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Surviving amidst neglect: management and marketing practices of donkeys (*Equus asinus*) in Central Region of Malawi

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Abstract

Background Despite playing a pivotal role in global edible products, transport for household use, and income generation, donkey production in many developing countries has been overlooked. Revival of the industry requires various stakeholders to be involved in improving the productivity, production, and marketing of the donkeys in these countries. The Malawi government has a history of introducing donkeys into the farming system to improve farm productivity through traction and transportation for both input and output markets. However, for decades, donkey production in Malawi has been neglected in both agricultural policies and practices. This study assessed donkey production and marketing by specifically focusing on the socioeconomic characteristics of donkey farmers., current donkey production practices, and the current donkey marketing practices in Malawi.

Methods The data was collected from 168 donkey farmers using a semi-structured questionnaire. The data included the socioeconomic characteristics of donkey farmers, donkey production practices in Malawi, and the current donkey marketing practices. Descriptive statistical analyses were performed using the STATA 18 software package.

Results The key findings show that none of the donkey farmers in the study areas had neither been trained in donkey production (0%) nor used the mating breeding technique. Although the study found that all donkeys were housed, only a few of the houses (23.3%) were made of bricks. The donkeys were mostly fed on natural grass (88.1%), and supplemented with maize bran (80.4%). The major health-related problems in donkeys were body sores (88%), mud conditions (34%), and weight loss (23.1%). The farmers in the study area practised vaccination (60%) and hygiene (30%) to prevent health-related issues. The study further found no existence of organized donkey markets, and that most farmers sold donkeys to fellow farmers.

Conclusions This study recommends training donkey farmers in production practices by introducing programs on donkey farming promotion and organizing farmers into groups. There is also a need to introduce a stud breeding program to avoid future genetic crushes due to inbreeding, which is now being practiced. Further, there is a need to commercialize donkey farming, formalize marketing, and improve donkey extension to help farmers use modern techniques and technologies in breeding, feeding, parasites and disease control to facilitate access to better markets.

Keywords Donkey (Equus asinus), Management practices, Marketing, Utilization, Malawi

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Background

Malawi's agricultural development has faced numerous challenges weighing down on its productivity potential. Although current efforts aim to enhance productivity in the sector through commercialization and mechanization, the age-old mechanisation practices through the use of donkeys, for instance, cannot be ignored in policy discourse at this stage. Globally, donkeys are a source of edible products, such as milk and meat, and can be used for traction and transport for household use and income generation [1, 3, 6, 7, 10, 14]. Rossel et al. [23] asserted that the domestication of donkeys from African wild ass transformed ancient transport systems in Africa and Asia and the organization of early cities and pastoral societies. In 1957, the colonial government in Malawi introduced donkeys to improve the country's level of agricultural mechanization [15, 16]. Donkeys have since become indispensable companions in the daily lives of many Malawians, supporting a wide range of agricultural activities, facilitating transportation, and contributing to trade [17].

Unfortunately, the fate of donkeys in Malawi has, over time, been overshadowed by larger and more glamorous livestock, such as cattle and goats. This is because donkeys are not generally raised for meat [10]. Their well-being, production, and marketing have regrettably received limited attention in agricultural policies and practices, creating a significant void in Malawi's pursuit of sustainable livelihood and economic growth. Notably, the 2021 National Livestock Development Policy and Guide to Agriculture production and natural resources management do not prioritize donkeys or mention them. Furthermore, donkeys are conspicuously absent from the statistical records of the Ministry of Agriculture, resulting in a lack of essential data on donkeys in Malawi [8].

Neglecting donkey production management and marketing strategies in Malawi poses a multifaceted challenge. Firstly, the lack of attention to donkey production can diminish donkey populations, affecting their availability for work and breeding [11]. Secondly, the neglect of donkeys will continue to reduce agricultural productivity by reducing the level of mechanization at that local level. Donkeys play a crucial role in transporting goods to markets, especially in remote areas. Neglects can hinder market access, impacting farmers' income and food distribution [6, 12, 28].

Studies on donkeys in Malawi have been limited to factors affecting their efficient use [13] and welfare [17]. There is a dearth of literature on donkey production and marketing practices in Malawi. Such information is crucial for developing sustainable strategies to ensure the welfare of the animals and communities that rely on them. By identifying current production practices and potential areas for improvement, this study contributes to the broader discourse on animal welfare, rural development, and livelihoods of donkey farmers, which will inform the development of policies surrounding donkey production and marketing.

According to Ravichandran et al. ([22], p.1), 'donkeys and mules are non-ruminant members of the Equidae family found in a range of ecological zones, including semi-arid, temperate, and highlands across the globe'. Donkeys are resilient animals that can survive harsh climatic conditions associated with drought, flooding, limited access to food, water, and high temperatures [4, 17, 19]. These traits make donkeys easy to maintain in resource-constrained environments, including Malawi. In 2018, the estimated global population of donkeys, according to the FAO, was 50 million [20]. Donkeys are valuable livestock in society and play a crucial role in the survival of poor people in rural areas as they perform laborious and time-consuming chores for many resource-constrained communities. However, donkeys are exposed to long working hours with little rest, little poor husbandry, lameness, severely tethered or hobbled, cruel training methods, lack of shade, lack of water, inhumane handling and disposal when old or worn out [14].

Malawi's economy is agro-based, with over 80% of farmers living in rural areas. Mechanization in the agricultural sector is still in its infancy, as most farmers rely on hand tools and draught animals. The promotion of donkeys can, therefore, improve household agricultural productivity and production by providing animal power for various agricultural activities. In this case, donkeys can play an important role in pulling carts as a means of transporting agricultural products from farms to home and market centres, as well as farm inputs from markets to farms, and tillage [16, 17, 27]. According to Tufa et al. [28], the use of donkeys in farmsteads may increase the efficiency of farm processes and activities, including cultivated areas, crop yields, and drudgery levels. In addition to agricultural use, donkeys can serve other household social and economic needs, such as carrying water, firewood, commercial items, and sick family members to hospital [12]. There are 17,104 donkeys in Malawi [8], and they are concentrated in the central region of Malawi.

Despite the crucial role donkeys play in the farming system, literature on the production and marketing of donkeys in Malawi is scanty. Therefore, this study aimed to shed light on the myriad issues plaguing donkey production and marketing in Malawi. We address these concerns by answering the following research questions: (1) What are the socioeconomic characteristics of donkey farmers in Malawi? (2) What are the current donkey production practices in Malawi? (3) What are the current

donkey marketing practices in Malawi? The new knowledge gained from this study forms valuable input into designing strategies to improve donkey production and marketing practices and enhance the well-being of these animals by improving the livelihoods of their owners.

Methods

Study area

The study was conducted in Dowa, Lilongwe, and Dedza districts. These districts are in the central region of Malawi. Dowa and Lilongwe districts lie on the flat plains of the Lilongwe Kasungu plain, while the Dedza district is mountainous. Dowa district is located at 13.6041S, 33.8858E. Lilongwe is located at 13.9626S, 33.7741E, and Dedza is located at 14.3817S, 34.3255E. Figure 1 shows a map of the study area.

According to the Malawi Population and Household Census [18], Dowa, Lilongwe, and Dedza districts have populations of 772,569, 2,626,901, and 830,512, respectively. The households in the three districts depend on rain-fed agriculture for their livelihood. The main crops grown in these areas include maize, soybean, tobacco, and beans. The principal livestock reared are cattle, local chickens, goats, and donkeys.

Sampling

A stratified three-stage sample design was used in this study. The first stage involved purposive sampling of the Dedza, Dowa, and Lilongwe study districts. These districts were chosen because they have more donkeys in Malawi than the other districts. The second sampling stage involved random sampling of Extension Planning Areas (EPA) in each selected district. An EPA is a section of an Agriculture Development Division (ADD) demarcated based on agro-ecology to plan and disseminate agricultural extension services for farmers [5]. The EPA is the lowest administrative unit of district agriculture, with well-defined boundaries. Five EPAs were sampled for the study, as presented in Table 1. The third stage involved simple random sampling of donkey farmers in

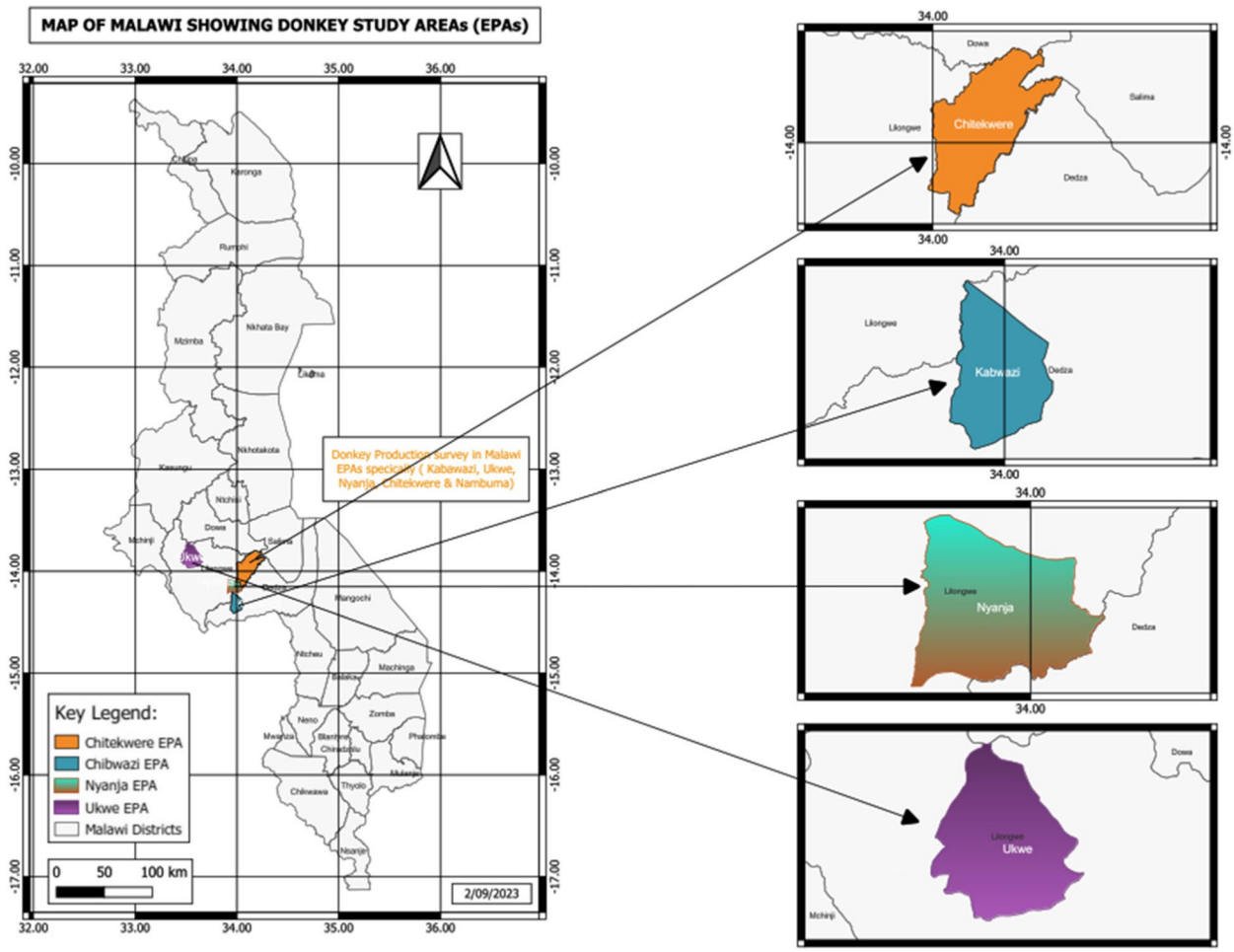

Fig. 1 Map of Malawi showing the study area

Table 1 Description of study sample size

District	EPA	Sample size
Lilongwe	Ukwe	21
	Chitekwere	57
	Nyanja	31
Dedza	Kabwazi	43
Dowa	Nambuma	16
Total		**168**

the selected EPA. A list of EPAs with donkey farmers for each district was compiled. The sample size of the study was determined using Cochran's (1963) Sample Size Formula [25].

$$n = \frac{z^2 pq}{e^2}$$

where n is the sample size, z is the standard error with a chosen level of confidence, p is the sample proportion probability of desirable characteristics in a population, $q = 1\text{-}p$, and e is the acceptable error. It was assumed that 15 per cent of households in the selected EPAs had donkeys. The samples were analysed at 95% confidence interval. The mean sample size was 196. The study included a 10% nonresponse allowance, giving a total sample of 216 households. During data collection, only 178 participants were willing to participate in this study. The number of respondents per EPA is presented in Table 1.

Data collection

This study used two data collection methods. Firstly, a survey was conducted on all five selected EPAs. Data were solicited mainly from the primary source using a semi-structured questionnaire. The questionnaire was programmed using the World Bank's Survey Solutions application and was deployed on Android tablets for personal interviews. The semi-structured questionnaire consisted of three sections. The first section captured the socioeconomic and institutional characteristics of the donkey farmers. The second was production practices, and the third was donkey marketing. Secondly, key informant interviews were conducted using an interview guide to obtain a deeper understanding of donkey management practices from the technocrats. The key informants were the Agricultural Extension Development Coordinators (AEDCs) and Assistant Veterinary Officers (AVOs) from the sampled EPAs. The interview guide was used to capture data on donkey production practices, breeding, feeding, housing, health-related conditions, and marketing. Approval to conduct this study was sought from the AEDCs, who are persons in charge of the EPAs. The data collection tools were pretested in other EPAs for validation before they were administered in the study area. Further, consent was sought from each participant before the commencement of each interview. The clinical trial number was not applicable.

Table 2 Age of household head and size

Variable	n	Mean	Sd	Min	Max
Age of household head	168	42.3	13	18	83
Household size	168	5.4	1.9	1	12

Data source: Own compilation from field data

Data analysis

The data captured on the Interviewer Application were downloaded from the server for cleaning and management purposes. Cleaned data were analysed using the STATA 18 software. The reliability test was conducted before data analysis. The Cronbach Alpha was run and an alpha value of 0.851 was found meaning that the tool was reliable. Descriptive statistics such as frequency and percentage were used to analyse the data and are presented in tables, while qualitative data were narrated and explained logically based on the existing condition to explain the quantitative data.

Results

Household characteristics

The study found that the mean age of the household head was 42.3 (range 8–83) and the mean household size was 5.4 (range 1–12). Additionally, it was observed that the majority (92.2%) of the donkey farming households were male-headed. The study further observed that the majority (92.3%) of the household heads were married. It was also noted that most (55.4%) household heads attained primary school education. The majority of the donkey farmers (92.9%) were engaged in farming as their primary occupation. The study also found that most donkey farmers (65.5%) participated in credit activities. Furthermore, it was observed that most donkey farmers (46.6%) accessed loans from village savings and loan groups, and none of them attended donkey-rearing training. Tables 2 and 3 show the household characteristics of the donkey farmers in the study area.

Donkeys management practices

Sources of donkey

Donkey farmers in the study area source donkeys by buying them from fellow farmers. Thus, there is no established formal market for donkeys. Buying and

Table 3 Description of household socio-economic data

Variable	Category	Frequency	Percentage
Household type	Male headed	156	92.9
	Female headed	12	7.1
Marital status	Single	3	1.8
	Married	155	92.3
	Divorced	3	1.8
	Widowed	3	1.8
	Separated	4	2.4
Education	Never attended school	18	10.7
	Primary	93	55.4
	Secondary	56	33.3
	Tertiary	1	0.6
Main occupation	Farming	156	92.9
	Casual labor	1	0.6
	Business	8	4.8
	Formal employment	3	1.8
Membership to farmer organization	No	84	50
	Yes	84	50
Participation in credit activities	No	110	65.5
	Yes	58	34.5
Access to credit	Village savings and loans	24	41.3
	Banks	7	12.1
	Micro-institutions	15	25.9
	Family and friends	12	20.7
Attendance to donkey training	Yes	0	0
	No	168	100

Table 4 Sources of donkeys for donkey farmers

Variable	Category	No	%
Source of donkey	Bought	160	93.2
	Inherited	8	6.8

Table 5 Breeding practices among donkey farmers

Variable	Category	No	%
Breed	Local	160	95.2
	Exotic	7	4.2
Breeding system	Cross	2	1.2
	Inbreeding	118	70.2
	Outbreeding	50	29.8
Breeding technique	Mating	168	100
	Artificial insemination	0	0

inheritance are the means through which donkey farmers acquired donkeys in the study area. The study found that the majority of the donkey farmers (93.2%) became donkey owners by buying from fellow farmers and only a few (6.8%) inherited the donkeys they were keeping. Table 4 summarizes the findings on sources of donkeys.

Breeding

Donkey farmers maintained three breeds of donkeys in the study area. The breeds were local, exotic, and cross. The majority of the donkey farmers (95.5%) maintained local breeds, while the rest remained exotic (4%) and crossed (1.1%). Farmers were practising two breeding systems, referred to as inbreeding and outbreeding. The results showed that most donkey farmers (70.2%) in the study area practised an inbreeding system. All donkey farmers (100%) used mating as a breeding technique. Table 5 summarises findings on types of breeds in the area, breeding systems, and breeding techniques.

The study also found that the majority of the floors of donkey houses (72%) were made of mud. It was found that a few of the walls of donkey houses (23.3%) were made of bricks. The majority of the donkey farmers (72%) indicated that the roofs of their donkey houses were made up of thatched grass. Table 6 below

Table 6 Description of donkey housing in the study area

	Iron sheet	Grass	Wood	Plastic	Bricks	None	Mud
Variable	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Roof	7.7	72	3	9.5	0	7.7	0
Wall		1.2	74.4	0	23.2	0.6	0.6
Floor	0	0	0.6	0	5.4	22	72

Table 7 Description of donkey feeding practices

Variable	Category	No	%
Feeding system	Scavenging/free range	159	94.6
	Stall feeding	9	5.4
Feed type	Grass	148	88.1
	Crop residual	108	64.3
	Maize bran	135	80.4
	Hey	9	5.4
	Silage	15	8.9

Table 8 Description of annual donkey feed availability

Month	Plenty feed		Feed scarcity	
Month	**No**	**%**	**No**	**%**
January	33	19.6	85	50.6
February	36	21.4	74	44
March	41	24.4	40	23.8
April	77	45.8	11	6.5
May	119	70.8	4	2.4
June	113	67.3	10	6
July	92	54.8	16	9.5
August	71	42.3	33	19.6
September	37	22.0	45	26.8
October	23	13.7	66	39.3
November	21	12.5	84	50
December	29	17.3	89	53

summarizes the building materials that donkey farmers use to construct donkey houses.

Donkey feeding system, feed, and feed availability

The study revealed that donkeys are fed using two systems: free-range and stall feeding. The majority of the farmers (94.6%) feed their donkeys using a free-range system. The study found that the majority of the farmers use grass (88.1%), maize bran (80.4%), and crop residues (64.3%) for feed. The donkey feeding systems employed in the study area are summarized in Table 7 presented below.

Over 50% of interviewed donkey farmers indicated that donkey feed is abundant in May, June, and July and scarce in December, January, and February. Table 8 below presents a summary of the donkey feed availability in the study area.

Table 9 Prevalence of donkey Health related conditions

Health condition	Frequency	Percentage
Arthritis	4	1.8
Bites	2	0.9
Body sores	114	88
Body tumors	6	2.7
Conjunctivitis	1	0.5
Cough	8	3.6
Diarrhea	5	2.3
Epilepsy	2	0.9
Equine Influenza	12	5.5
Hair loss	20	9.1
Mange mites	4	1.8
Mud conditions	11	34
Tapeworms	12	12.7
Ticks	3	1.4
Weight loss	19	23.1
Injuries	2	0.9

Health related conditions

Although donkeys are often described as sturdy and resilient animals, they succumb to various parasites, diseases, and other health-related conditions. The donkey health-related conditions for the study area were body sores, mud conditions, and weight loss as presented in Table 9.

Most donkey farmers pointed out that these donkey health-related conditions occurred in January, February, March, and December (Table 10).

The study established that few farmers (8%) did not employ strategies to prevent donkey health-related conditions (Table 11).

Table 10 Occurrence of health-related conditions in donkeys

Occurrence of health-related conditions in donkeys		
Month	**Frequency**	**Percentage**
January	109	67
February	100	62
March	73	45
April	19	12
May	16	10
June	19	12
July	17	11
August	10	6
September	7	4
October	5	3
November	34	21
December	72	44

Table 11 Donkey health condition prevention strategies

Donkey health condition prevention strategies		
Quarantine	**22**	**13**
Deworming	26	16
Spraying	23	14
Slaughtering	3	2
House hygiene	50	30
Biosecurity	3	2
Vaccination	101	60
None	14	8

Table 12 Donkey marketing and customers

Variable	Category	No	%
Selling	No	85	50.6
	Yes	83	49.4
Donkey customers	Farmers	74	89.2
	Vendors	9	10.8

Marketing

Selling of donkeys

This study also aimed to determine whether farmers sell their donkeys in the study area. The study found that 49.6% of farmers sell their donkeys. The majority of the farmers (89.2%) sold their donkeys to fellow farmers (Table 12).

[1] K is the short code for Malawi currency Malawi Kwacha. At the time of writing this paper 1 USD was equivalent to K 1,735.

Table 13 Selling price of donkey classes

Donkey class	Frequency	Min	Max
Foal	83	K 50,500.00	K 80,000.00
Colt	83	K130,000.00	K 250,000.00
Jenny/Jack	83	K180,000.00	K 300,000.00

Donkey selling prices

The study found that a foal was being sold at a price range of K 50,500.00[1] to K80,000.00, a colt was being sold at a price range of K130,000.00 to 250,000.00 and a jenny/jack was being sold at K 180,000.00 (Table 13).

Discussion

Most of the donkey farmers had an average age of 42.3 (range 8–83) and were within the age group of 8–82 years age group and an average of 5.4 household members. This means that donkeys can be owned by people of different ages, including the elderly because other family members who usually provide labour within farming households can support the aged donkey owner. This result is consistent with Mwasame et al. [6], who found that donkey farmers in Kenya were of an average age of 46.65 years. However, this contradicts a previous study [10] that found that most donkey farmers were less than 40 years old. This may be the case, as proposed by Mwasame et al. [6], that as individuals grow older, household labour supply decreases, requiring labour-augmenting strategies to accomplish household activities.

The study also revealed that most donkey farmers (66.1%) had never attained secondary or tertiary education. These results are similar to those of an earlier study conducted by Hassen et al. [10], which found that most donkey farmers have never attained secondary and tertiary education. Asfaw and Admassie [2] assert that literate farmers are usually risk averse and tend to understand and adopt new technologies quicker than those who have attained lower educational literacy.

In addition, the study found that most (92.2%) donkey farming households were male-headed. The results agree with a previous study by Hassen et al., [10], which found that most donkey household owners were male-headed. This is because livestock handling and management is regarded as a male role.

This study found that most donkey farmers depend on farming as their primary occupation. This result is similar to that of Mwasame et al. [6], who reported that few donkey owners had formal employment compared with those who did not own donkeys. In Malawi, most people live in rural areas and engage in farming for their livelihood because of low levels of industrialization.

Regarding the marital status of the farmers, the study found that most donkey farmers were married. This result concurs with Mwasame et al. [6] finding that many donkey owners were married. Married people tend to save money and diversify their income sources to meet their ever-increasing needs.

Another interesting aspect of the study was the donkey farmers' income source. The study found that most donkey farmers (65.5%) participated in credit activities. Furthermore, it was observed that most of donkey farmers (46.6%) accessed loans from village and savings loan groups. This outcome agrees with findings from a different study on access to credit by Salima et al. [24], who found that 42.1% of Malawians access credit for both household and consumption needs from village-based banks because of limitations in accessing the same from mainstream financial institutions.

Another aspect considered in the study was how the farmers came to own donkeys. It was found that donkey farmers in the study area source donkeys through buying or inheritance. This means that compared to other livestock species, such as cattle, goats, and chickens, which have pass-on and distribution programs, governments, non-governmental organizations, or private programs do not provide donkey intervention. This may be an outcome of the neglect of donkeys in policy, research, and development in Malawi.

In terms of breed, farmers maintain local breeds. This is because farmers locally source donkeys. Donkey farmers practice two uncontrolled breeding practices: inbreeding and outbreeding. While inbreeding refers to the mating of related individual donkeys, outbreeding is the mating between individuals from different subspecies, populations, or species. These results concur with those of earlier studies by Hassen et al. [10], and Tuaruka and Agbolosu [27], which found that farmers practice uncontrolled breeding since they were raised under extensive systems. Most farmers use the inbreeding system, which is the mating of related donkeys for breeding. The inbreeding may lead to the extinction of donkeys because of inbreeding depression [21]. Inbreeding could be a result of the free-range feeding systems of donkeys. Apart from being labour-extensive, the free-range system is subsequently used as a means for breeding, as many herds of donkeys feed together. Despite artificial insemination breeding techniques being done in donkeys across the globe [29], the farmers in central Malawi do not practice this breeding technique. This may force the farmers to have a jack in their herd or hire it for breeding. Lack of jack in the herd delays mating and, consequently, increases the janny calving interval.

Housing is a critical management practice for improving donkey welfare. Despite the perception that donkeys are hardy and resilient animals, the smallholder donkeys in Malawi keep their donkeys in well-ventilated and secure places. Housing practices differ from those that were observed in studies by Hassen et al. [10], and Tuaruka and Agbolosu [27], conducted in Ghana and Ethiopia, respectively, which found that the donkeys were housed in an open area by tethering them around the household compound and letting them freely roaming without providing housing. The donkeys in the study area are kept in better conditions, and their welfare is considered compared to other communities [12, 26, 27], where donkeys are housed in poor houses without roofs. The differences in the findings might be related to donkey farmers' attitudes towards donkeys. Farmers in the study area said they house donkeys because they are valuable household assets.

Despite the farmers housing their donkeys, there are variations in the roofing, walls, and floor materials used to construct donkey houses. The house floors are made of mud rather than concrete, allowing good water drainage during leakage or cleaning. The walls were made of wood and mud, which were temporary. This results in high housing maintenance costs. Donkey roofs are made of thatched grass, which is replaced every year.

The major donkey feed is grass, crop residues, and maize bran, with a minor feed of hay and silage. These results conflict with those of Hassen et al. [10] who found that the primary feed resources of donkeys were green maize leaves, natural pasture, rain supplements, hay, and household waste, irrespective of the work type and load. However, the amount and type of feed given to donkeys should be determined by the physical and biological needs of the donkey [9]. The results further contradict earlier findings by Thutwa and Nsoso [26] and Kimaro and Kipanyula, [12] that few farmers give supplementary feed, such as maize bran, to their donkeys. Feed given to donkeys may vary depending on the crops, pasture, and feed technologies used. Hay and silage are some of the feeds that farmers can make and feed on donkeys using the crops and pasture found in their localities. Balanced feed rations are required to meet the daily nutrient requirements of donkeys. Farmers in Malawi use a free-range system to feed their donkeys. The donkeys are free to eat in the natural pasture and were sometimes supplemented with maize bran.

Despite being labour-intensive, few farmers in the study area use intensive systems to raise their donkeys. These results resonate with those of earlier studies in Ghana and Tanzania by Tuaruka and Agbolosu [27] and Kimaro and Kipanyula [12], which found that the donkeys were kept extensively under the free-range grazing system. The intensive system acts as a measure to prevent the exposure of donkeys to poor health-related

conditions, such as parasites and diseases, as the donkeys are confined.

Regarding donkey feed availability, the study revealed that the feed is abundant in May, June, and July and scarce in December, January, and February. The months of scarcity fall in the early stages of the rainy season, during which the grass in the natural pasture is not yet fully established. The local practice in the study area is that the donkeys are tethered during the rainy season to prevent them from damaging crops in the fields since, within the communities, most donkeys are raised on a free-range system. This practice tends to affect feed accessibility to the donkeys in the mentioned scarcity months. The period of abundant feed availability coincides with the beginning of the dry season in Malawi. This is cropping harvesting time in Malawi; hence, maize bran and crop residues exist in abundance. Therefore, there is a need to solve the food availability nexus to ensure sustainable feed availability and accessibility for donkeys throughout the year.

Although donkeys are often described as sturdy and resilient animals, they succumb to various parasites, diseases, and other health-related conditions. The donkey health-related conditions for the study area are body sores, mud conditions, and weight loss. Some donkey health-related conditions are welfare problems that donkeys face in Malawi, such as using carts designed for oxen, which cause wounds and sores on the shoulders and necks [14]. The study established that a few farmers (8%) did not use strategies to prevent donkey health-related conditions.

These results are in line with the findings of Hassen et al. [10], who reported that donkeys suffered from back sores, respiratory problems (with common symptoms such as coughing and nasal discharge), lameness, bite wounds, eye problems, and hoof overgrowth. This study found that most farmers in the study area vaccinate their donkeys and practise house hygiene to ensure their health. However, other farmers do not provide any preventive health measures to their donkeys. These sentiments were echoed by the AVOs. Most donkey farmers reported that these donkey health-related conditions were rampant in January, February, March, and December.

Regarding marketing, some farmers sell their donkeys, whereas others do not. This may be attributed to small herd sizes and the fact that most farmers have not kept their donkeys for long enough to start selling them. There are several markets for donkeys, including commercial processors, middlemen (vendors) and farmers. In Malawi, donkeys are sold to farmers and vendors. This result is consistent with the findings of Thutwa and Nsoso [26], who found that donkey farmers sell their donkeys to fellow farmers in Botswana. To a larger extent, farmers provide a larger market for donkeys in Malawi. This result was further confirmed by the sources of donkeys for the farmers in the area. Most farmers indicated that they sourced their donkeys from their fellow farmers. This means that there is no organized market for donkeys in Malawi. The study found that the foal was being sold at a price range of K 50,500.00 to K80,000.00, the colt was being sold at a price range of K130,000.00 to 250,000.00, and Jenny/Jack was being sold at a price range of K 180,000.00.

Conclusion

This study assessed donkey production management and marketing practices in Malawi. The study found that farmers in Malawi have not been trained in donkey production and that donkey farmers in the study area source donkeys by buying them from fellow farmers. The study also revealed that most farmers rear local donkey breeds inbred by mating and that the donkeys are housed in grass-thatched houses made of wood with a mud floor. The donkeys are fed on a free-range system, and the main feed is natural grass, maize bran, and crop residues. Further, donkey feed is abundant in May, June, and July and scarce in December, January, and February. The main health-related conditions affecting donkeys in Malawi are body sores, mud conditions, and weight loss. It was also noted that vaccination and observing donkey house hygiene are strategies farmers employ to ensure their donkeys are in good health. Some donkey farmers sell their donkeys; their main customers are fellow farmers. This study recommends that the Department of Animal Health and Livestock Development, the Department of Agricultural Extension Services, Mzuzu University, Lilongwe University of Agriculture and Natural Resources, Mikolongwe College of Veterinary Sciences, and Lilongwe Society for the Protection and Care of Animals to train donkey farmers in production practices to improve donkey productivity and welfare. This can be achieved by introducing programs on donkey farming promotion and organizing farmers into groups. There is a need to introduce a donkey stud breeding program to avoid future genetic crushes due to inbreeding, which is now being practised. Additionally, there is a need to commercialize donkey farming so that farmers can fetch higher prices, as donkeys are being sold to farmers without industrial buyers. Lastly, farmers must be trained in donkey production and improved donkey extension to help farmers use modern techniques and technologies in breeding, feeding, parasites, and disease control.

Abbreviations

EPA Extension Planning Area
ADD Agriculture Development Division

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
Zondiwe Mabilabo Jere: Conceptualization, methodology, formal analysis, data curation, writing original draft, review and editing. Jim Chatambalala: Conceptualization, methodology, data curation, review and editing. Richard Zidana: Data Curation, methodology, review and editing. Samuel Mwafulirwa: Data Curation, methodology, review and editing. Zephania Nyirenda: Formal analysis, review and editing.

Data availability
The data are available from the authors upon reasonable request and with the permission.

Declarations

Ethics approval and consent to participate
The authors sought consent from each participant before the commencement of each interview.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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