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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

Equine welfare issues are significant challenges in Ethiopia, threatening the health of the animals and the livelihoods of their owners. A cross-sectional study was conducted between November 2021 and May 2022 in districts around Alagae. The study aimed to assess the welfare status of working equines and the practices surrounding wound management in the region. Both direct (animal-based) and indirect (owner interviews via questionnaire) methods were employed. A total of 400 equines were examined, comprising 312 donkeys, 78 horses, and 10 mules, revealing an overall wound prevalence of 69.3%. The species-specific prevalence of wounds was 54.3% for donkeys, 13.5% for horses, and 1.5% for mules. The intensity of wounds was categorized as mild (46.8%), moderate (9.5%), and severe (3.0%) among donkeys, horses, and mules, respectively. Packed equines experienced a higher occurrence of wounds (56.5%) compared to cart animals (12.8%). Additionally, common equine problems included hoof overgrowth (16.5%), hoof deformity (0.8%), and gait and posture abnormalities (6.3%). The study indicated that among 277 equine wound cases, 14.1% were left untreated by either veterinary professionals or traditional healers. Significant differences ($p < 0.05$) were found in wound care conditions among donkey species based on management practices, showing a strong association between wound care management and conditions ($\chi^2 = 19.148$, $df = 3$, $p = 0.014$). Overall, external injuries represent major health and welfare concerns for working equines in the study area. Therefore, the development of a comprehensive equine health management and welfare improvement program is essential to address these issues effectively.

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

1 Introduction

Equines are essential to transport and farming systems in various developing countries, including Ethiopia. The country is home to approximately 2.14 million horses, 0.36 million mules, and 10 million donkeys (CSA, 2022). These animals play a fundamental role in the livelihoods of many rural communities, providing both financial and social capital. For both rural and urban poor communities, equines serve as a low-cost means of transport and can plow in areas where draft oxen are scarce.

Working equines in Ethiopia, particularly those pulling carts, often labor for 4 to 12 hours a day without rest, transporting people over long distances with an average load of 3 to 4 individuals (195–260 kg) in a single trip (Biffa and Woldemeskel, 2006; Nejash *et al*., 2017). Donkeys are typically engaged in more diverse activities than horses, carrying goods between markets, farms, and shops. They often transport loads that are 3 to 4 times their body weight (Brooke, 2011).

Despite the significant contributions of equines to

daily life and the livelihoods of their owners, their management is often inadequate. As a result, they suffer from poor health, malnutrition, and overall poor welfare (Guyo *et al*., 2019). Furthermore, the government's livestock ministry and foreign aid agencies tend to focus on other livestock, neglecting equine production and productivity (Yoseph *et al*., 2001).

Although equines significantly contribute to local communities and the national economy, research on equine welfare and health issues in Ethiopia is limited. There has been little attention given to the study of skin wounds and welfare problems affecting working equines, particularly in and around the Alage district of Central Ethiopia. More comprehensive studies are necessary to explore their welfare and health status, which will aid in implementing guidelines set forth by the "Prevention of Cruelty to Animals Act 1960." Therefore, the main objectives of this study were to assess the status of external injuries and welfare in working equines, along with their wound management practices in and around the Alage district.

2 Materials and Methods

2.1 Description of the Study Area

Alage is located between the Southern Nations, Nationalities, and Peoples' (SNNP) Regional State and the Oromia region of Ethiopia. It lies approximately 217 km south of Addis Ababa along the Rift Valley and is bordered by two Rift Valley lakes: Lake Abijata (10 km east) and Lake Shalla (8 km north). Alage is situated at 38o27' east longitude and 7^{o}36' north latitude, with an altitude ranging from 1,580 to 1,650 meters above sea level (a.s.l.).

The region receives bimodal rainfall, with wet seasons occurring from June to September and from March to April, resulting in an average annual rainfall of 860 mm. Temperatures in Alage range from 16 to 29^{o}C, with a mean daily temperature of 21^{o}C (Agerie & Afework, 2013).

2.2 Study Animals

The study animals comprised randomly selected equines (donkeys, horses, and mules) from six kebeles: Arsi Negele (Negale Wadasha, Aje Kebele), special districts from SNNPR (Mito Dubela, Algie Dibulto Kebele), and Adami Tulu Jido Kombolcha districts from the Oromia region (Mudi, Arja, and Naka). These kebeles were chosen based on the concentration of equines in and around Alage. A total of 400 equines of varying sex, age, and body condition were included in this study.

2.3 Study Design and Sampling

A cross-sectional study was conducted on randomly selected equines (312 donkeys, 78 horses, and 10 mules) from November 2021 to May 2022 in the Alage district and its surroundings. The study collected information on species, sex, age, body condition, types of work, causes of back sore wounds, wound intensity, and wound management practices. The age of the selected equines was determined by dentition (Crane, 1997), and body condition scores were subjectively estimated based on guidelines published by Svendsen (1997).

Sample size determination

The sample size for this study was calculated using the formula provided by Thrusfield (2007). Given the absence of previous studies in the area, a 50% expected prevalence was assumed to determine the sample size, with a 95% confidence level and a 5% absolute precision. Consequently, the required sample size was 384; however, to enhance precision, the study included 400 animals.

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

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

Equines included in the study were physically examined for any visible wounds, with results recorded according to the wound sites. Representative photographs were taken when possible. The age of the

selected equines was assessed by inspecting and estimating the incisor eruption times (Crane, 1997; Svendsen, 1997). Equines were categorized into two age groups: young (< 5 years) and adult (> 5 years). Body condition was scored as poor, medium, or good, following the criteria described by Carroll and Huntington (1988) and Svendsen (1997).

Common welfare challenges for equines include overworking and overloading, as well as improper harnessing (Kumar *et al*., 2014). A poorly designed or ill-fitted harness can lead to fatigue, discomfort, or lesions on the animals (Pearson *et al*., 2003).

Wound intensity was classified according to Biffa and Woldemeskel (2006). Severe wounds involved ulceration with pronounced contusion over wide areas, tissue hypertrophy, and severe complications. Moderate injuries consisted of clusters of small wounds with tissue sloughing but no complications or hypertrophy, and some with chronic courses. Mild wounds were defined as those involving only loss of the epidermis and superficial layers, with no further trauma.

Wounds (skin injuries) were also classified as abrasion, laceration, incision, and puncture (Feseha, 1997). Abrasions involved superficial denuding of the epidermis with minimal capillary bleeding and some serum/plasma exudation. Non-penetrating wounds from abrasion against rough surfaces, such as roads, were categorized as abrasions. Puncture wounds were defined as those caused by sharp objects like nails or glass shards, which create small skin tears or holes. Incision wounds were characterized by sharp, defined margins caused by sharp metal or glass, resulting in clean cuts with minimal tearing. Lacerations were described as traumatic tears of the skin occurring in an uncontrolled direction (Knottenbelt, 2003).

2.5 Welfare assessment protocol

Animal welfare is a multidimensional concept that encompasses good health, comfort, and the expression of natural behaviors (Botreau *et al*., 2007). Therefore, it is essential to consider both health and behavior when assessing animal welfare. Observational assessments were conducted using direct (animal-based) methods with "The Hand Tool" (Galindo *et al*., 2018). Additionally, a semi-structured, pre-tested questionnaire was prepared for interviews to collect data on welfare issues, such as harness type, wound intensity, causes of wounds, and owner responses regarding wound management.

Welfare assessments were carried out by veterinary students and agricultural experts, who underwent a three-day training course (described in Burn *et al*., 2009). A welfare assessment trainer evaluated animals in each location to ensure consistency across sites. Assessments were tailored to the size of the equine population in each area.

Equine age and body condition scores (BCS) were determined using the method described by Svendsen (2008). Wound severity and classification were estimated according to the guidelines provided by Biffa and Woldemeskel (2006) and Knottenbelt (2003), respectively.

2.6 Data Analysis

The collected raw data were organized and arranged using Excel spreadsheets, with appropriate coding, and analyzed using SPSS version 25.0. The prevalence of wounds in equines was calculated, and associations between wound prevalence and each risk factor were tested for significance using Pearson's Chi-square analysis at a probability level of $p < 0.05$.

3 Results and Discussions

Among the 400 examined equines (312 donkeys, 78 horses, and 10 mules), the prevalence of wounds on various parts of the body was diagnosed. The results indicated that 277 equines (69.3%) had different types of wounds. Specifically, the prevalence of equine wounds was 54.3% in donkeys, 13.5% in horses, and 1.5% in mules. Based on sex, wound prevalence was 49.5% in males and 19.8% in females (Table 1).

The study found no significant association between the age of the animals and wound prevalence, although there was a higher numerical prevalence in adults (56.3%) compared to young equines (13.0%) ($p = 0.477$). This result aligns with findings by Birhan *et al*. (2014) and Fikru *et al*. (2015), which

reported a relatively higher prevalence of wounds in adult equines, likely due to their exposure to heavy loads over long distances and extended working hours.

A high prevalence of wounds was also observed in equines with poor body condition (29.0%), compared to those with moderate (26.5%) and good body condition scores (13.8%) (p = 0.489). This finding is higher than the report by Tsega *et al*. (2016) in Northwest Ethiopia. Poor body condition can induce stress, potentially aggravating and prolonging the wound healing process. Similarly, Pearson *et al*. (2000) and Mekuria *et al*. (2013) indicated that physically poor-conditioned equines, often due to malnutrition, are more susceptible 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		

The proportion of identified wound types, intensity, type of work, lameness, and abnormalities is summarized in Table 2. The study found that the overall prevalence of wounds in equines was 69.3%, which is higher than the 37.9% prevalence reported by Usman *et al*. (2015) in Batu Town, East Shoa, but lower than the 72.15% prevalence indicated by Biffa and Woldemeskel (2006) in Hawassa, Southern Ethiopia. The differences may be attributed to variations in owners' management styles and husbandry practices across different production systems. Additionally, the incidence of wounds in equines could be influenced by variations in working conditions, owner awareness, and various seasonal factors (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

The current study indicated that among the diagnosed equines, the prevalence of wound intensity was 46.8% for mild cases, 19.5% for moderate cases, and 3.0% for severe cases. Pack animals exhibited higher wound occurrences (56.5%) compared to cart animals (12.8%), providing strong evidence of a relationship between wound occurrence and the type of work performed (Figure 1). This difference may be attributed to variations in husbandry practices, working conditions, management knowledge, and seasonal factors (Pearson *et al*., 2000).

The highest prevalence of wounds based on location was found on the back (15.8%), while the least prevalence was noted in mixed wounds (4.8%). This finding is consistent with reports by Tesfaye and Curran (2005) and Biffa and Woldemeskel (2006), which indicated that the back is particularly susceptible to wounds. This vulnerability may stem from poorly designed or improperly fitted saddles and inappropriate load placement in relation to the straps used by owners.

The prevalence of hoof overgrowth was 23.5%, 33.3%, and 33.3% for donkeys, horses, and mules, respectively. Hoof deformity was observed at rates

of 0.9%, 1.9%, and 0.0%, while gait and posture abnormalities were noted at 9.2%, 7.4%, and 0.0% for donkeys, horses, and mules, respectively (see Table 2). Lameness was identified as a significant health problem among equines, caused by various conditions (Putnam *et al*., 2014). A high proportion of lameness was observed in cart horses (24.1%) and pack donkeys (23.5%), primarily due to hoof overgrowth. In contrast, the prevalence of lameness in cart-pulling donkeys was 1.6%, which is significantly lower than the 40.2% reported by Fekadu *et al*. (2015) for cart-pulling donkeys in Hawassa. 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.

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	

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. 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.

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 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 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	

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.

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).

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	

This study revealed that among the 400 sampled cases, 9.3% were left untreated by either veterinary professionals or traditional healers (Table 7). The results indicated that the percentages of untreated equines were 6.4% for horses, 15.1% for donkeys, and 20.0% for mules. Additionally, 31.5% of the equines in the study received treatment from traditional healers, while a surprising 25.8% of sick equines were treated by their owners using hot iron on the affected body parts. These management conditions may be attributed to the owners' economic status, a lack of veterinary service delivery, and gaps in knowledge regarding equine welfare issues. Overall, the study highlights several common welfare problems faced by working equines in the area.

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 risk factors associated with wound incidence in equines include sex, age, and body condition, with abrasions being the most prevalent type of wound. Improper placement and types of harnesses used are major contributors to these injuries.

To address these equine welfare problems, significant efforts are needed to raise awareness among equine owners about proper management and handling practices. Improving equine welfare and health status can enhance management conditions, ulti-

mately benefiting the livelihoods of the community. Furthermore, equine welfare policies and protocols should be endorsed to ensure animal welfare issues are addressed in Ethiopia, particularly in the study area.

Conflicts of Interest

The authors have not declared any conflict of interests.

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Availability Statement

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

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