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The Socioeconomic Value of Rearing Different Ecotype of Donkeys (*Equus asinus*) in South Darfur State, Sudan

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ABSTRACT

The current study was designed to investigate the frequency of different ecotypes (breeds) of donkeys as well as to assess the social role and economic value of donkeys keeping in Nyala (South Darfur State, Sudan). Detailed structural questionnaire was designed and personal interview with respondent donkey owners (n=105) was carried out for data collection. *Derawi* and *Rifawi* ecotypes and their hybrids were observed as 78.09, 20.08 and 1.90%, respectively. The most frequent eyes and coat colors were brown (57.32%) and grey (65.86%), and brown (80.95%) and white (90.48%) among *Derawi* and *Rifawi* ecotypes, respectively. Keeping donkeys is of great social role and effective economic value in the area of the study. It provides job opportunities, diversified source of income and represents important dragging power resource used in different activities. Moreover, the price of distinguished riding donkey reached up to 10000 SDG, thus riding such donkey is of magnificent social value. Nevertheless, owners in the study area lack basic husbandry and reproduction information which reflected in poor management. More oriented research, combined with intensive extension work to better characterization indigenous donkeys' ecotypes (breeds) and to increase the awareness of owners, is highly recommended.

INTRODUCTION

Donkeys (*Equus asinus*) were domesticated more than 5000 years ago, since then they were used by man in different ways, different environments and for different activities (Zakari *et al*., 2015). Up to date, donkeys are still playing important role as source of power in both rural and urban areas, particularly, in developing countries, where donkeys are widely used for transportation of man and goods in relatively low cost (Angara *et al.*, 2011). In these communities, donkeys contribute the major proportion of readily available transport needs of poor families thus enabling them to have better social and economic interaction (Swai and Bwanga, 2008). Moreover, donkeys have the ability to cope with high temperatures and drought, and can survive with poor feed quality. Donkeys reach maturity around four years with live body weight in range of 120 to 180 Kg. Under good management, donkeys have working life of around 15 years and even longer (Oudman, 2004). In addition to their other roles, donkeys are also valuable source for human nutrition as mature male and kids (asses or jacks and foals) are slaughtered for their meat and females (jennies) are reared for their milk in some parts of the world (Simonella *et al.,* 2013 and Cavallarin *et al.,* 2015).

Based on the statistics of Food and Agriculture Organization, Starkey and Starkey (2004*)* estimated the total world population of donkeys as 44 million. The largest donkey population is found in China with about 11 million head. African countries together have about one quarter of the global population of donkeys (Fielding and Starkey, 2004). In Sudan where the wild Nubian ass was reported to be domesticated (Beja-Pereira *et al.,* 2004), the population of donkey was estimated at 7.5 million, out of which about 4% found in South Darfur State, according to the Sudan Ministry of Animal Resources, Rangelands and Fisheries (MARRF, 2013).

Socioeconomically, different untraditional livestock population, such as camels are of great importance in developing countries (Shuiep *et al.,* 2014). Donkeys' populations in particular, are not only important for the survival of poor families, but also for the livelihoods of families keeping them (Kumar *et al.,* 2014 and Herago *et al.,* 2015). Moreover, donkeys represent a valuable genetic resource which has not received the attention that it deserved yet (Kuglerm *et al.,* 2008). In Sudan, particularly, two ecotypes of donkey namely, *Derawi* and *Rifawi* donkey in addition to their hybrids are well recognized (Porter *et al.,* 2016). However, information about different ecotypes is very limited. Hence, the aims of this study were to assess the socioeconomic value of rearing donkeys as well as to investigate the frequency of different ecotypes of donkey based on phenotypic characteristics in Nyala city, South Darfur, Sudan.

MATERIALS AND METHODS

Study area*:* South Darfur State comprised of 135 thousands km^2 of semi-arid and savannah zones. The State lies within area defined by the coordinate 24:30 and 27:00 °E longitude and 9:30 and 13:00 °N latitude. The annual rainfall ranges between 300 to 1000 mm/year increasing from north to south. The climate is semi-arid with mean annual temperature above 30 °C (Elagib and Mansell, 2000).

According to the Central Bureau of Statistics (CBS, 2013), the total human population in South Darfur State is about 4.1 million residents, about 80% of them are rural and nomads.

Collection of data and statistical analysis: A detailed structured questionnaire was prepared and pre-tested for clarity and appropriateness of the questions as well as the simplicity of language used. A direct personal interview was conducted with corresponded donkeys' owners (n=105), whom were randomly investigated at markets, water points and elsewhere possible, to collect information during the course of the study (March to July 2016). Moreover, the questionnaire was also supported by personal observation during interviews. The aim of the questionnaire was to collect socio-demographic, general household characteristics and economic information. Moreover, information about donkeys, such as phenotypic characteristics, age, sex, reproductive parameters and purpose of keeping was also targeted. In addition to that economic parameters related to the animal such as cost of feeding, the income generated by working donkeys and the current market price of donkeys were also obtained.

The data was firstly coded then introduced to the Statistical Package for Social Science (SPSS, 2004) for processing. Descriptive statistics was run and the obtained results were presented in tubular form as frequencies. Economic parameters were presented as maximum, minimum and mean± standard deviation.

RESULTS AND DISCUSSION

Socio-demographic indicators: The results of the current study revealed wide range in the age of donkey owners with mean age of 32.8±10.99 years. The youngest was under 12 years, while the eldest was above 75 years. This result indicated that children have significant contribution and they take great responsibilities among studied community. This result is in general agreement with Oudman (2004) who concluded that donkeys are very friendly animal, easily trained and safely handled even by children.

The family size of respondent donkey owners in the study area was found in range between 4 and 21 persons/family. The raw data showed that more than 75% of respondents claimed that their families composed of more than 12 members, which indicated large family size and accordingly, a high dependency rate. That is mainly could be due to extended families, as people are socially very attached to parents as well as close relevant. Moreover, adopting polygamy is common and widely practiced which resulted in more than one family for a single father. In addition to that, and due to the consequence of the running conflict in the region, wide movement from rural areas to Nyala city is well recognized. All these factors together resulted in that Nyala city is the fastest growing city in the country. It holds the second largest human population just second to the capital Khartoum (CBS, 2013).

The educational level of correspondents was categorized in three groups (Table 1). Result indicated that most of respondents were either not educated or had elementary reading and writing skills. This result is in line with Zenebe and Fekade (2004) and Swai and Bwanga (2008) who reported similar situation in Ethiopia and Tanzania,

respectively. This could be explained by that nature of work performed by donkey owners is more physical, which requires no high skills. That could be considered as a positive point, as donkeys provide job opportunities for less or uneducated people.

The majority of respondents as shown in Table (1) were males (85.71%). This result could be better explained when read together with the job of owners. In this context, it is necessary to explain that some jobs such as porter (who perform loading and unloading tasks), is not commonly accepted for females from cultural point in such conservative communities, although, female farmers were very common. Moreover, other jobs categories including students (7.6%) and house wives (2.9%) were also observed. This observation indicated that donkeys are primarily kept to generate income as part time jobs offers for students during vacations and after school days, while reproduction comes in the second priority.

Table 1: Socio-demographic indicators and some aspects associated with keeping donkeys in Nyala (South Darfur State, Sudan)

Attributes		No	%
Education level of respondent donkey owners	Not educated	55	52.38
	Basic/ Primary school	42	40.00
	Secondary School	8	7.62
Gender of owners	Male	90	85.71
	Female	15	14.29
Job of owners	Porter	50	47.62
	Farmer	28	26.67
	Free business (private)	16	15.24
	House wife	3	2.86
	Student	8	7.61
Number donkeys owned (head)	One	97	92.38
	Two	4	3.81
	Three	3	2.86
	> 3	1	0.95
Keeping other animals beside	Only donkey	46	43.81
	Goat	49	46.67
	Cows	6	5.72
	Horse	2	1.90
	Goat and cows	2	1.90
Bearing capacity (Kg)	100- 250	1	0.95
	250- 500	52	49.52
	500- 750	52	49.52
	Total	105	100.00

Utilization of donkeys: Purpose of donkeys keeping in Nyala was shown in Table (2). Results also demonstrated that the majority of donkeys were kept for dragging (61.90%). It is also clear that *Rifawi* ecotype was mainly kept for riding as 61.90% of *Rifawi* donkey

owners claimed. Generally, 13.33% of respondent in this study were keeping donkey for riding. This proportion is relatively low in an area were 80% are rural and nomads (CBS, 2013). This could be due to the fact that people are increasingly substituting donkeys by vehicles. Now-a-days motor cycles in different forms are widely replacing animal in different activities, and this would of course have a negative drawback on keeping donkeys.

Working donkeys mainly those dragging carts were found to be loaded in range of 100 to 750 kg. The weight was standardized by 50 kg sugar cane sac. About fifty percent of owner claimed those mature donkeys can easily loaded 500 to 750 kg (10 to 15 sugar cane sac) and even more. The load declared by respondents in this study is higher than that reported by Zenebe and Fekade (2004) and Hanekom (2004). They reported average carrying capacity of donkeys employed in transporting grain as 100 kg and one third of its body weight, respectively. Moreover, Oudman (2004) reported that a single mature donkey can be loaded up to 60 Kg depending on body size. He added that two donkeys together can safely pull a cart with maximum 500 Kg. In this context, the lack of national disciplines pertaining to animal welfare (or miss application when exists) is the main cause behind the heavy loads observed in the current study. When principles of animal welfare are applied, such loads might not be allowed.

Despite the fast rhythm of urbanization and the effect of globalization, donkeys are still could be recognized as a widely used animals. In the study area, donkeys were found to be involved in wide range of activities including riding, water transport, dragging cart, farming, transporting of consumable goods and agricultural products as well as been used in public transportation (Figure 1).

Phenotypic description and purpose of keeping donkeys: The donkeys in South Darfur like elsewhere could be characterized based on body conformation including coat and eye color in addition to body size. According to the classification of Porter *et al.* (2016), the two ecotypes, *Derawi* and *Rifawi* in addition to their hybrid were observed during this study. *Derawi* is short and small in size, mainly used for dragging, farming and also for riding. The coat color of this ecotype is mainly grey (65.86%), although white, black and brown coat colors were also observed (Table 2). The eye colour of *Derawi* donkey is brown (57.32%) or black (29.27%) and rarely greys. On the other hand, *Rifawi* donkey is of higher and larger body size compared to *Derawi*. It is mainly used for riding and very rarely used for work. Moreover, the ecotype is also kept as investment or for prestige due to its high market price. These ecotypes are white in colour (90.48%) and very rarely grey (9.52%). The color of eyes is brown (80.95%) or black (19.05%). Generally, as shown in Table 2, the population of donkeys in Nyala is of brown and black eye color (60.95 and 28.57%, respectively), grey and white coat color (55.24 and 32.38%, respectively) and used for dragging and/or farming and riding (76.19 and 13%, respectively).

Figure 1: Demonstration of application of donkey in wide range of activities in South Darfur (Sudan)

Phenotypic parameters addressed in this study could be of significant value when genetic assessment or improvement was intended. It represents base line information which might be needed for further studies that deals with genetic mutters. Once more, it is necessary to highlight that population of donkey is an important genetic resource, and at the same time it is increasingly playing significant roles in rural communities in particular. However, is actually neglected in many parts of the world including Sudan. Nevertheless, due to their importance, more attention should be paid to studying the species and the socioeconomic roles it can play.

Husbandry and reproduction of donkey: The vast majority of correspondents (92.38%) in this study were keeping a single donkey. This result indicated that donkeys were not reared in herds rather; they were kept as single animal for certain purpose. This result could be red together with the lack of some basic production and reproduction information about donkeys. During data collection the correspondents were rarely and not confidently able to respond to questions regarding husbandry practices and reproduction of donkeys. The deficiency of information among owners resulted in under estimating the value of donkeys which reflected in poor management and careless handling. Considering this situation, strengthening the role of agricultural extension together with designing oriented research programs aiming to increase the public awareness about donkeys is necessary.

Table 2: Phenotypic description of eye and coat color and purpose of keeping donkeys in Nyala (South Darfur State, Sudan)

Attributes	Donkey ecotype (breed)							
	Derawi		*Rifawi*		Hybrid		Total	
	No	%	No	%	No	%	No	%
Eye colour								
Brown	47	57.32	17	80.95	0	0.0	64	60.59
Black	24	29.27	4	19.05	2	100.0	30	28.57
Grey	11	13.41	0	0.00	0	0.0	11	10.48
Coat colour								
Black	9	10.97	0	0.00	0	0.00	9	8.57
Brown	4	4.88	0	0.00	0	0.00	4	3.81
Grey	54	65.86	2	9.52	2	100.00	58	55.24
White	15	18.29	19	90.48	0	0.00	34	32.38
Purpose of keeping								
Dragging	61	74.39	2	9.53	2	100.00	65	61.90
Dragging and farming	13	15.85	2	9.52	0	0.00	15	14.29
Farming	3	3.66	0	0.00	0	0.00	3	2.86
Riding	1	1.22	13	61.90	0	0.00	14	13.33
Investment	0	0.00	3	14.29	0	0.00	3	2.86
Riding and farming	4	4.88	1	4.76	0	0.00	5	4.76
Total	82	100.00	21	100.00	2	100.00	105	100.00

In practice, as autumn considered the breeding season for donkeys, owners mainly used to set donkeys free in natural pastures during this season. This way owners save the cost of feeding. Some of owners claimed that jenny gave birth for the first time at age of 4 years. When better management applied and genetic improvement was planned, that of course could reduce the age of first calving significantly.

Jennies have been reported to have a relatively low conception rate compared to mares, in which it ranges from 60 to 65%. Moreover, the gestation period of a Jenny varies from 11 to 14 months and usually gives birth to a single foal, as giving birth into twins is very rare (Porter *et al.,* 2016). Although jennies come in heat within 9 or 10 days after giving birth, it is recommended to delay rebreeding for one or two further cycles. As a consequence, a jenny will produce less than one foal each twelve months. In the same context, donkeys can and they do interbreed with other members of the family Equidae. While the hybrid between a jack and a mare is a mule, which is valued as a working and riding animal in many countries, mating of a stallion with a jenny produce a hinny, which is less common (Porter *et al.,* 2016). In addition to that, donkeys have also been bred with zebra in which the offspring called a zonkey. Nevertheless, like other inter-species hybrids, mules, hinnies and zonkeys are usually sterile.

Our result indicated that the age of working donkeys ranged between 3 to 15 years with average of 7.50±2.28 years. This result is within the range that

reported by Angara *et al.* (2011). During this study, female donkeys were not found to be used for working. It is mainly used for riding. This observation is in agreement with Oudman (2004) who concluded that jennies were not used for work when they are pregnant.

Economic aspects related to keeping donkeys: Working donkeys are used to generate income to meet the needs of the family. The average daily income was found as 134.93±50.62 Sudanese Pound (SDG), it ranges between 75 to 250 SDG. This income is spent on family members ranges between 2- 21 people in average of 9 people/family. The minimum and maximum monthly income generated by single working donkey is 2250 and 7500 SDG, respectively (Table 3), with mean value found as 4047.90±129.02 SDG. Taking into consideration that the minimum monthly wage in the Sudan is 425 SDG (http://www.nationmaster.com/country-info/profiles/Sudan/Labor), which is equivalent to 69.90 USD. During this study which was conducted from March to July 2016, the official exchange rate was 6.09 according to the archive of Central Bank of the Sudan http://www.cbos.gov.sd/en/currency_archive (CBOS, 2016). This indicated that the amount of money generated by a single working donkey is higher than the minimum monthly wage of some public jobs. Our result is however, higher than that reported by Angara *et al.* (2011). They concluded that the average daily income of working donkeys in Khartoum State was in rang of 4 to 80 SDG with mean value of 20 SDG. This wide variation could be justified by the high economic inflation during the last years in the country. The result obtained from the current study demonstrated that donkeys diversified the source of owners' income in both urban and rural areas. This is in complete agreement with Siebert (2004) who concluded that donkeys enable owners to increase their income. Not that only, but in many cases, especially in families headed by females (due to different social reasons), donkeys represent the single source of income. Similar findings were previously reported by Angara *et al.* (2011) and Hassan *et al.* (2013). This is an evidence declares the socioeconomic value of donkeys in the study area.

The cost of feeding was found in range between 15 to 40 SDG with mean 24.63±6.34 SDG/day. The owners investigated in this study claimed that this amount of money was too much. They justify that based on their income and the high prices of family needs. Similar results were also reported by Zenebe and Fekade (2004). However, some owners declared that they were rarely spending money in feeding donkeys, because animals mainly relay on natural pastures. Similar practice was also reported by Fitsum and Ahmed (2015).

Our result indicated that the market price of donkeys in Nyala is influenced by breed in range between 2000 to 10000 SDG. The highest price was of *Rifawi*, followed by *Derawi* then the hybrids (Table 3). The result illustrated that donkeys were of high economic value. Their market prices were higher than was expected.

Table 3: Some economic indicators related to donkey keeping in Nyala (South Darfur State, Sudan)

Indicators (SDG)	Minimum	Maximum	Mean±Sd
Market price of *Derawi*	2500	5000	3045.12±1100.00
Market price of *Rifawi*	2000	10000	6685.71±3354.00
Market price of Hybrid	2000	4000	2000.00±150.00
Average price of donkey	1000	9000	3734.29±2324.43
Average daily income	75	250	134.93±50.62
Monthly income (25 working days)	2250	7500	4047.90±129.02
Average cost of daily feeding	15	40	24.63±6.34

CONCLUSION AND RECOMMENDATIONS

1. Donkeys have great socioeconomic role as they diversified source of income and offer job opportunities among both rural and urban communities when applied, in addition to being a prestigious symbol as riding animal. Nevertheless, wide scale evaluation of their economic contribution and social roles is needed.
2. The limited information of owners about husbandry and reproduction of donkeys is in need to be addressed as the awareness of owners would have a positive impact on management practices.
3. Donkeys are important but neglected natural resource as research dealing with this species is still lagging too far behind compared to other species. Therefore, more oriented research work is needed to evaluate, characterize, preserve and improve the indigenous ecotype for better utilization of the species.

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