years, both sexes	4.3	5.4	7.5	–	–	–	10.3	9.8
All	–	–	10.4	16.1	12.5	13.0	4.4	–
X^2	2.314[A]	3.156[A]	11.163[A]	13.394[A]	19.478[A]	9.174[A]	33.146[A]	27.275[A]
P	0.0314	0.206	0.025	0.020	0.002	0.057	0.000	0.000

M, male; F, female.
[A]No statistics were computed.

cattle, sheep, goats, chickens, and donkeys per household were 33.745 ± 3.373, 15.27 ± 4.771, 27.62 ± 5.561, 7.08 ± 0.933, 3.70 ± 0.218 respectively. The respondents did not have a horse, mule, or camel. Mostly, the household head (husband) and spouse were joint flock owners. The number of foals less than 1 year old per household was 1.04 ± 0.036. In the case of livestock holding and flock structure, there was no difference ($P > 0.05$) between the districts (Table 2).

Gender involvement in donkey management

Decision-making and labour division on household donkey production are presented in Table 3. Most activities like donkey feeding, rearing, treating, working, with donkeys, and transport were significantly ($P < 0.05$) carried out by males over 18. The women play a pivotal role in transporting (39.3%), working (36.8%), and feeding donkeys (21.4%).

Purposes of keeping donkeys

In the Hamer district, donkeys were mainly kept for packing, transport, and jointly for packing, pulling, transport, and breeding (45.5%, 33.3%, and 3.0% respectively (Table 4). Donkeys were mostly used in the Dasenech district for transport, packing, and jointly packing, pulling, transport, and breeding (7.1%, 28.6%, and 52.4% respectively).

Selection of breeding donkeys

The majority of respondents selected their breeding donkeys on the basis of growth performance, followed by body size,

Table 4. Purpose of keeping donkeys.

Item	Hamer	Dasenech	Overall	X^2	*P*-value
Packing	45.5	7.1	24.0	51.232[A]	0.000
Transport	33.3	28.6	14.7		
Breeding and pulling	3.0	–	1.3		
Custom and pulling	6.1	–	2.7		
Transport and packing	9.1	–	20.0		
Packing, pulling, transport, breeding	3.0	52.4	30.7		
Household consumption	0	11.9	6.7		

[A]No statistics were computed.

Table 5. Ranked selection criteria for breeding donkeys.

Item	Rank 1	Rank 2	Rank 3	Index
Size	22	11	29	0.26
Colour	3	7	7	0.07
Temperament	5	8	7	0.08
Growth performance	20	28	11	0.28
Disease resistance	15	20	22	0.24
Total	75	74	76	1

as the most significant donkey selection traits, and also on the basis of disease resistance. The respondents also reported that they considered colour and temperament as important selection criteria (Table 5).

Farmers' perception on the indigenous donkey traits

Genetic improvement for productive traits in livestock, particularly in donkeys, has been very slow and insignificant in the study area. One major reason has been the lack of well-organized and usable recorded information on donkey performance to undertake structured selection and breeding programs. A summary of the reported trait preferences of the respondents in the Hamer and Dasenech districts is presented in Table 6, and there was a significant difference between the districts. The major preferred traits reported by respondents were shape, size, colour, disease resistance, drought tolerance, high-temperature and cold-temperature adaptation, temperament, pulling ability, growth performance, and longevity of donkeys.

Temperature adaptation of donkeys is highly significant, and there was a significant difference between the districts. High-temperature adaptation was high in percentage in the Dasenech district with good intensity preference. There was a significant difference between the districts in pulling ability. Pulling ability was high in the Hamer district with good intensity preference (intensity of preference is a term used to describe models for aggregating ordinal rankings. It can be useful in decision-making, where the strength of preference can be used to guide decisions among competing items. It can also be used to evaluate different scenarios and identify which one is most likely to lead to the desired outcome). Disease resistance was also found to be essential. Disease resistance of indigenous donkeys was high in the Hamer district with good intensity preference.

Donkey drought tolerance differed significantly between the districts. Drought tolerance of indigenous donkeys was high in the Dasenech district with good intensity preference. The result showed that low-temperature adaptation differed significantly between the districts. Adaptation to low temperatures was high in the Hamer district with medium intensity preference. The result showed that the longevity of donkeys was not significant among the districts. On the basis of this, the local farmers appreciated the local breeds for their longevity irrespective of the district (Table 6).

Culling criteria for donkeys

With rising production costs, livestock keepers must assess each animal to determine whether it is productive or not. Non-productive donkeys should not be kept in the herd. Culling is the most effective method for boosting the productivity of donkey breeds. The majority of respondents culled their breeding donkeys, with poor fertility and old age being important culling criteria, followed by temperament and colour (Table 7).

Donkey reproductive performance

Age at first service

The average age at first service for jacks and jennets varied among breeds. Reproductive performance is summarised in Table 8.

Age at first foaling and foaling interval of donkeys

The average reported minimum, medium, and higher age at first foaling for donkey breeds varied (Table 8). The

Table 6. Trait preference of donkeys by district (%).

Variable	Intensity of preference	Districts		X^2	*P*-value
		Hamer	Dasenech		
Shape	Poor	3.2	4.1	10.991[A]	0.012
	Medium	22.6	14.6		
	Good	74.2	51.2		
Size	Short	0	26.8	20.807[A]	0.000
	Medium	15.2	39.0		
	Long	84.8	34.1		
Colour	Poor	3.0	31	9.549[A]	0.023
	Medium	18.2	14.3		
	Good	78.8	54.8		
Disease resistance	Poor	3.1	29.3	9.658[A]	0.022
	Medium	12.5	12.2		
	Good	84.4	58.5		
Drought tolerance	Poor		24.4	15.474[A]	0.000
	Medium	41.9	9.8		
	Good	58.1	65.9		
High-temperature adaptation	Poor	0	31.7	18.723[A]	0.000
	Medium	45.2	9.8		
	Good	54.8	58.5		
Coldness adaptation	Poor	6.4	48.8	15.957[A]	0.001
	Medium	58.1	24.4		
	Good	35.5	26.8		
Temperament	Poor	3.3	38.1	18.629[A]	0.000
	Medium	16.7	31.0		
	Good	80.0	31.0		
Pulling ability	Poor		29.3	13.445[A]	0.001
	Medium	17.2	26.8		
	Good	82.8	43.9		
Growth performance	Poor	0	36.6	14.501[A]	0.002
	Medium	25.8	19.5		
	Good	74.2	43.9		
Longevity	Poor	10.3	29	6.979[A]	0.073
	Medium	27.6	22.0		
	Good	62.1	48.8		

[A]No statistics were computed.

average reported minimum and higher foaling intervals were 14.43, and 25.48 months respectively. Age at first service of jennets, the minimum age at first foaling, maximum foaling interval, market age of jacks, and market age of jennets differed significantly between the Hamer and Dasenech districts. Age at first service of the jack, medium age at first foaling, and minimum foaling interval were not significantly different. The results showed that the average market age of jacks and market age of jennets were 36.52 ± and 36.31 months respectively.

Major constraints of donkey production

The lack of water and disease were the major constraints of donkey breeding (Table 9), followed by feed shortage, an inadequate extension service, and a lack of drugs.

Discussion

Designing and implementing a breeding program at the community level necessitates a detailed assessment of livestock farmers' production goals and breeding practices (Abebe *et al.* 2020). Most households were headed by males. This aligns with Zewdu *et al.* (2013), where most livestock farmers were of old age, a common phenomenon in most developing countries. However, in this study, most donkey farmers were middle-aged, with 31–50-year-old farmers owning 79.4% and 76.2% in Hamer and Dasenech districts respectively. The proportion of female-headed households in the present study was higher than 1.9% for the Metekel and Assosa zones (Melak *et al.* 2020), suggesting men, whether in male-headed or female-headed households, are mostly responsible for donkey rearing, whereas women are responsible for crop cultivation and household chores. The average household family size was 7.18 (ranging from 2 to 15), which is higher than that in the report of the Central Statistical Agency (CSA) [Ethiopia] and ICF 2016, which was 4.8 persons, and smaller than that reported by Melak *et al.* (2020), which was 7.75 persons. Large family size was considered essential for donkey production activities. Larger families appear as an asset and security in times of retirement. The majority of the respondents had no formal education, an obstacle to understanding extension messages, and the importance of new technologies within a short time. Huffman (2020) noted that better-educated farmers are more likely to innovate and adopt new and profitable agricultural technologies. Herd structure is described in terms of the number and proportion of different age groups and sexes in the herd. The average number of donkeys in this study was higher than that of the Bamongu District in the northern region of Ghana reported as 3 ± 1.2 and 1 ± 0.13 for donkeys and adult jennets respectively, per household (Tuaruka and Agbolosu 2019). The focus group discussion showed that family heads provided donkeys for adult males on request and that most often, according to Burden's (2012) assessment, adult males share ownership of and duty for donkey care and feeding.

Ownership patterns were usually related to decision-making in donkey buying and selling. Men over 18 years played the major decision-making role in donkey sales (93.2%), a finding in line with that of Mamo *et al.* (2017)

Table 7. The culling reason for donkeys in the study area.

Item	Rank 1	Rank 2	Rank 3	Index
Old age	32	16	13	0.35
Size	23	19	14	0.3
Temperament	2	8	12	0.08
Poor fertility	8	21	22	0.22
Colour	0	4	12	0.05
Total	65	68	73	1

Table 9. Major constraints of donkey breeding in the study area.

Item	Rank 1	Rank 2	Rank 3	Index
Lack of water	27	16	12	0.29
Disease	21	15	6	0.23
Feed shortage	9	17	23	0.19
Lack of drug	11	9	8	0.14
Lack of adequate extension service	5	19	12	0.15
Total	73	76	61	1

Table 8. Reproductive performance of donkeys in months (mean ±s.e.m.).

Item	Hamer	Dasenech	Overall	X^2	*P*
Age at first service of jack	45.19 ± 3.196	47.14 ± 3.648	46.20 ± 2.419	14.259[A]	0.219
Age at first service of jennets	41.76 ± 4.086	48.43 ± 3.851	45.28 ± 2.813	30.330[A]	0.016
Minimum age at first foaling	53.09 ± 4.32	55.94 ± 4.19	54.34 ± 4.45	18.533[A]	0.047
Medium age at first foaling	57 ± 3.85	58.63 ± 3.9	58.3 ± 3.88	12.292[A]	0.139
Maximum age at first foaling	59.44 ± 4.59	60.21 ± 5.42	59.91 ± 5.02	13.763[A]	0.184
Minimum foaling interval	14.00 ± 0.539	16.00 ± 2.000	14.43 ± 0.600	6.081[A]	0.298
Maximum foaling interval	26.15 ± 1.047	22.00	25.48 ± 1.202	21.000[A]	0.002
Market age of jack	37.75 ± 2.485	35.80 ± 3.163	36.52 ± 2.186	31.865[A]	0.001
Market age of jennets	36.42 ± 2.342	36.25 ± 3.497	36.31 ± 2.341	36.368[A]	0.002

[A]No statistics were computed.

in Gambella, western Ethiopia, who reported that men determined livestock transactions to service immediate household expenses. Men also performed most donkey-rearing activities except barn cleaning, which was mainly undertaken by women and young females. These results differ from those of Ghafar *et al.* (2020) in Pakistan who reported that more than three-quarters of livestock-related tasks (feeding, taking care of young and sick animals, milking, etc.) are the responsibility of women. For example, in India, the livestock industry is dominated by women, who provide more than half of the employed livestock farming labour, and perform approximately three-quarters of the work involved in livestock care, a consequence of several factors. First, women have traditionally been the primary caregivers for animals in India, because they are entrusted with the responsibility of caring for and maintaining animal health within households. This includes providing food and water, as well as cleaning stalls, grooming, and providing healthcare. In contrast, men are seen as primarily responsible for providing labour or money to pay for animal care. Additionally, women are the primary decision-makers in rural households, and this extends to the livestock industry in India. Women often have the authority to decide which animals to purchase and how much to invest in their care, and they are responsible for the sale and marketing of livestock products. Therefore, women are well-positioned to benefit from the profits of the livestock industry. Furthermore, the livestock industry in India is largely unregulated, leaving women with greater control over the industry and the prices they charge. Finally, women are more likely to be literate than their male counterparts and are more likely to be aware of the opportunities available in the livestock industry, such as improved animal husbandry and marketing techniques. These factors contribute to the dominance of women in India's livestock industry. Furthermore, over 90% of people employed in dairying are women. Dudi *et al.* (2019) recorded that women perform the majority of the tasks associated with animal husbandry, such as gathering fodder, feeding, watering, caring for animals' health, general management, making compost, milking, and adding value to the family level. Although women contribute significantly to the livestock industry, their work in raising animals has not received adequate recognition, and their share of income from livestock is viewed as being low. However, activities related to going outside the house are mainly managed by men. There is also a salary gap between the sexes. It is necessary to make efforts to eliminate gender prejudice, improve women's ability to achieve their strategic needs, and carefully document their inputs and outcomes. Women in Ethiopia should be encouraged to participate in activities that expose them to the outside world, such as marketing, selling, and acquiring animals because they have limited access to technology, extension services, and women's farmer organizations.

Donkeys were commonly used for packing, transport, and breeding, a result in line with those of Abebe *et al.* (2020) who reported that donkeys are mostly employed by farmers for social status, cart pulling, and draft power. As reported by Hu *et al.* (2020), donkeys are widely used for household breeding and transport, and large donkeys are useful for mule breeding. These could be possible opportunities for farmers to better utilize their indigenous donkeys. Female and male donkeys are maintained mainly for packing, followed by transport (Table 4). This saves money that the respondent would pay for transporting goods. Donkeys are a highly valued livestock species, next to goats, cattle, and sheep, and fulfill diverse socio-cultural needs. Donkeys provide cheap and easily accessible transport for goods in rural areas and are mostly employed to carry carts filled with agricultural goods from farm to home and marketplaces, and agriculture inputs to farms. Donkeys are also commonly used for breeding purposes. Their hardy nature, strong work ethic, and low maintenance requirements make them an ideal choice for those looking to have a dependable source of livestock. Donkeys have been known to be incredibly loyal to their owners, which has endeared them to many people around the world. Donkeys are also highly intelligent and can be trained to pull carts and even perform tricks. This makes them a valuable asset to many communities around the world. With their gentle disposition, donkeys are also a great choice for those looking for a companion animal. They can be very loving and affectionate towards people, and make great pets.

All in all, donkeys are an incredibly versatile and valuable asset to our lives, and their continued use in packing, transport, and breeding is a testament to their importance. They can endure hot environments (Tuaruka and Agbolosu 2019). Keeping donkeys for culture is limited compared with keeping them for packing and transporting, because of societal beliefs and through ignorance concerning donkeys for cultural usage.

Disease resistance was considered the most important trait, followed by pulling ability and drought tolerance, a finding in line with Gebeyehu *et al.* (2013), who found that farmers considered disease resistance the most important criterion, followed by walking ability, for selecting their breeding donkeys in Dire Dawa. Donkeys are known for their strong pulling ability owing to their stout stature and muscular build. This is beneficial to farmers because it can reduce the money spent on medical care, treatments, and vaccinations. It can also help preserve the quality of the animals because they can be more productive with a reduced chance of disease. Additionally, it can help keep the herd healthy, avoiding the spread of diseases to other animals and, potentially, to other farms. Disease resistance can also help increase animal longevity because animals will be less likely to succumb to diseases and other health problems. It is beneficial to farmers not only because it helps reduce costs, but it also helps increase overall herd productivity, improving profits. Identification of traits of economic importance is vital in the development of breeding

objectives. In this regard, local donkey breeds are noted for their good disease resistance and pulling ability. This implies that the local donkeys can serve in transport to ease the lives of the farmers. Their disease resistance can enhance survival. Disease resistance of indigenous donkeys was higher in the Hamer district.

One crucial element of animal breeding is the choice of animal parents that will enhance the genetic quality of offspring (Xu *et al.* 2020). Small-scale farmers prioritized physical traits such as body size, disease resistance, growth performance, and coat colour when choosing breeding animals (Abebe *et al.* 2020). According to the findings of the current study, coat colour was not the deciding factor for which donkeys were chosen to produce offspring, perhaps because coat colour cannot be chosen or controlled. Additionally, coat colour does not indicate donkey health or temperament, making it difficult for farmers to make informed decisions about which donkeys to keep for breeding. Furthermore, coat colour does not indicate the quality of offspring, so farmers do not want to risk investing in a donkey with an unknown lineage or one that may not produce the desired traits in the offspring. Finally, coat colour is a largely aesthetic trait that has little bearing on the functionality of the donkey, so farmers prefer to choose donkeys on the basis of more practical criteria, such as body size, temperament, and conformation. A donkey's body size has a big impact on the tasks for which it will be used because body size dictates how much weight it can carry, how quickly it can move, and how far it can travel. Smaller donkeys are often used to pull carts and carriages, transport goods and people, and as pack animals. Larger donkeys can be used to plow fields, pull farm machinery, and transport heavier loads. Smaller donkeys are also suitable for riding, being more agile and maneuverable than are larger breeds. In addition, body size affects lifespan, as larger donkeys tend to live longer than smaller breeds. Therefore, when selecting a donkey for a particular task, it is important to consider its body size, because this will determine its suitability for the job. Mekonnen *et al.* (2012) discovered that local farmers gave high marks to drought tolerance and milk production of livestock. Growth performance was recognized as one of the favoured features, although this variable did not obtain a high score in this study. Some farmers were more interested in the animal products such as meat and milk and they were also interested in the animals' ability to move. Body size, growth performance, and disease resistance were essential traits in the study area.

The high ranking of growth performance as a selection criterion indicates that farmers who desire a higher financial return on labour and capital place a higher emphasis on aspects of economic importance. These findings are consistent with Maswana *et al.* (2022), who found that growth rate and body size were among the most important characteristics in choosing donkeys to be the parents of the next generation. In conventional situations where recording is not frequently practiced, growth performance provides an option for determining an animal's capacity for rapid growth. The strong and steady growth of donkeys makes them an ideal choice for those requiring a reliable source of transportation or labour. Introducing a system for collecting data on farms could help with the impartial selection of the best animals. Data recording is essential for choosing breeding jacks for the community breeding program on the basis of performance records, as opposed to the current practice of using visual appraisal for growth performance and body size. Body size was important when choosing jacks. Particular colour patterns may be favoured by donkeys because of their cultural and biological benefits, although Etana *et al.* (2020) reported that culture and tradition were important in farmers' preferred traits. The establishment of donkey markets and cultural shifts brought about by rural community modernization have enhanced the relevance of parameters such as growth rate and body weight relative to qualitative traits such as coat colour. In the traditional system, where coat colour was given more weight, animals with good breeding value may have been culled and a poor performer retained solely because of its colour. This may be advantageous when considering selection and culling criteria from an economic and production standpoint. When designing a community-based breeding program, it is essential to consider both the qualitative traits that farmers seek for non-economic reasons and the quantitative traits that affect production, so as to ensure the sustainability of the program.

The recorded age at first mating of female donkeys is greater than that recorded by Deng *et al.* (2020), and findings do not agree. The average age at first mating for female donkeys can differ for a variety of reasons. Where donkeys are used for work, such as for transportation or to pull carts, female donkeys may be bred at a younger age so as to produce foals that are strong enough to help with the work. Additionally, in some areas, donkeys are bred for meat, and the females may be bred at a younger age so as to produce foals that will be ready for earlier slaughter. In other areas, donkeys are bred as companion animals and female donkeys may be bred at an older age so as to ensure that the foals are mature enough to form a bond with their owners. Additionally, the availability of suitable mates can play a role, because it can be difficult for a female donkey to find a mate in areas with a limited number of males. Finally, some owners may wait to breed their female donkeys until they reach a certain age, because this may increase the chance of a successful pregnancy. The varying environmental conditions (temperature and nutrition) in the study districts may be the cause of the variance in age at first mating.

The lack of water was the first constraint for donkey production because of the limited availability of natural water sources. The area experiences frequent droughts, whereas the majority of the region is covered by grassland and shrubland, being unsuitable for crops. The lack of infrastructure in the region also makes it difficult to access water

from other sources, such as rivers and ponds, which further exacerbates the water scarcity issue. As a result, the donkeys living in the study area are unable to access enough water to sustain them and are limited in their growth and production.

Different livestock diseases ranked second in the list of factors affecting livestock production, a consequence of the impact on animal health and productivity, farm profitability, and farmer livelihoods. Livestock diseases can spread quickly within a herd, and diseases can spread to humans and cause serious public health concerns, such as zoonotic diseases. Livestock diseases can also contaminate water sources and affect biodiversity. Measures to prevent, control, and manage livestock diseases, such as regular vaccinations, biosecurity protocols, adequate nutrition, and proper hygiene are important and can help minimize negative effects, ensuring agricultural production is not affected and farmers can continue to have a successful and sustainable livelihood.

Feed shortage is a serious problem, and is ranked third. It is a major cause of animal malnutrition and death and is causing economic losses for farmers and other stakeholders. A combination of factors such as drought, floods, and other extreme weather conditions, overgrazing, deforestation, and land degradation usually causes feed shortage. Overgrazing can reduce the nutritional value of feed and lead to soil erosion, which can make it difficult for animals to find nutritious food. Deforestation and land degradation can also reduce feed availability and reduce the grazing land area. These factors can lead to feed shortages, resulting in poor animal health and nutrition, and a consequent economic loss (Lal 2015).

Extension services are limited by a lack of resources and personnel, and farmers lack access to relevant information on the latest livestock farming techniques. Extension services are not adequately tailored to the needs of local farmers or adequately funded, limiting their effectiveness, and limiting farmer access to credit, necessary for investing in livestock production.

The lack of drugs is a further constraint, and creates a barrier for effective animal management and protection from diseases, and hampers livestock farmers' production because they are unable to provide the necessary treatment to their animals to boost productivity. The lack of drugs also affects the quality of the products the farmers produce. Consequently, farmers' income is negatively affected because low-quality products fetch lower market prices.

Conclusions

These findings, prerequisites for creating breeding programs, give an insight into the major production-trait preferences, selection criteria, and major constraints. Indigenous donkey breeds are important because of their adaptability under low-input and extensive production environments where disease is the major constraint. The donkey is a highly valued animal by the southern people, next to cattle and goats, reared to fulfill diverse socio-cultural needs. Donkeys support food security at the household level by creating an enabling economic environment that enables farmers to have better purchasing power or better access to purchase food, and provides financial support for education of children. Pulling ability and disease resistance were given high priority in the trait preferences. The majority of the respondents have not accessed regular vaccination programs and proper prevention mechanisms for their donkeys.

Recommendations

Effective extension services are needed to persuade farmers and pique their interest in the advantages of superior genotypes, or potential incentives for those who select their best males for breeding. Because of the small number of donkeys, reasonable genetic gain necessitates the creation of breeders' organizations or cooperatives, which in turn necessitates the full engagement and longer-term commitment of donkey keepers and other actors involved in livestock development. A concomitant improvement in non-genetic elements (disease and feed) is crucial to maximizing the benefits of breeding operations. The government and the concerned organizations should focus on the main constraints to reduce donkey loss.

When developing and putting into practice community-based breeding programs in South Omo, it is necessary to take into account breeding practices and trait preferences.

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