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Occurrence of External Injuries in Working Equines and associated risk factors, Around Alagie Districts, Southern Ethiopia

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Abstract

In Ethiopia, problems with equine welfare pose serious risks to both the animals' well-being and the owners' means of subsistence. In the districts around Alagae, a cross-sectional survey was carried out from November 2021 to May 2022. The purpose of the study was to evaluate the region's wound care methods and the welfare status of working horses. Both indirect (owner interviews via questionnaire) and direct (animal-based) approaches were used. An overall wound incidence of 69.3% was found in 400 horses, including 312 donkeys, 78 horses, and 10 mules. Wounds were present in 54.3% of donkeys, 13.5% of horses, and 1.5% of mules, according to species-specific data. Donkeys, horses, and mules were classified according to the severity of their wounds: mild (46.8%), moderate (9.5%), and severe (3.0%). Wounds occurred more frequently in packed horses (56.5%) than in cart animals (12.8%). Hoof deformity (0.8%), hoof overgrowth (16.5%), and improper gait and posture (6.3%) were all common equine issues. According to the study, 14.1% of the 277 equine wound cases that were examined went untreated by traditional healers or veterinarians. Based on management techniques, significant variations ($p < 0.05$) in wound care conditions were observed among donkey species, indicating a substantial correlation between conditions and wound care management ($\chi^2 = 19.148$, $df = 3$, $p = 0.014$). All things considered, exterior injuries pose serious health and welfare issues for working horses in the research region. To properly address these concerns, a comprehensive program for equine health management and welfare enhancement must be developed.

Keywords/Phrases: Equines, Hoof deformity, Posture, Welfare, Wound management

1 Introduction

In many developing nations, like Ethiopia, horses are vital to farming and transportation systems. There are roughly 10 million donkeys, 0.36 million mules, and 2.14 million horses in the nation (CSA, 2022). Because they provide both social and financial capital, these animals are essential to the livelihoods of many rural people. In places where draft oxen are limited, horses can plow and provide low-cost transportation for impoverished communities in both rural and urban locations.

Transporting people over long distances with an average load of three to four persons (195–260 kg) in a single trip, working horses in Ethiopia, especially those pulling carts, frequently work four to twelve hours a day without rest (Biffa and Woldemeskel, 2006; Nejash *et al*., 2017). Compared to horses, donkeys usually perform a wider range of tasks, such as transporting merchandise between marketplaces, farms, and retail establishments. According to Brooke (2011), they frequently carry loads that are three to four times their own body weight.

Even while horses play a vital role in daily life and the livelihoods of their owners, they are frequently

not managed well enough. They consequently endure poor health, malnourishment, and general low well-being (Guyo *et al*., 2019). Additionally, horse productivity and output are often overlooked by foreign aid organizations and the government's livestock ministry, which tends to concentrate on other livestock (Yoseph *et al*., 2001).

There is little research on equine welfare and health issues in Ethiopia, despite the fact that horses play a major role in both local communities and the national economy. The research of skin wounds and welfare issues affecting working horses, especially in and around the Alage district of Central Ethiopia, has received little attention. Their welfare and health state need to be investigated in more detail in order to help enforce the rules outlined in the "Prevention of Cruelty to Animals Act 1960." Thus, this study's primary goals were to evaluate the wellbeing and external injury condition of working horses as well as their wound care procedures in and around the Alage district.

2 Materials and Methods

2.1 Description of the Study Area

Alage is situated between the Oromia and the Southern Nations, Nationalities, and Peoples' (SNNP) Regions of Ethiopia. The area is roughly located 217 kilometers south of Addis Ababa along the rift Valley. Lake Shalla (8 km north) and Lake Abijata (10 km east) form its borders. With an elevation of 1,580 to 1,650 meters above sea level (a.s.l.), Alage is located at 38°27' East Longitude and 7°36' North Latitude. The research area experiences bimodal rainfall, with wet seasons from March to April and June to September. This leads to an average of 860 mm of rainfall each year. The average daily temperature of Alage is 21°C, with temperatures ranging from 16 to 29°C (Agerie & Afework, 2013).

2.2 Study Animals

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2.3 Study Design and Sampling

In the Alage district and its environs, a cross-sectional study was carried out from November 2021 to May 2022 on randomly chosen horses (312 donkeys, 78 horses, and 10 mules). The study gathered data on back sore wound etiology, wound intensity, age, sex, species, bodily condition, and wound treatment techniques. According to Svendsen's (1997) recommendations, the bodily condition scores of the chosen horses were subjectively rated, and their age was ascertained by their teeth (Crane, 1997).

Sample size determination

The formula given by Thrusfield (2007) was used to determine the sample size for this investigation. Due to the lack of prior research in the field, the sample size was calculated using a 50% predicted prevalence, 95% confidence level, and 5% absolute precision. As a result, 384 animals were needed for the investigation; nevertheless, 400 animals were used to increase accuracy.

$$n = \frac{1.962[Pexpe(1-Pexpe)]}{d2}$$

Where;
n = required sample size,
$Pexpe$ = expected prevalence and
d = desired absolute precision

Hence, a total of 384 animals were sampled from the site. In these work animals of different age group, sex and origin were included.

2.4 Study Methodology

Equine welfare status

The study's equines were physically inspected for any apparent wounds, and the results were documented based on the locations of the wounds. When feasible, representative photos were obtained. By examining and estimating the incisor eruption periods,

the age of the chosen horses was determined (Crane, 1997; Svendsen, 1997). Young (less than five years old) and adult (more than five years old) horses were the two age groups into which they were divided. Using the standards outlined by Carroll and Huntington (1988) and Svendsen (1997), body condition was rated as poor, medium, or good.

Inadequate harnessing and excessive workload are frequent issues for the welfare of horses (Kumar *et al*., 2014). An inadequately made or fitted harness may cause the animals to become tired, uncomfortable, or develop lesions (Pearson *et al*., 2003).

Biffa and Woldemeskel (2006) classified the severity of the wound. In severe wounds, there was tissue enlargement, ulceration with noticeable contusion across large areas, and serious consequences. Small wound clusters with tissue sloughing but no sequelae or hypertrophy were considered moderate injuries; some of these wounds had chronic histories. In the absence of additional damage, mild wounds were characterized as those that solely involved the loss of the epidermis and superficial layers.

Additionally, abrasion, laceration, incision, and puncture were used to categorize wounds (skin injuries) (Feseha, 1997). Abrasions caused superficial epidermal denudation, some serum/plasma exudation, and little capillary hemorrhage. Abrasions were defined as wounds that did not penetrate through rough surfaces, like highways. According to the definition, puncture wounds are tiny tears or holes in the skin brought on by sharp things like glass fragments or nails. Sharp, defined margins from sharp metal or glass were a defining feature of incision wounds, which produced clean cuts with little tearing. Traumatic skin tears that happen in an uncontrollable direction were referred to as lacerations (Knottenbelt, 2003).

2.5 Welfare assessment protocol

According to Botreau *et al*. (2007), animal wellbeing is a multifaceted term that includes comfort, health, and the expression of natural behaviors. Thus, it is crucial to evaluate animal welfare by taking into account both behavior and health. "The Hand Tool" was used to do observational evaluations through direct (animal-based) approaches (Galindo *et al*., 2018). Data on welfare issues, including harness type, wound intensity, wound causes, and owner comments to wound management, were also gathered through interviews using a semi-structured, pretested questionnaire.

Following a three-day training program, veterinary students and agricultural specialists conducted welfare assessments (detailed in Burn *et al*., 2009). To guarantee uniformity across sites, a welfare assessment trainer assessed the animals in each location. Evaluations were customized based on the number of horses in each region.

The technique outlined by Svendsen (2008) was used to calculate the age and body condition scores (BCS) of the horses. Estimates of wound severity and categorization were made using the criteria set out by Knottenbelt (2003) and Biffa and Woldemeskel (2006), respectively.

2.6 Data Analysis

Excel spreadsheets were used to organize and arrange the raw data that had been obtained, the data was coded appropriately, and SPSS version 25.0 was used for analysis. Horse wound prevalence was determined, and Pearson's Chi-square analysis was used to evaluate for significance at a probability threshold of $p < 0.05$ in the relationships between wound prevalence and each risk factor.

3 Results and Discussions

Wounds on different body parts were found to be common among the 400 equines that were inspected (312 donkeys, 78 horses, and 10 mules). 277 horses (69.3%) experienced various kinds of wounds, according to the results. Equine wounds were specifically present in 54.3% of donkeys, 13.5% of horses, and 1.5% of mules. Male wound prevalence was 49.5%, while female wound prevalence was 19.8% (Table 1).

According to the study, there was no significant correlation between the age of the animals and the incidence of wounds; nevertheless, the numerical prevalence was higher in adults (56.3%) than in young horses (13.0%) ($p = 0.477$). This outcome is consistent with research by Birhan *et al*. (2014) and Fikru

et al. (2015), which found that mature horses had a comparatively greater occurrence of wounds, most likely as a result of their prolonged working hours and exposure to large loads over long distances.

Additionally, a higher percentage of wounds was found in horses with poor body condition (29.0%) as opposed to those with moderate (26.5%) and good (13.8%) body condition scores (p = 0.489). Compared to the Northwest Ethiopian report of Tsega *et al*. (2016), this finding is higher. The process of wound healing may be aggravated and prolonged by stress brought on by poor physical condition. According to Pearson *et al*. (2000) and Mekuria *et al*. (2013), horses that are physically unwell—often as a result of malnutrition—are more vulnerable to wound complications.

Table 1. Prevalence of wound in relation to sex, age and body condition of equines in the study area

Risk related factors		No of examined	No of affected	prevalence	χ^2	P value
Species	Donkey	312	217	54.3	0.415	0.813
	Horse	78	54	13.5		
	Mule	10	6	1.5		
Age category	Young	71	52	13.0	1.482	0.477
	Adult	329	225	56.3		
Sex	Male	287	198	49.5	0.032	0.857
	Female	113	79	19.8		
Body condition	Poor	161	116	29.0	1.430	0.489
	Moderate	154	106	26.5		
	Good	85	55	13.8		
Total		400	277	69.3		

Table 2 provides an overview of the percentage of recognized wound kinds, intensity, type of work, lameness, and anomalies. The overall prevalence of wounds in horses was 69.3%, according to the study. This is lower than the 72.15% incidence suggested by Biffa and Woldemeskel (2006) in Hawassa, Southern Ethiopia, but higher than the 37.9% prevalence reported by Usman *et al*. (2015) in Batu Town, East Shoa. The discrepancies might be explained by the diverse husbandry techniques and management philosophies of owners in various production systems. Moreover, changes in working conditions, owner knowledge, and different seasonal factors may have an impact on the frequency of wounds in horses (Pearson *et al*., 2000).

Figure 1. Equines welfare and consequence of overloading

Table 2. Prevalence of equine wound, intensity, type of work and abnormalities among equine spp

Parameters	Donkey %	Horse %	Mule %	Total
Positive	217(69.6)	54(69.3)	6(60.0)	277(69.3)
Negative	95(29.7)	24(30.8)	4(40.0)	123(30.8)
Total	312	78	10	400
χ^2	1.321	4.301	5.131	
p-value	0.813	0.211	0.381	
		Intensity of identified wound		
Mild	148(47.4)	35(44.9)	4(40.0)	187(46.75)
Moderate	57(18.3)	19(24.4)	2(20.0)	78(19.5)
Sever	12(3.9)	0(0.0)	0(0.0)	12(3.0)
Total	217(40.7)	54(69.2)	6(60.0)	277(69.3)
χ^2	19.148	6.821	2.490	
p-value	0.323	0.152	0.476	
		Type of work		
Cart	41(13.1)	8(10.2)	2(20.0)	51(12.75)
Pack	176(56.4)	46(59.0)	4(40.0)	226(56.5)
Total	217(40.7)	54(69.2)	6(60.0)	217(69.3)
χ^2	18.602	7.383	4.321	
p-value	0.000	0.451	0.160	
		Lameness & movement		
Hoof overgrowth	51(16.4)	13(16.7)	2(20.0)	66(16.5)
Hoof deformity	2(0.6)	1(1.3)	0(0.0)	3(0.8)
Gait & posture Ab	21(6.7)	4(5.1)	0(0.0)	25(6.3)
Unaffected	143(45.8)	36 (46.2)	4 (40.0)	183(45.8)
Total	217	54	6	277
χ^2	1.346	3.321	1.012	
p-value	0.969	0.212	0.312	

Ab= Abnormality

According to the current study, the prevalence of wound intensity among the diagnosed horses was 3.0% for severe cases, 19.5% for moderate cases, and 46.8% for mild cases. The prevalence of wounds was higher in pack animals (56.5%) than in cart animals (12.8%), indicating a clear correlation between the type of activity done and the occurrence of wounds (Figure 1). Seasonal fluctuations, management expertise, working circumstances, and husbandry techniques could all be responsible for this discrepancy (Pearson *et al*., 2000).

According to location, mixed wounds had the lowest occurrence (4.8%), whereas the back had the highest prevalence (15.8%). It is in line with findings by Tesfaye and Curran (2005) and Biffa and Woldemeskel (2006) that the back is more vulnerable to injuries. This vulnerability may result from saddles that are poorly made or fitted, as well as from the wrong placing of loads in relation to the owners' straps.

The incidence of hoof overgrowth in mules, horses, and donkeys was 33.3%, 33.5%, and 33.3%, respectively. In donkeys, horses, and mules, the rates of hoof deformity were 0.9%, 1.9%, and 0.0%, respectively, and the rates of gait and posture abnormalities

were 9.2%, 7.4%, and 0.0% (Table 2). Due to a variety of factors, lameness has been recognized as a serious health issue for horses (Putnam *et al*., 2014). Hoof overgrowth was the main cause of the high percentage of lameness seen in pack donkeys (23.5%) and cart horses (24.1%). The prevalence of lameness in cart-pulling donkeys, on the other hand, was 1.6%, which is substantially less than the 40.2% found in Hawassa by Fekadu *et al*. (2015). This lower prevalence may be due to a lack of awareness, inadequate veterinary services, and poor equine management practices by owners. Overall, gait abnormalities were highly prevalent in the equine population, ranging from slight issues to significant weight-bearing difficulties.

Among the sampled equines, the most frequently observed problems were abrasions (20.75%), followed by lacerations (19.8%), incisions (11.8%), punctures (10.8%), and skin avulsions (6.3%). The high incidence of abrasions in this study aligns with findings from Biffa and Woldemeskel (2006) and Pearson *et al*. (2000). This prevalence may be associated with poorly designed harnesses, improperly fitted saddles, inappropriate load placement, and the use of inadequately designed straps manufactured by unskilled individuals.

Wounds were frequently observed on different parts of the same animal, with the highest prevalence noted on the back (15.8%), followed by the abdomen (12.5%), hind limbs (11.8%), neck (9.5%), forelimbs (8.5%), withers (8.5%), and mixed regions (6.8% and 4.8%) (see Appendix 1). However, no significant differences were observed between species regarding the distribution of wounds across various body parts, as summarized in Table 3.

Table 3. The welfare conditions of equines in the study area

Type of wound	Donkey %	Horse %	Mule %	Total
Abrasion	69(22.1)	14(17.9)	0(0.0)	83(20.75)
laceration	57(18.3)	19(24.4)	3(3.9)	79(19.75)
Puncture	33(10.6)	9(11.5)	1(1.3)	43(10.75)
Incision	39(12.5)	7(9.0)	1(1.3)	47(11.75)
Skin avulsion	19(6.1)	5(6.4)	1(1.3)	25(6.3)
χ^2	2.960	4.143	5.110	
P value	0.937	0.103	0.321	
Back	53(17.0)	8(9.0)	2(20.0)	63(15.8)
Wither	18(5.8)	7(9.0)	2(20.0)	27(6.8)
Neck	31(9.9)	7(9.0)	0(0.0)	38(9.5)
Abdomen part	39(12.5)	10(12.8)	0(0.0)	49(12.3)
Hing limb	36(11.5)	11(14.1)	0(0.0)	47(11.8)
For limb	24(7.7)	9(11.5)	1(10.0)	34(8.5)
Mixed	16(5.1)	2(2.6)	1(10.0)	19(4.8)
χ^2	12.151	9.521	7.314	
P value	0.389	0.531	0.621	

According to Mekuria *et al*. (2013), equines found in poor welfare situations, particularly during intense drought and packing conditions, are more susceptible to injuries and wounds on different body parts.

The prevalence of wounds in relation to harness type was observed as follows: plastic (32.7%), grass rope (19.9%), and leather (17.0%) for donkeys, as summarized in Table 4. This study indicated that the majority of wounds in equines were caused by the improper application of harnesses, the types of harness used, and overloading. In contrast, a lower prevalence of wounds was attributed to falls.

Table 4. Prevalence of wound in relation to the nature of harness in the study area

Species	harness	No. animal	Wound	prevalence	χ^2	p-value
Donkey	Plastic	140	102	32.7	1.041	0.903
	Grass	96	62	19.9		
	Leather	76	53	17.0		
Horse	Plastic	34	21	26.9	7.059	0.133
	Grass	26	19	24.4		
	Leather	18	14	18.0		
Mule	Plastic	3	2	20.0	5.011	0.212
	Grass	4	3	30.0		
	Leather	3	1	10.0		
Total		400	277	69.3		

The prevalence of each behavioral response among the examined equines is presented in Table 5. Behaviors proposed to test aversion to humans were positively correlated across the tests. The study found that normal behaviors (alertness, responsiveness to surroundings, head and ears up) were observed in 52.6% of donkeys, 46.2% of horses, and 80% of mules. In contrast, abnormal behaviors (such as apathy or depression) were noted in 41.0% of donkeys, 47.4% of horses, and 10% of mules. The responsiveness of the observer's approach was evident in approximately 52.6% of donkeys, 46.2% of horses, and 80% of mules (Table 5). This may be attributed to the low level of owner awareness regarding proper approaches and the resulting changes in the behavior of their equines.

Table 5. The percentages of each working equine species displaying the behaviors

Behavioral response	Donkey	Hors	Mule	Total
Responsive	164(52.6)	36(46.2)	8(80.0)	208(52.0)
Apathetic	128(41.0)	37(47.4)	1(10)	166(41.5)
Aggression	20(6.4)	5(6.4)	1(10)	26(6.5)
Total	312(78.0)	78(19.5)	10(2.5)	
χ^2	5.103	6.12	3.101	
p-value	0.258	0.191	0.13	

Overall, the primary causes of wounds in equines were improper harnessing (25.0%), followed by overloading (21.0%), multifactor causes (7.8%), biting (6.8%), unknown causes (5.3%), and skin infections (3.5%), as summarized in Table 6. These findings are consistent with the report by Pearson *et al*. (2000), which indicated that improper application of harnesses and overloading were major contributors to equine injuries. These issues may be related to poorly designed harnesses, improperly fitted saddles, inappropriate load placement, and the use of inadequately designed straps manufactured by unskilled individuals. Generally, working equines in several developing countries are already known to face extremely high welfare challenges (Burden *et al*., 2010).

The 400 cases that were sampled for this investigation showed that 9.3% of them were untreated by traditional healers or veterinarians (Table 7). The percentages of untreated horses, donkeys, and mules were 6.4%, 15.1%, and 20.0%, respectively, according to the results. Furthermore, traditional healers treated 31.5% of the study's equines, whilst owners handled a startling 25.8% of sick horses by applying hot iron to the afflicted areas of their bodies. A lack of veterinary care, the owners' financial situation, and a lack of awareness about equine welfare issues could all be contributing factors to these management situations.

The study's overall findings highlight several prevalent welfare issues that local working horses face.

Table 6. Reason for the formation of wound and welfare condition of equines in the study area

Cause of wound	Donkey %	Horse %	Mule %	Total
Improper harness	80 (25.6)	18(23.1)	2(20.0)	100(25.0)
Overloading	65(20.8)	17(21.8)	2(20.0)	84(21.0)
Biting	19(6.1)	7(9.0)	1(10.0)	27(6.8)
Unknown cause	17(7.8)	4(5.1)	0(0.0)	21(5.3)
Skin infection	14(5.5)	0(0.0)	0(0.0)	14(3.5)
Multifactor	22(7.1)	8(10.3)	1(10.0)	31(7.8)
Total	217	54	6	277
χ^2	6.011	4.201	2.067	
p.value	0.814	0.301	0.735	

Table 7. Equine owners' Responses to the Management of wound in the study area

Parameters	Donkey %	Horse %	Mule %	Total
Veterinary service	63(20.2)	14(17.9)	3(30.0)	80(20.0)
Traditional healers	84(26.9)	37(29.4)	5(50.0)	126(31.5)
Burning	87(27.9)	16(20.5)	0(0.0)	103(25.8)
Sulpheric acid treatment	31(9.9)	6(7.7)	0(0.0)	54(13.5)
No treatment	47(15.1)	5(6.4)	2(20.0)	37(9.3)
Total	312(78.0)	78(19.5)	10(2.5)	400(100.0)
χ^2	19.148	8.241	4.972	
p-value	0.014	0.371	0.154	

Traditional healers=include by local community using different medicinal plants

4 Conclusion and Recommendations

Although equines play a significant role in various transportation systems in the study area, they are often the most neglected among domestic animals. This lack of attention has led to compromised management and welfare conditions for these species. In the study area, equines face a range of welfare problems, including issues with harnessing, challenges in accessing veterinary services, overloading, poor management, and a high prevalence of wounds.

The most common type of wound in horses is an abrasion, and the risk factors for wound incidence are age, sex, and physical condition. These injuries are mostly caused by improper harness placement and kind.

It will take a lot of work to educate horse owners about appropriate handling and management techniques in order to solve these equine welfare issues. Enhancing the welfare and health of horses can improve management circumstances, which will ultimately improve community livelihoods. Equine welfare policies and procedures should also be supported in order to guarantee that Ethiopian animal welfare concerns are taken care of, especially in the research region.

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Conflict of Interest

The authors have not declared any conflict of interests.

Availability Statement

The authors declare that all data supporting the findings of this study area available.

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