

Identification of causes and associated risk factors for lameness in working donkeys in and around Bishoftu

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ABSTRACT: The present study was conducted from November 2014 to April 2015 in and around Bishoftu town to determine causes, associated risk factors and owner's response to causes of lameness for lame donkeys presented to Donkey Health and Welfare Project Clinic. Accordingly, 325 lame donkeys were purposively selected for this study. Questionnaire survey and physical examination were employed as study design. Results of 325 donkey owners interviewed revealed that various causes of lameness. Among these interviewed 222 and 221 respondents has better knowledge about the lameness caused by hyena bites and various wounds respectively, whereas 2, 8 and 41 respondents have information about various diseases, solar penetration and overloading as a causes of lameness respectively. The current study includes 2 young and 323 adult donkeys. Out of the 325 lame donkeys, 179 were females and the remaining 146 were males. Upon physical examination of all donkeys taken into study, seventeen types of musculoskeletal abnormalities were identified, among these, higher frequency of foreign material in hoof, crackling and hoof overgrowth with 293, 245 and 208 cases respectively. Low frequency of hygroma (3) and bone fracture (8) were also observed. Grade analysis of lame donkeys revealed 3 (0.92%) mild cases, 84 (25.85%) moderate, 234 (72.92%) severe and 1 (0.31%) non-weight bearing cases. Grade three was most frequently observed which appeared in one out of two cases of lameness. The average grade of lameness was 2.72 ± 0.47 . There was no statistically significant difference ($P > 0.05$) between the two sexes, body condition scores and age of animals regarding identified abnormalities and grade of lameness. However, the high number of donkeys which had lameness (79.08%) were found with poor body condition scores. Lameness was seen on both front and hind limbs but majority (97.23%) was unilateral type, of which 60% was presented with front limb while 37.5% was with hind limb. Significant difference was observed between front and hind limbs ($P < 0.05$) for occurrence of lameness. Poor husbandry practices and lack of knowledge or information on causes of lameness among owners remain the factor for occurrence and severe grade of lameness.

Key words: Bishoftu, causes, donkeys, lameness.

INTRODUCTION

Lameness is defined as an abnormal stance or gait caused by either a structural or a functional disorder of the locomotor system. A great deal of equine lameness comes from hoof abscesses. Equines are the only family of mammals that have evolved to walk on the tip of one

finger. The entire weight of the horse is borne by the coffin bone, which is suspended above the sole of the foot by its attachment to the outer hoof wall by laminar layer (Thal, 2005). Failure of the lamellar attachment results in loss of the suspension of the coffin bone within the hoof capsule

and results in lameness (Moyer, 2006).

Lameness is one of the most common problems seen in working equids from developing countries. Pritchard et al. (2005) reported gait abnormalities in 91% of 4903 working equids examined in 5 developing countries. Maranhao et al. (2006) reported high prevalence of multiple pathological abnormalities of limbs in a study of 58 draught equids in Brazil; the pathological abnormalities developed were reported as due to the type of work undertaken. Lameness can cause suffering directly through pain (Whay et al., 2005), and indirectly by altering the stresses on the body (Weishaupt et al., 2004; Alvarez et al., 2007); slower progression can lead to beating. Besides impact on body condition, Pritchard et al. (2005) stated that an extremely high prevalence of lameness and associated pain is great welfare concern in working equids who are often required to work for long hours, in harsh conditions. Major causes of lameness in donkey include thrush, solar penetration by sharp objects like nails, thorn, wires and sand cracks, hobbling and tethering, hyena and donkey bite, overloading and hoof overgrowth as reported by Moti (2005). The thrush cases diagnosed as causes of lameness were characterized by deep erosion of the frog with characteristic foul smelling, black tarry discharge. Thrush results from improper foot care, where the sulci of the frog not cleaned out daily, and it causes lameness when deep erosion of infection occurs (Rose and Hodgson, 1993).

Lameness (as one of Musculoskeletal Disorders) is a departure from the normal stance or gait resulting from a structural disorder of one or more limbs or the trunk. Lameness is not a disease but an indication of pain, weakness, deformity, or other impediment in the musculoskeletal system. In most cases, the lameness is associated with pain. However, occasionally there is no pain involved and a mechanical type of lameness seen (Jacobs, 1998). Lameness in equines more often affects the feet and lower limbs than the upper limbs, and more often in the forelegs than the hind. Conversely, abnormalities of gait as opposed to lameness are more often observed at the rear due to lesions at hock level or above, and particularly in the back. Donkeys are considered to be the affected equine species in this respect, due to work related stresses and faulty conformation (Hovel, 2000). Moreover, problems with the quality of the hoof horn, both of the sole and wall, is a common problem in donkeys and can occur due to a variety of reasons. Some of the easier to identify factors are: nutrition, environment, trimming and shoeing, traumas, local and systemic diseases, exercise and genetics in which they contribute for occurrence of lameness (Hovel, 2000).

Diagnosis of the lameness is complex as it affects ability to move and may be due to lesions of at least three body systems (musculoskeletal, nervous and integumentary) independently or in combination (Chris, 2010).

Although lameness has been reported as one of the health problems of working donkeys affecting their health

and welfare, little attempt has been made to characterize the nature of lameness on working donkeys and to identify knowledge of owners in Bishoftu. Hence, the objective of this research is to identify causes and associated risk factor of lameness in working donkeys and the reactions of owners towards causes of lameness, in and around Bishoftu.

MATERIALS AND METHODS

Study area

The Study was conducted in and around Bishoftu town in East Shewa zone of Ethiopia from November 2014 to April 2015. The districts are located within 100 km radius of the College of Veterinary Medicine and Agriculture Donkey health and welfare clinic at Bishoftu town, which is 47 km south east of Addis Ababa. Bishoftu is the main town of Ada district which is located at 9°N and 40° E and altitude of 1900 m above sea level. The rain is bimodal. It receives an annual rain fall of 850 mm with a mean maximum and minimum temperature of 30°C and 8.5°C respectively, and a mean relative humidity of 61.3% (NMSA, 2003). The means of transportation for different commodity and humans in the area include vehicles, horse drawn carts and donkey pack transport. It has donkey population of 46,222 (MOA, 2004). Bishoftu town is surrounded by different rural kebeles (smallest administrative unit in Ethiopia) of the Ada district such as Kejima, korke, Kelity, Dalota, Giche Gerbabo, Babogaya, Sardo, Bedagebabe, Gerbicha, Dembi, kurkura, Keta, Dire, Yerer, Dankaka, Ganda gorba, kuftu, Ketila, Hidi and Yatu. Animals from these kebeles are usually presented to Donkey Health and Welfare clinic in College of Veterinary Medicine and Agriculture when they get diseases or disorders for veterinary service.

Study animals

The study animals were donkeys with lameness cases presented to donkey health and welfare project clinic at college of veterinary medicine and agriculture. All donkeys with lameness conditions irrespective to sex, age and body condition scores were considered in the study. Donkeys were grouped into three age categories as young when the age was <2years, adults when the age is from 2 to 10 years and old when the age is beyond 10 years as described by Shiferaw et al. (2001). The body condition score (bcs) of working donkey observed was also classified into 3 groups body condition score 1-1.5 as (poor), 2-2.5 as (medium) and 3 as (good) (Svendson, 1997).

Study design

The study was case report type using purposive sampling

techniques to grade the lameness and identify associated problems. Detection of any musculoskeletal abnormalities was performed using appropriate visual and physical examination of the donkeys at rest and motion. Parallel to physical examination, semi-structured questionnaires were also developed and delivered to owners admitted to clinic with lamed donkeys to assess risk factors and to determine reactions of owners towards causes of the lameness. Accordingly, 325 lame donkeys and 325 donkey owners or users were included in the study during the study period.

Questionnaire survey

A semi structured questionnaire was designed and delivered to owners with lame donkeys to acquire detailed information regarding the lameness, overall management practices and associated risk factors, owners' reaction towards the causes of the lameness. A total of 325 donkey owners or users were interviewed. The interview was carried out to donkey owners arrived to donkey health and welfare stationary and mobile clinics with lame donkeys. A full history, management practices, reactions of owners about the causes and other useful information were recorded for each donkey.

Clinical examination of study animals

The animals used in this study were working donkeys with lameness cases presented to the DHWP clinics for treatment. A total of 325 donkeys with lameness cases were physically examined using lameness assessment format and then, lameness grading was done.

The diagnosis of musculo-skeletal abnormalities was undertaken according to Stashak (1987). Anamnesis, visual examination and examination by manipulation and palpation were used in the diagnosis of lameness. Hoof tester's and digital pressure application on suspected areas was made to identify and localize the pain.

Examination at rest: careful examination done at a distance, then up on close, viewing the animal from front, sides and behind to assess symmetry of lameness, conformation, the condition and the alteration in posture, weight shifting and pointing.

Examination at exercise: this was to identify the limb involved and the degree of lameness and in coordination in movement. Each selected donkey was examined while it was walking and trotting. The degree of lameness was categorized into four: grade 1, grade 2, grade 3 and grade 4. Following observation of the animals from a distance, close examination of the limb by palpation and manipulation were performed.

Foot: A foot was evaluated for over growth, wearing

patterns, signs of cracks, chaffing, fissure, hoof loss, presence of foreign materials in the hoof and poor conformation and palpated for signs of increased heat around the coronary band. Hoof tester, hoof nipper, and hoof knife were used during hoof examination.

Palpations to joints was undertaken to detect swelling, pain, thickening of the joint capsule and slight increase in temperature. The sites of joint with abnormalities were properly noted.

Hoof pastern axis (HPA) and mediolateral axis were considered while detecting conformation and posture abnormalities.

Statistical analysis

Data were entered into Microsoft Excel and checked for errors that occurred during data entry. Any error was sorted and corrected. Finally, data analysis was made through STATA 11 version (STATA, 2009). The association of lameness and grade of lameness on the basis of age, sex and body condition was compared using X² test (chi-square). A p-value lower than 0.05 was considered as statistically significant.

RESULTS

Questionnaire survey

325 donkey's owners presented lame donkey to DHWP clinic were interviewed for donkey husbandry practices and reaction to suggested causes of lameness. In current study area, all respondents use their donkeys for pack purpose. Among 325 respondents 295 (90.77%) were owners, the remaining 30 (9.23%) were donkey users. Regarding source of donkeys, 184 (56.62%) born or produced at their home where as 141 (43.38%) were purchased from surrounding markets. Results obtained from owner indicated that majority 196 (60.31%) donkeys were housed in soil type of floor (simply natural environment) followed by 100 (30.77%) donkeys were kept in concrete floor and 29 (8.92%) donkeys were kept on the floor made of stone which is believed to reduce chance of mud. The majority of respondents 188 (57.85%) tether their donkeys to restrict movement or manage donkeys at day time, whereas 144 (35.08%) respondents hobble their donkeys at day time management (Table 1). Regarding feeding type, 62% of the total donkeys had practice grazing on natural environment whereas 38% of the total donkeys obtained their feed from both grazing and concentrate feed.

The results of this survey showed that 227 (69.85%) respondents identified donkey lameness cases within a time period of a week, 61(18.77%) respondents

Table 1. Management conditions of donkeys involved in the study (N=325).

Housing (floor type)			Management (day time)			Feeding	
Concrete	Soil	Stone paved	Hobbled	Tethered	Floor	Grazing	Concrete and grazing
100 (30.77%)	196(60.31%)	29(8.92%)	114(35.08%)	188(57.85%)	15(4.62%)	201(61.85%)	124(38.15%)

Table 2. Summary of information obtained from owners regarding onset and what contributed for lameness (N=325).

Seen or came across cases			Condition of cases observed		Reason for occurrence		
A day	Week	Month	Up on loading	Occurs seasonally	Hoof abnormality	Hyena bite	Work over load
61(18.7%)	227(69.85%)	37(11.38%)	86(26.7%)	239(73.3%)	223(68.7%)	79(24.2%)	22(6.7%)

Table 3. Situations of cases and owners hoof management aspect.

Situation after occurrence		Hoof overgrowth before		Trimming by himself/herself	
Worse	Better	Yes	No	Yes	No
325(100%)	0	158(48.6%)	167(51.4%)	1(0.6%)	324(99.4%)

recognized the cases within a day and less considerable number of respondents 37 (11.38%) identify lameness cases after a month. 239 (73.54%) of respondents said that they have seen lameness seasonally whereas 86 (26.46%) informed as they saw lameness up on loading the donkeys only. Regarding occurrence of lameness, about 223 (68.62%) respondents stated hoof abnormality as major causes of the lameness, followed by 79 (24.31%) respondent said hyena bite and 23 (7.07%) respondents implicated work overload as potential cause for lameness. This implies that many owners had little knowledge as work overload lead to the lameness. All respondents stated that once their animal developed lameness, without treatment the condition worse from time to time (Table 2). All respondents reported that lame donkeys in current study had hoof overgrowth before occurrence of lameness. However, none of respondents trim hoof by themselves or using farrier (Table 3). The results of owners reactions towards suggested causes of lameness demonstrated that out of 325 interviewed owners, 222 (68.2%) and 221 (69.9%) had better knowledge as hyena bite and wound causes lameness, respectively, nearly half of interviewed owners had knowledge as traumatic injury, mixing with horned animals, donkey bite and solar abscessation leads to lameness whereas only few owners 0.6% for diseases, 5.8% for solar penetration and 12.5% for overloading known as these causes lameness (Table 4).

Physical examinations

In the study, female donkeys were 55% while 44% were

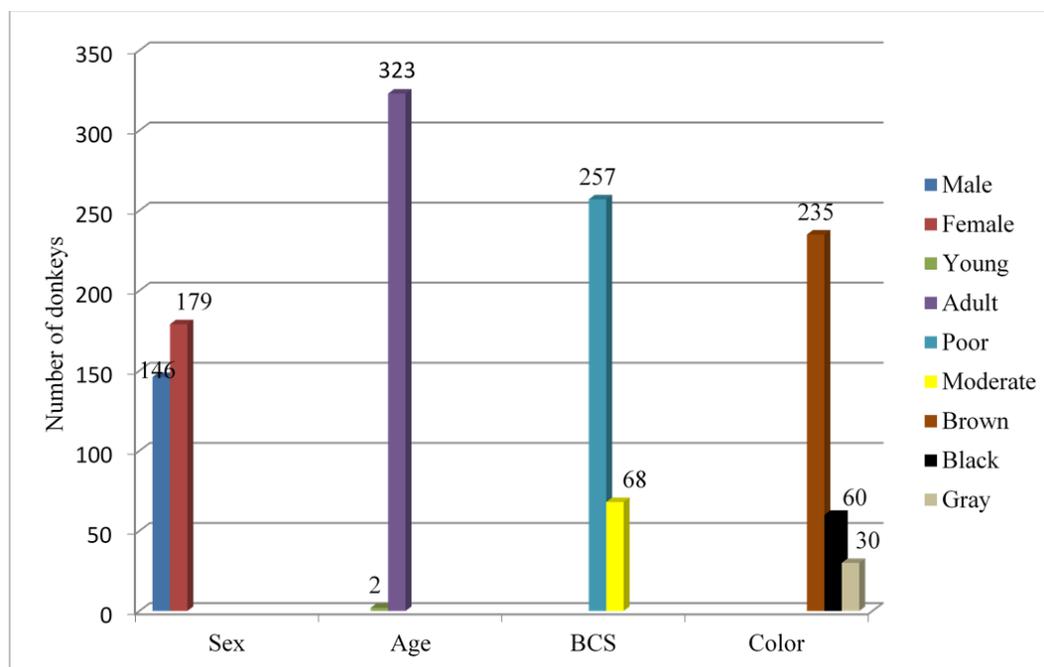
the male. 79% accounted for donkeys with poor body condition while 21% had a moderate body condition. The dominating age's groups of lame donkeys in this study were adults which account for 99% and the remaining (1%) were young donkeys. The majority of donkeys (72.31%) in the study were attributed to brown colour followed by black colour (18.46%) as shown in Figure1.

From 325 lame donkeys up on physical examination, 17 types of musculoskeletal abnormalities were identified. From these, 19.38% was posture and gait abnormality, 61.5% was hoof overgrowth, 33.5% was toe in, 29.5% was toe out, 31.1% was broken backward, 28% was broken forward, 75.4% was cracking, 32% was chaffing, 15.4% was arthritis, 0.92% was hygroma, 16% was joint dislocation, 2.46% was bone fracture, 8.92% was hoof loss, 26.8% was tendon and muscle related injury, 90.15% was presence of stones and sharp materials (nails, thorny grasses, etc) in hoof, while 44% was thrush and 3.38% was mud fever which were identified as causes of lameness in current study (Table 5). The highest identified problem was the presence of foreign body in hoof 293 (90.15%) followed by crackling 245 (75.4%) and hoof overgrowth 208 (61.5%). Few cases of the hygroma 3 (0.92%) and bone fracture 8(2.46%) were identified (Table 5). Grade analysis of lame donkeys revealed 3 (0.92%) donkeys had mild, 84 (25.85%) had moderate, 234 (72.92%) had severe and 1(0.31%) non-weight bearing. Grade three was most frequently observed which appeared one out of two cases of lameness. The average grade of the lameness was 2.72 ± 0.47 .

When comparing the distribution of lameness between forelimbs and hind limbs, forelimb lameness was the most

Table 4. Reactions of owners to suggested causes of lameness.

Suggested causes	Owners response	
	Yes [N (%)]	No [N (%)]
Traumatic injury	167(51.4%)	158(48.6%)
Mixing with horned animals	167(51.1%)	158(48.6%)
Diseases	2(0.6%)	323(99.1%)
Hoof overgrowth	158(48.3%)	167(51.4%)
Overloading	41(12.5%)	284(87.2%)
Hyena bite	222(68.2%)	103(31.6%)
Donkey bite	158(48.6%)	167(51.2%)
Wound	221(67.9%)	104(32.1%)
Solar penetration	18(5.8%)	307(94.2%)
Subsolar abscessation	184(56.6%)	141(43.4%)
Trush	121(37.23%)	204(62.77%)
Joint dislocation	87(26.9%)	238(73.1%)
Flexural deformity	70(21.7%)	255(79.1%)
Hoof puncture	156(48%)	169(52%)

**Figure 1.** General information (sex, age, bcs and color) of donkeys involved in the study.

common. Majority (97.23%) of the lameness was unilateral type, of which 60% was presented with front limb while 37.5% was with hind limb. Significant difference was observed between front limb, hind limb and both front and hind limbs ($P < 0.05$) (Figure 2).

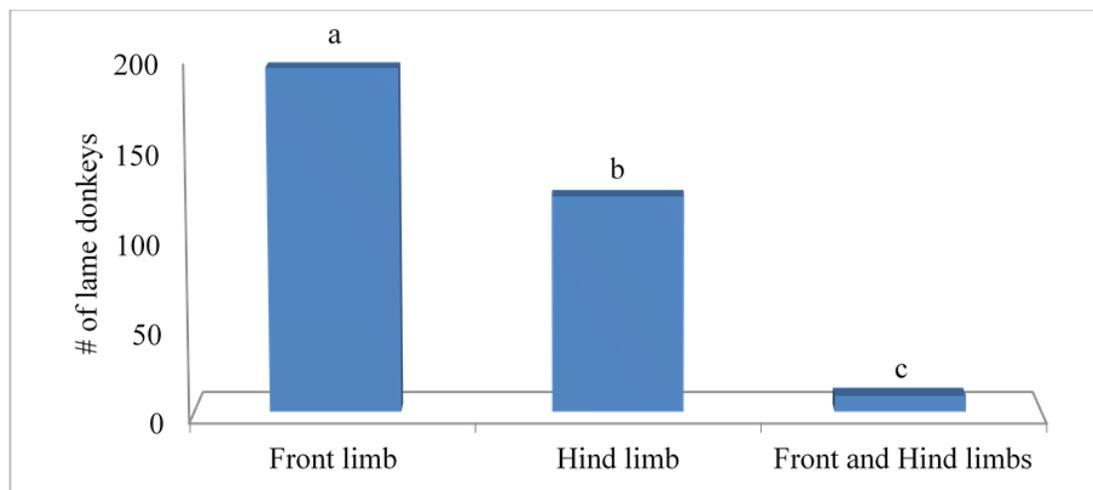
DISCUSSION

The result of questionnaire survey showed that donkeys

were used for packing purpose. Majority of the donkeys [196 (60.31%)] were housed in the soil type of floor which has high probability to become muddy/ to develop mud and predisposes donkeys to trush, hoof overgrowth and easy penetration by sharp objects. This finding concurs with study report of Yohannes (2007) who stated that 80.3% of house simply earth or soil type among lame donkeys in Ada districts. About 57.85% of respondents tether their donkey's leg for management at day time. This potential damage skin of the leg by cutting and have tendency to

Table 5. Major problems identified from lame donkeys by observation (at rest and moving) and palpation.

Identified problems	No of donkeys (N=325)	
	Present [N (%)]	Absent [N (%)]
Posture and gait abnormality	63(19.38)	262(80.62)
Hoof overgrowth	208(61.5)	125(38.5)
Toe in	109(33.5)	216(66.5)
Toe out	96(29.5)	229(70.5)
Brocken forward	101(31.1)	224(68.9)
Brocken backward	91(28)	234(72)
Crackling	245(75.4)	80(24.6)
Chaffing	104(32)	221(68)
Arthritis	50(15.4)	275(84.6)
Hygroma	3(0.92)	322(99.08)
Joint dislocation	52(16)	273(84)
Bone fracture	8(2.46)	317(97.54)
Hoof loss	29(8.92)	296(91.08)
Tendon and muscle related injury	87(26.8)	238(73.2)
Presence of foreign body in hoof	293(90.15)	32(9.85)
Thrush	143(44)	182(56)
Mud fever	11(3.38)	314(96.62)

**Figure 2.** Distribution of lameness among limbs. a, b, c = means proportion with in column or series are statistically different ($p < 0.05$).

create lameness. The results of this survey showed that 227(69.85%), 61(18.77%) and 37(11.38%) of respondents identified lameness cases within week, a day and month, respectively. This clearly indicated that some owners had no regular inspection for hoof of their donkeys. Majority [239 (73.54%)] of respondents said that they have seen lameness seasonally whereas 86 (26.46%) informed as they saw lameness up on loading only. The seasonal appearance may be associated to during high intensity of work like harvesting season and rainy season in which the

hoof growth and penetration by sharp objects higher whereas appearance of the lameness during loading might be because of induced pain and disruption in weight bearing. The results obtained from respondents in the present survey regarding occurrence of lameness confirmed that, at the beginning of interview, knowledge of the owners towards the causes of lameness was low as they mentioned only three causes such as hoof abnormality, hyena bite and overloading. All respondents informed as their donkey had been developed hoof

overgrowth before occurrence of lameness. This suggests that hoof overgrowth had the highest contribution for lameness in the area. All respondents stated that once lameness occurred the situation was aggravated as time goes on. This is because lameness could reduce body condition indirectly through pain and perhaps loss of appetite (Dobromylskyj et al., 2000; Almeida et al., 2008). Results of this study revealed that reactions of owners can be varied among suggested causes of lameness. Better owners' knowledge was seen on hyena bite (n=222) and wound (n=221) as these cause lameness whereas only few owners for diseases (n=2), for solar penetration (n=18) and overloading (n=41) known as these conditions result in lameness. This implies the presence of huge gap among donkey owners on causes of lameness.

There were multiple abnormalities identified in lame donkeys. However, the most common findings on physical examination were presence of foreign materials (n= 293) and crackling (n= 245). Similarly, hoof overgrowth (n=208) were also identified with a higher frequency. High percentage hoof overgrowth observed during physical examination was support result of owners reflected on questionnaire survey. Conversely, hygroma (n= 3) and bone fracture (n= 8) were identified with lower frequency. This finding coincides with report of Naeini and Niak (2005) who reported 0.82% of hygroma from 364 horses in Iran. Based on the severity in this study, grading lameness were distributed as follows: mild = 3, moderate = 84, severe=234 and non-weight bearing =1. The overall average of lameness grade obtained in this study (2.72±0.47) was comparable with lameness grade of 2.23±1.47 reported by Yohannes (2007). It was lower than the current finding which could be due to high cases of lameness in current study. There was no statistically significant difference (P>0.05) between the two sexes, bcs and age of animals regarding identified abnormalities and grade of lameness. However, the highest proportions of donkeys (79.08%) were found with poor body condition score. This might be because lameness could reduce body condition through expending more energy on locomotion than healthy ones (Weishaupt et al., (2006) and also overworking could independently lower body condition and increase lameness simultaneously (Maranhao et al., 2006). Similarly, the dominating ages of lame donkey in this study were adult which accounts 99.38%, this probable due to age of working donkeys (working animals being selected around this age for their work efficiency). The proportion of lameness identified from front limb was significantly (P<0.05) greater than from any of the other limb lameness (hind limb: both front and hind limb). This finding is in harmony with report of Yohannes (2007) who reported as lameness common in forelimb than hind limb at Ada. The difference found regarding higher lameness proportion in front limbs than in hind limbs P<0.05) might be due to weight bearing close 60% of their body front limbs (Boswell et al., 2003; Ross, 2003) and because of most hobbling and tethering were made on front limb.

Conclusions and Recommendations

The current study identified causes, characterized nature of lameness and associated risk factors in working donkeys. Poor husbandry practices and lack of knowledge or information on causes of lameness among owners remain the factor for occurrence and severe grade of lameness. Hoof overgrowth, crackling and presence of foreign materials in hoof was highly prevalent and assumed to potential causes of the lameness. The current research revealed most of lameness cases are seen in front limb than hind limb or both. Grade three lameness occurred most frequently among lame donkeys. Overall lameness creates great impact on productivity and work output of animals by reducing body conditions and also disrupts welfare of animals.

Based on the above findings, the following recommendations were forwarded: Donkey owners should be informed on how to manage donkeys and causes of the lameness, Donkey owners should regularly inspect hoof of their donkeys and take immediate actions. Delayed hoof trimming usually results in lameness. It must be pointed out that factors such as hoof overgrowth, thrush, unbalanced hooves, presence of foreign bodies in hoof, conformation defects, overloading, soil floor type house, tethering and hobbling with nylon predisposes donkeys to lameness. So, during diagnosis of lameness all these factors should be kept in mind. Further studies are necessary to determine roles of each risk factor for occurrence of the lameness.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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