

Full Length Research Paper

The prevalence of foot related problems in working donkeys and its implication on the livelihood of donkey owners in Hawassa City, Southern Ethiopia

Asrat Solomon¹, Amene Fekadu¹, Bereket Molla^{1,2*} and Desie Sheferaw¹

¹Faculty of Veterinary Medicine, Hawassa University, Hawassa, Ethiopia.

²The Donkey Sanctuary Ethiopia SNNPRS Project, Hawassa, Ethiopia.

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A cross sectional study was conducted from April 2014 to April 2015 to assess foot related problems in working donkeys and their effects on the owners' livelihood in Hawassa City. The hoof problems in donkeys included hoof abnormality, apparent lameness or standing lameness. 369 owners owned 1 to 5 donkeys, 161 (43.35%) and 1(0.3%). 14(3.8%), 6(1.6%), 211(57.2%) and 138(37.4%) were illiterate, educated in religion, had elementary education and completed high school. The owners had 3 to 5 years' experience. 139(37.7%) donkeys had foot related problems. Hoof over-growth was the highest cause of foot problem (12.46% prevalence) followed by hoof abscess (9.2%). The owners' educational status and work experience were statistically and significantly associated with foot problem in donkeys (P=0.002) and (P=0.000). The number of days the donkeys work weekly and amount of weight they carry were also statistically and significantly associated with foot problems (P=0.044) and (P=0.008). The level of dependency of household on cart pulling donkey was not statistically and significantly associated with the foot problem. The age and body condition score of the donkeys were also significantly associated with the prevalence of lameness (P=0.013) and (P=0.011). The average annual financial earnings from a donkey with and without foot problem were 10,271.00 Ethiopia Birr (ETB) (513.55\$) and 12,536.00 ETB (626.8\$). The monetary loss from foot problems per a donkey yearly was 2469 ETB (123.45 US\$) assuming the life expectancy of donkeys was calculated as a loss. Each donkey owner loses 45,614 ETB (2280.7US\$) per donkey averagely due to culling of the donkey. The foot problems did not only affect donkeys, but also the living standard of the people depending on them. A systematic approach should be made to enhance donkeys' health and the livelihood of people engaged in it.

Key words: Cart pulling donkeys, financial loss, foot problems, Hawassa city, livelihood.

INTRODUCTION

Ethiopia possesses about 6.4 million donkeys (CSA, 2012), which is the largest in Africa. Despite this huge number of donkeys, its role in terms of economic

contribution to the country and community is very limited due to various constraints. The common constraints include poor production and management system, poor

*Corresponding author. E-mail: mollabereket@gmail.com.

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development of the working condition, various types of diseases, and inadequate information on the epidemiology of donkey diseases (Ento, 2005). In Ethiopia, diseases are among the causes of high economic losses and leading to low productivity of donkeys (Jones, 2006). Hoof related problem is one of the problems that affect the welfare of donkey and livelihood of the owners, particularly, those depending on donkeys alone (Feseha et al., 2004; Aboud et al., 1998). Studies to elucidate the magnitude of this problem are lacking. Such information would be useful for designing strategies that would help to improve donkey health and welfare (Feseha et al., 2004).

In Ethiopia donkeys are used as a means of transporting a range of products; they help for rapid transportation of much quantity goods to the market than foot. Donkeys are reliable means of transportation as they provide a door to door transport service, where mechanized transportation cannot deliver due to poor infrastructure. Moreover, donkeys help to transport perishable products such as vegetables, milk and eggs safely with less damage than with other means of transport (Pearson et al., 2001).

Working donkeys play a central role in the livelihoods of many people across the world, and are often peripheral or invisible to others. For instance, in Ghana the main reason donkeys were kept was for transportation (91% of respondents) of household resources such as water, building materials, farm inputs and farm produce that might have otherwise been carried by women and children over long distances (Avornyo et al. 2015). According to Upjohn and Valette 2014, donkeys were used to bring in feed for the other livestock species and also carry sick animals to the veterinary clinic. Fielding and Krause (1998) remarked that pack donkeys alleviated the work of women farmers by carting farm produce over long distances; which clearly indicated the significant socio-economic contribution of this animal to the poor rural community. The role of donkeys varies from place to place, over time and between those who use them, even within the same household or small community. Working animals are the bases for the livelihood of households and they maintain or enhance other livelihood assets (Wade, 2014). According to Avornyo et al. (2015), having a donkey could earn the owner a mean annual income of US\$110.06 from using the donkey for transport of various loads, and hiring out the donkeys to other people that could also earn a mean of US\$70.56 for the household. In addition, manure from the donkey can be sold for a mean of US\$28.27 in Ghana.

Despite donkeys' several contributions to the socio-economy in Ethiopia, their health and welfare problems are wide spread. According to Molla et al. (2017), the common health problems were skin problems, musculo-skeletal problem, wounds and behavioral abnormalities in Hawassa city that affect donkeys and livelihood of

owners. These problems are not only affecting donkeys but also the livelihood bases of the households dependent on them. But there is no study in Ethiopia on the contribution of donkeys to the livelihood of their owners. Furthermore, no study estimates the loss due to their health problems in general and foot related problems, in particular. Therefore, the purpose of this study is to investigate the contribution of cart pulling donkeys to their owners and the impact of foot related problem on the livelihood of the owners in the study area.

MATERIALS AND METHODS

Study area and population

This study was conducted in Hawassa City from April 2014 to April 2015. Hawassa is located at an altitude of 1708 m above sea level; and with an average annual rain fall of 997.6 mm and mean annual temperature of 25°C. The study population was all cart pulling donkeys residing in all the 8 sub-cities of Hawassa. The study animals were selected by systematic random sampling technique from donkeys coming to veterinary clinics, gathered at market places waiting for working and resting places.

Sampling method and sample size determination

The sample size was calculated taking the 40.2% prevalence of lameness for donkeys reported by Teshome (2014), and then computed using the formula described by Thrustfield (2005). The study considered 95% confidence level and 5% desired absolute precision. Accordingly, a total of 369 donkeys and donkeys' owners were engaged for the study.

Data collection methods

Interview schedule

Structured questionnaire was administered to randomly selected donkey owners. The interview was based on the willingness of the owners to participate; informed verbal consent was obtained. The questionnaire covered various areas like awareness about foot health care and management, the daily earning and expenses for working on cart pulling donkeys and the types and duration of occurrence of foot related problems and costs for managing and treating foot related problems. The occurrence of foot related problems, costs associated with them and absenteeism from work due to foot related problems for the last one year (April 2014 to April 2015) were also included.

Observation and clinical examination of foot related problems

The donkeys were critically observed and clinical diagnosed both at rest and in locomotion for the occurrence of any foot related problems during the study period, April, 2014 to April, 2015. Both visualization and palpation of the musculoskeletal system were conducted in clinical examination. The visualization of the donkeys was conducted by visualizing the donkeys at side, in front and behind both at rest and in motion followed by friendly approach to the donkeys (Hodgson and Rose, 2000). The donkeys that showed any clearly impaired movement with uneven length and timing and those reluctant to bear weight on one or more limb were considered as having foot related problems. The skeleton and joint of the

donkeys were palpated from distal to proximal, noting the presence of pain responses, swelling and wounds. Donkeys were handled as per ethical consideration of The Donkey Sanctuary, Ethiopia.

The contribution of donkeys and implication of lameness

The contribution of donkeys to the livelihood of the owners was assessed through what the owners are earning as incomes generated from the cart pulling donkeys business. Whereas, the financial loss due to foot related problems was determined through loss either by direct financial loss or absenteeism from work or additional costs incurred for managing and treating it. The financial loss due to culling of donkeys as a result of severe foot related problems were also taken into consideration in assessment of financial loss due to foot related problems. The computation was conducted taking into account the one year period, from April 2014 to April 2015.

Data management and analysis

All collected data were entered into Microsoft Excel spread sheet, and then summarized by using descriptive statistics like mean and percentage. Pearson's Chi-square (χ^2) test was used to test the association between variables. Benefit-cost ratio was used to analyze the monetary earning of non-lame cart pulling donkeys, and the actual (net) monetary benefit per year was also calculated. The net income/financial earning generated by the non-lame cart pulling donkey was calculated by subtracting the average gross annual money incurred by the owner (direct or indirect) to use for cart pulling from average gross annual income generated by the non-lame cart pulling donkey. The direct monetary loss due to lameness was calculated by multiplying the average frequency of lameness per year/ days of absenteeism from work due to lameness to obtain total days of absenteeism from work per year. This result was then multiplied by money earned per day for each donkey owner and treatment cost for lameness was added to it. Money loss due to culling as a result of foot related problems was calculated by considering the age of the donkey at culling, the life expectancy of the donkey and annual income generated by non-lame cart pulling donkey. The trend of cart pulling business was obtained by interviewing the owners.

RESULTS

Questionnaire introduced to the 369 donkey owners was fully responded to and submitted. Their cart pulling donkeys (n=369) were examined for lameness. From a total of 369 cart pulling donkeys examined, 139(37.7%) had foot related problems

Cart donkey owners' characteristics

All respondents of cart pulling donkey owners were males; and the age of 85.9% of the respondents were between 21 to 30 years. Among 369 respondents of cart donkeys owners, 161 (43.6%), 167 (45.3%) and 41 (11.1%) of them possessed one, two and three and more donkeys. About 345 (93.5%) of the respondents were fully dependent on their cart pulling donkeys for their households livelihood. The educational status of

respondents included completed high school 138 (37.4%), completed elementary school 211 (57.2%) and illiterate 20 (5.4%). Working days and working hours of the respondents and cart pulling donkeys were more or less similar (Table 1).

The prevalence of foot related problems

From 369 cart pulling donkeys examined for foot related problems, 139 (37.7%) were found with one or more of foot related problems. The major types and causes of foot related problems and their proportion are shown in Table 1.

Risk factors associated with the occurrence of foot related problems

Among the various risk factors considered, the body condition score, weight carried at a time and the work experience of the owners were found to be statistically and significantly associated with the occurrence of foot related problems in donkeys. A detail of the results observed during this study is shown in Table 2.

The contribution of donkeys for the livelihood of the owners

The maximum and minimum working days of cart pulling donkeys were seven and five days per week, respectively. According to the respondents the average working hours was 8 h per day. The minimum and maximum income of the cart pulling donkey owners per hour was 4 and 45 Ethiopian Birr (ETB), respectively. Considering, a donkey working on average for eight hours daily, the minimum and maximum income of the owners was 32 and 360 ETB per day, respectively. The result from the respondents revealed that the average daily income was 124 ETB. The average working days/week was 5 days, and hence, the average working days/month was 20 days. Since, there are 12 months in a year; the average working days in a year were 240 days. The overall annual income of cart pulling donkey owners was computed to be 29,760 ETB (1488 US\$) in Hawassa City during the study period (Table 3).

Average annual net contribution of the donkey to the owner was 12,536 ETB (626.8 US\$). The benefit-cost ratio obtained by dividing annual earn from non-lame cart pulling donkey to the cost incurred by the owner for this business was 1.72. The ratio being greater than 1, cart pulling business has higher financial earning than cost incurred for the business. The benefit in this study indicates the financial earn, but not the actual benefit of the cart pulling business as there are other factors which affect the actual benefit to be earned. The exchange

Table 1. Major types and causes of foot related problems cart pulling donkeys in Hawassa, April, 2014 to April 2015.

Causes of lameness	No of lame donkeys	Prevalence (%)	95 % CI
Posture and gait abnormality	2	0.5	-0.2 - 1.3
Hoof over growth	46	11.7	8.4 - 14.9
Hoof abscess	34	9.2	6.2 - 12.2
Broken forward	1	0.3	-0.3 - 0.8
Arthritis	14	3.8	1.8 - 5.8
Dislocation	2	0.5	-0.2 - 1.3
Apparently lame	5	1.4	0.2 - 2.5
Fracture	1	0.3	-0.3 - 0.8
Muscular problem	20	5.4	3.1 - 7.7
Wound on the leg	14	3.3	1.4 - 5.1
Overall	139	37.7	32.7 - 42.6

Table 2. Risk factors associated with the occurrence of foot related problems of donkeys in Hawassa, April 2014 to April 2015.

Risk factor	Level of risk factor	No examined	Lameness number (%)	95% CI	χ^2	P-Value
Age	< 6 years	65	17 (26.2)	15.4-37.0	5.66	0.059
	6-10 years	269	105 (39.0)	33.2-44.9		
	> 10 years	35	17 (48.6)	31.7-65.4		
BCS	2	26	11 (42.3)	22.9-61.7	8.93	0.011
	3	238	101 (42.4)	36.1-48.8		
	4	105	27 (25.7)	17.3-34.1		
Weight carried	≤ 100Kg	313	109 (34.8)	29.5-40.1	7.11	0.008
	≥ 100 Kg	56	30 (53.6)	40.3-66.8		
Working days ^D	5 days	26*	7 (26.9)	9.4-44.4		
	6 days	330	124 (37.6)	32.3-42.8		
	7 days	13*	8 (61.5)	33.9-89.2		
Work hours per day ^D	6 h	3*	1 (33.3)	-	2.67	0.102
	8 h	147	48 (32.7)	25.2-40.3		
	10 h	219	90 (41.1)	34.5-47.6		
Work experience ^O	3 year	175	92 (52.6)	45.1-60.0	32.56	0.000
	4 years	158	41 (25.9)	19.1-32.8		
	≥ 5 years	36	6 (16.7)	4.3-29.1		
No donkeys possessed ^O	1	161	62 (38.5)	30.9-46.1	1.39	0.498
	2	167	65 (38.9)	31.5-46.4		
	≥ 3	41	12 (29.3)	15.1-43.4		

* Not analyzed due to smaller sample size (≤ 30); Superscript D=Donkey, and O=Owner.

rate of 20 ETB for 1US\$ was considered.

Financial loss due to foot related problems

The foot related problems were leading to financial loss in two categories: one by absenteeism from work and another by treatment and management cost and culling

of severely affected donkeys by foot related problems.

Financial loss due to absenteeism from work

The minimum and maximum days of absenteeism work from due to foot related problems during the study time period was 5 and 30 days, respectively. The average

Table 3. Mean monthly and annual financial income from cart pulling donkey to owners from non-lame donkeys in Hawassa from April, 2014 to April, 2015.

Average working hours/day	8 h
Maximum income/hour	45 ETB
Minimum income/hour	4 ETB
Maximum income/day	Maximum income/day*Maximum income/hours =360 ETB
Minimum income/day	Minimum income/day*Minimum income/hours =32 ETB
Average income/day	124 ETB
Annual average income/year	29,760 ETB(1488 US\$) ^{by then exchange rate}
Average annual cost incurred by the donkey owner for cart pulling donkey	17,224 ETB (861.2 US\$)
Average annual net income/year/donkey.	12,536 ETB (626.8 US\$)
Cost benefit ratio of working on cart puling donkeys	1.72

^{by then exchange rate} The exchange rate of 20 ETB for 1US\$ was considered.

Table 4. Financial losses due to foot related problems in working donkeys in Hawassa, April 2014 to April, 2015.

Average days of work absenteeism per foot related problems	9 DAYS
Average frequency of foot related problems per year	2 TIMES
Total days of work absenteeism per year	18 DAYS
Average money earned per day	124 ETB
Average money lost due to work absenteeism/year	2232 ETB
Average annual treatment cost per donkey per year for foot related problems alone per donkey	33 ETB
Average financial loss due to culling (scenario 1=life time expectancy)	203.83*
Average financial loss due to culling (scenario 2= donkey market price estimation)	8.03**
Average annual financial loss due to foot related problem = Financial loss due to work absenteeism + financial loss due to treatment + financial loss due to culling	2469 ETB(123.45 US\$)* 2273 ETB (113.65 US\$)**
Financial income from a cart pulling donkeys without lameness/year (from Table 3)	12536 ETB (626.8 US\$)
Average annual net benefit from lame donkey (average net annual contribution of non-lame cart pulling donkey (table 5)-average annual loss due to foot related problems)	10067 ETB (503.35 US\$)

*scenario one was assumed to work in the study area.

absenteeism from work of donkeys due to foot related problems was 9 days. The average recurrence of foot related problem in a donkey per year was found to be 2 times. Multiplying average days of absenteeism from work by average recurrence of lameness per year gives the total days of absenteeism from work per year by a donkey due to foot related problem to be 18 days. Hence, this was multiplied by average daily income (124 ETB). Therefore, the owners lose on average 2,232 ETB annually due to foot related problem in a donkey (Table 4). The minimum and maximum days of absenteeism from work per year due to foot related problems in the donkey were 10 and 60 days, respectively. An owner with lame donkey lost a minimum of 1240 ETB annually and a maximum of 7740 ETB per donkey yearly (Table 4).

Financial loss due to treatment and management of foot problems and culling of donkeys

The average cost for treatment of a foot related problems

in Hawassa city was 33 ETB per year for a donkey. In severe cases of foot related problems or when it is complicated, the owners were forced to cull the donkey. This was found to have significant impact on livelihood of the owners. The culling rate due to foot related problems was found to be 2(1.44%) donkeys per year during the study period. The financial loss incurred due to culling was computed based on the life expectancy and market value of the donkey.

Computation based on the life expectancy of the donkeys

This computation is based on the cumulative monetary value of the donkeys, that is, assuming the owner uses the donkey for its expected productive life time. The life expectancy of cart pulling donkey in Ethiopia is reported to be 10-25 years (W/Giorgis et al., 2013). For the purpose of this study the minimum life expectancy, 10 years, was used to compute the financial loss; and the

age of the animal at culling time of 4 years for both culled donkeys forms the average age of the donkeys. The expected productive age was calculated by subtracting the age of the animal at culling from the expected life expectancy of the donkey. Therefore, the productive ages of the donkeys missed due to culling were 6 years. Then, by multiplying the remaining 6 years of expectancy life by average annual income from non-lame donkey resulted in 75,216 ETB (3760.8US\$) per donkey owner due to culling. When bringing it to the individual donkeys, on average each owner is incurring costs of 203.83 ETB for culling of donkeys due to severe cases, when life time expectancy is considered (total costs for culling divided by the sample size; that is 75,216 ETB/369) (Table 4). The probable occurrence of lameness in culled donkeys in prospective years was ignored.

Computation based on the cost of the donkeys at public market

The minimum and maximum price of healthy donkey in Hawassa market in the year 2014-2015 was 2000 and 5000 ETB, respectively. The average price of healthy donkey was 2965 ETB. Hence, each of the two owners lost 2965 ETB on average. When bringing it to the individual donkeys, on average each owner is incurring costs of 8.03 ETB for culling of donkeys due to severe cases, when average market price of donkey is considered for financial loss estimation (by the above manner) (Table 4).

DISCUSSION

The current study revealed that the overall prevalence of cart pulling donkey foot related problems was 37.7% in Hawassa. This finding is higher than the report of Morgan (2007), who reported the prevalence of 3.1% in Debre-Zeit and Addis Ababa. But the prevalence observed in this study is lower than that reported by Reix et al. (2014) from Pakistan (89%). The variation in prevalence might be accounted to the differences in management systems prevailing in each study areas, difference in the working topography and load carried by donkeys. According to Mekuria et al. (2013), lameness is associated with continuous movement in various landscapes and on bumpy roads. It might also be due to variation in the type of work; the current study was on cart pulling donkeys whereas that of Debre-Zeit and Addis Ababa was donkeys used for pack purpose. The finding of current study is in line with report of Grave and Dyson (2014) who reported a lameness prevalence of 38.1% in horses, in United Kingdom.

Among the risk factors considered the body condition of the donkeys ($\chi^2=8.93$, $P < 0.05$), weight carried by the donkeys ($\chi^2=7.11$, $P < 0.05$) and working experience of

the owners ($\chi^2=32.56$, $P < 0.05$) were found to be statistically and significantly associated with the prevalence of foot related problems (Table 2). Highest prevalence of lameness observed in those donkeys with body condition score of 2 and 3; it is in agreement with Reix et al. (2014). Lameness by itself has indirect influence on the body condition of donkeys, perhaps through loss of appetite (Dobromylskij et al., 2000; Almeida et al., 2008). high amount of weight carried by the donkeys increases the chance of lameness occurrences. This might be associated with the downward exerted pressure on the legs by the weight carried. Moreover, it might be related to the fact that owners did not load their donkeys based on the age of the donkeys.

The length of work experience of the owners and occurrence foot related problems in the study were inversely related. This might be due to the fact that owners with less work experience were also with weak management skill. Cart pulling donkey value for the owner and management skill can be developed gradually through time. The common causes of foot problem in cart pulling donkeys in this study were hoof over growth, hoof abscess, muscular problem and arthritis; a little bit different from the causes of lameness and associated risk factors in cart mules in Northern Ethiopia (Bazezew et al., 2014). They reported that age, rest within a day, load carried and educational status of the owner are not associated with lameness in mules. This difference may be due to the difference between socio-cultural and behavioural characteristics of the community in Hawassa and those in Northern Ethiopia as well as the time gap between the studies.

In the current study, 14.4% of donkeys work even they were lame and 64.24% donkeys stop working until recovery and the minimum and maximum working hour was 6 (0.8%) and 10(59.3%), respectively. This is an indication of the animals suffering, aggravated by beating, to make them carry loads beyond their capacity or work longer hours. Sick and injured animals put to work without adequate nutrition will have significant welfare consequences. This finding is in agreement with the report of Ramaswamy (1994): the state of health of draught animals is poor, as they are not fed adequately to replenish the energy required for work.

In the current study, there was no significant association between age of the donkey and weight carried by the donkey with the occurrence of foot related problems. This finding is consistent with Tadich et al. (2008), who reported that there was no association between the age of the donkey and the weight carried by it. The possible cause for this is that, all age groups ranging from ages less than 3 years to 15 years carry almost similar weights because the owners do not load their donkeys based on age or weight.

This study revealed that the average daily income of the cart pulling donkey owners was 124 ETB (6.2 US\$)

and the average annual income was 12,536 ETB (626.8 US\$). This finding is higher than the report of Pearson et al. (2001), who reported their contribution in terms of firewood trade to the family income is 156 to 1404 Ethiopian Birr annually in Tigray and the Rift Valley areas; in Ejersa, sand is transported in 20 litre containers fitted on the back of a donkey. Each day a donkey makes 80 shuttles from the river basin to the roadside transporting a volume of sand amounting to 4 m³ and costing 90 Birr.

But Admasu and Shiferaw (2011) reported a lower annual return from donkey keeping, which is 4419 ETB (330USD) per annum in Lemo, Shashego and Mesikan Woredas of Hadiya and Gurage zones. This variation of income across the areas might be due to the difference in the area of donkey operation, the number of people interested in using donkeys for transportation, working hours of the donkey as well as the performance of the donkeys. Also it might be due to the difference in the level of dependency on donkey for livelihood between the areas. For example: in Hawassa 93.76% donkey owners were wholly dependent on cart pulling donkeys for their livelihood. Moreover, it might be due to the difference in wealth status of the customers to pay for the service of the cart pulling donkey.

The result of the current research showed that the cart pulling donkey business was found to generate promising cost benefit ratio, which is in agreement with the reports of Admasu and Shiferaw (2011). Trechter et al. (2008) reported equine industry directly generates \$30 to \$35 million in annual revenues and \$735 to \$862 million in expenses. This is higher than the current finding in Hawassa, because of the difference in the study area, the value and status given to the donkey and the activity done by the donkey in the study areas. The current study deals only with the income generated by cart pulling donkeys. But, the finding of Trechter included equines in general not only the income from the cart pulling donkeys.

On average the total loss incurred due to lameness that include: absenteeism, treatment cost and culling of donkeys were 2469 ETB (123.45 US\$) per donkey yearly. This finding is very small compared with that of USDA (2001), that reported the total estimate ranges from \$678 million to \$1 billion for 1998 due to a range of estimates for the incidence of lameness in horses. This may be due to the difference in the value and status of donkey, treatment and other care costs in US and in Ethiopia, particularly in Hawassa. It can also be due to the difference in the considered factors in the calculation and species differences.

CONCLUSION AND RECOMENDATIONS

Cart pulling donkeys were one the means of livelihood for the owners and it is making valuable incomes that might be supporting the poor resource bases households in the

area. But foot related problems in particular and other welfare problems were major challenges to the cart donkey owners aggravated by the poor service delivery level in the area. A wide prevalence of foot related problems and tendency of working on donkeys with foot problems signifies there is crucial welfare consequences on the donkeys in the area. The implication of lameness on the income of the owners was evidenced with absenteeism from work and culling of working donkeys. Moreover, lameness was one major constraint affecting the donkey welfare and income of the people who depend on donkeys for their livelihood; it warrants there should be much higher attention. The donkey cart business can be assumed as a low income based livelihood alternative to engage people considering the capacity development of people and giving animal welfare priority attention. Accordingly; awareness creation and training of the donkey owners on welfare and managing foot related problems should be emphasized to improve the welfare of donkeys and sustain their livelihood.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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