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The Welfare of Working Equines and Their Socio-economic Dimensions in Hosanna, Southern Ethiopia

M.Sc. Thesis

Submitted to the School of Veterinary Medicine, Jimma University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Veterinary Epidemiology

By

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As thesis research advisors, we hereby certify that we have read and evaluated this thesis prepared under our guidance, by Dembelo Tiele Selato entitled: "**The Welfare of Working Equines and their Socio-economic Dimensions in Hosanna, Southern Ethiopia**." We recommend that it be subjected as fulfilling the thesis requirement.

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Final approval and acceptance of the thesis is contingent upon the submission of the final copy of the thesis to the Council of Graduate Studies (CGS) through the Departmental Graduate Committee (DGC) of the candidate's major department.

DEDICATION

This thesis is dedicated to my parents who taught me to appreciate the value of education and utility of knowledge.

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LIST OF ABBREVIATIONS

AAEP	American Association of Equine Practitioners
AHS	African Horse Sickness
ATNEA	Animal Traction Network for Eastern and Southern Africa
AWAKE	Animal Welfare Action Kenya
BCS	Body Condition Score
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization of the United Nations
FAWC	Farm Animal Welfare Council
INR	Indian Rupee
LWADO	Lemmo Woreda Agricultural Development Office
LS	Lesion Score
masl	meters above sea level
NGOs	Non Governmental Organizations
OIE	International Organization for Epizootics
PA	Peasant Association
SNNPR	Southern Nations, Nationalities and People's Region
SPSS	Statistical Package for Social Sciences
STD	Standard Deviation
UCI	Upper Corner Incisor
USD	United States dollar

ABSTRACT

Working equines have immense socio-economic importance but their health and welfare are highly compromized. A cross-sectional study was conducted from July to December 2011 to assess the major welfare problems of working equines and their socio-economic dimensions in and around Hosanna, southern Ethiopia. From the equine populations of the study area, 10–15% were sampled. Accordingly, 610 equines comprising 365 donkeys, 153 horses and 92 mules were selected using systematic random sampling technique and assessed by direct observation of health and behaviour parameters. In addition, the socio-economic importance was assessed by questionnaire survey conducted on randomly selected 72 households. The results of body condition score, across all three species of equines, showed that 32.6%, 62.6% and 4.3% had thin, fair and good body condition, respectively. The result of behavioral assessment revealed a statistically significant variation ($P < 0.05$) in general attitude, response to observer's approach and chin contact test among the work types. Draught animals showed the highest proportion of apathetic/depressed condition and lowest proportion of friendly approach compared to pack and ridden work types. Mules were most likely to show avoidance or aggressive behavior as compared to donkeys or horses towards an observer, while horses showed the highest proportion of friendly approach ($P < 0.05$). Based on the results of general health indicators, across all equines, 5.2%, 14.9% and 19.8% animals had abnormal mucous membranes, diarrhea under tail and ecto-parasites, respectively whereas 79.6% had eye lesions and 6.1% had missing teeth or poor coat with no statistically significant variation ($P > 0.05$) in each case. The overall prevalence of skin lesions was 63% (66.3% in donkeys, 56.9% in horses and 59.8% in mules) with no statistically significant variation ($P > 0.05$) among the species. However, there was a statistically significant variation ($P < 0.05$) among the work types, age and body condition score categories. The socio-economic dimensions of equines were enormous that they are used for draught, pack, riding, during wedding, funerals and other social work. Moreover, they are sources of income generation. Among the constraints of equine keeping in the area, feed and grazing area shortage, health problems and high cost of feed were the most important. Generally, our study showed that working equines had poor welfare status despite their huge contribution to the poor households with income-generating opportunities and their great social importance. Hence, a wide-range of equine welfare and health awareness to sensitize the equine owners and other concerned government and non-government bodies is essential to improve the welfare status of working equines.

Key words: *Equines, Hosanna, Socio-economic, Southern Ethiopia, Welfare*

1. INTRODUCTION

It has been suggested that more than half of the world's population depends on animals for power, income, social status, security as well as food and clothing; implying the welfare of their animals is essential for their livelihood (Robinson, 1995; Wilson, 2003 and Kay, 2007). With current efforts of increasing productivity, animals fall at the centre of development, whether as food or work animals. As technology advances and climate change becomes increasingly apparent, agriculture and livestock sectors are becoming increasingly important especially for Africa's rural and general development. Attached to global warming and improved livelihoods, is the need to improve the welfare of working animals as a sure way of providing a viable "smokeless" technology for farm and rural transport work (Mande, 2007). The welfare of humans and the welfare of animals are closely linked. In many regions, a secure supply of food for people depends on the health and productivity of animals, and these in turn depend on the care and nutrition that animals receive. Many diseases of humans are derived from animals, and the prevention of these animal diseases is important for safeguarding human health. Moreover, positive relations with animals are important source of comfort, social contact and cultural identification for many people (FAO, 2009).

In Ethiopia, about 83% of the human population live in rural areas, and are primarily engaged in agriculture and related activities (CSA, 2010). Thus agriculture, directly or indirectly, forms an important component of the livelihoods of more than 80% of the human population in the country. The varied and extensive agro-ecological zones and the importance of livestock in livelihood strategies make Ethiopia home to large numbers of livestock. Indeed, Ethiopia has the largest livestock inventory in Africa, including more than 51 million cattle, 48 million small ruminants, 2 million camels, 8 million equines, 42 million chickens and 5 million beehives (CSA, 2010). Livestock are kept for various reasons but primarily to achieve household food security, to reduce poverty through generation of employment, and for transportation of both people and materials. Livestock contribute to economic development through trade in livestock and livestock products, by supplying raw materials to industry, and as a means of earning income. The livestock sector interacts with other sectors of the economy such as crop cultivation, manufacturing and transportation, thereby producing additional economic benefits.

In the livestock sector, equines play an important role in the economy of developing countries. They are the engines that power rural as well as urban economic development. There are an estimated 100 million equines in the developing world with the highest population concentrations in central Asia and North and East Africa (FAO, 2003). Over 95% of all donkeys and mules, and 60% of all horses are found in developing countries and the majority of these are used for work (Fielding, 1991). Ethiopia possesses approximately half of Africa's equine population with 37%, 58%, and 46% of all African donkeys, horses, and mules, respectively (FAO, 1996).

The most important feature of animal use in Ethiopia is the use of donkeys, horses and mules as pack animals, for pulling carts and for riding. They transport a huge diversity of loads ranging from people, agricultural produce, food and water to building materials, such as timber, stone, bricks and even iron sheets and girders (Mekuria and Abebe, 2010). They have multiple functions, which are not limited to economic aspects only but are also related to socio-cultural issues. For example, equines have reduced the domestic transport burden of rural people, especially women, and have created employment and income-generation opportunities for many people (Mengistu, 2003 and Admassu and Shiferaw, 2011). Studies have shown that transport constitutes one of the necessary inputs for rural development and has a positive stimulus for growth in food production, poverty alleviation and overall communication (Pearson *et al*., 2000 and Pearson, 2005).

Equines are important animals to the resource-poor communities in rural and urban areas of Ethiopia, providing traction power and transport services at low cost. The use of equines in door-to-door transport service also provides urban dwellers with the opportunity of income generation (Wilson, 1991 and Agajie *et al*., 2000). Howe and Garba (1997) reported that pack animals in remote parts of the country offer the only realistic way of obtaining returns from agriculture above mere subsistence. In Ethiopia, the use of equines for transportation will continue for years to come because of the rugged terrain characteristics inaccessible for modern road transportation facilities as well as the absence of well-developed modern transport networks and the prevailing low economic status of the community (Mengistu, 2003).

Despite the immense contributions of equines to the resource-poor communities in rural and urban areas of most developing countries including Ethiopia, there are widespread problems

of health and welfare. In these countries, working equines are almost invisible on the agendas of policy-makers, researchers, institutional donors and many others who could make a difference to their well-being. Pearson *et al.* (1997) noted that working animals were not included in government policy documents on agriculture or rural development, although in many countries, particularly in Africa, they make a substantial contribution to the economy.

In Ethiopia, concerning the welfare and socio-economic importance of equines, there are few studies done in the central part of the country (Agajie *et al*., 2000). These researches may not fully elucidate the magnitude and types of working equines problems or their socio-economic importance for the whole country because of the variation in geographic location, cultural practices and beliefs toward equines which can affect issues such as welfare conditions and socio-economic values of equines. Regarding these specific issues, so far nothing is documented for Hosanna and its surroundings. Such information would be useful for designing strategies that would help improve equine health and welfare conditions. Therefore; the objectives of this study were:

- To assess the general physical health and behavioural parameters, indicators of welfare in equines of the study area
- To know the prevalence of poor welfare problems in relation to work types and species of working equines
- To quantify the gross mean annual income of sample households from equines
- To document the socio-cultural and socio-economic importance of equines
- To identify the problems and constraints of equine rearing in the study area

2. LITERETURE REVIEW

2.1. The Concept of Animal Welfare

Animal welfare is recognized as a core component of a responsible livestock sector and its importance is well established. Nowadays, animal welfare is accepted to be integral to programmes that improve animal health, increase livestock production, respond to natural disasters where animals are involved and to be instrumental in defining the fit between the genetic makeup of animals and the environments in which they are kept (FAO, 2009). It is emphasized in many ancient religious texts and agreed by many moral philosophers, political scientists, legal experts and economists (Regan, 1983; Garner, 1998; McInerney, 1998 and Wise, 2000).

Although animal welfare is the subject of global concern, there had been no consensus on its definition for long time. It is a complex issue with important scientific, ethical, economic, religious, cultural and political dimensions (Mande, 2007). Fraser and Broom (1990) define animal welfare as 'the state of an animal as regards its attempts to cope with its environment' whereas Webster (1995) defines as 'an animal's capacity to avoid suffering and sustain fitness'. In contrast, Duncan (1993) contends that 'neither health nor lack of stress nor fitness is necessary and/or sufficient to conclude that an animal has good welfare; welfare is dependent on what animals feel'. According to OIE (2008), animal welfare means how an animal is coping with the conditions in which it lives. Thus, animal welfare refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry and humane treatment. This definition clearly shows that an animal can experience both good and poor welfare and that there are important factors that influence its welfare. These factors are often described as 'The Five Freedoms' (Annex-1) and are widely recognized as defining ideal states of animal welfare (OIE, 2008).

An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well nourished, safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear and distress. Animals are "sentient beings" that experience states such as pain, suffering and contentment. The prevention and control of pain and suffering in animals are widely regarded as ethical requirements in the practice of scientific research and scientific education. Good animal welfare requires disease prevention

and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter/killing (OIE, 2008).

Many criteria for animal welfare are currently used; the following example is based on a concept of animal welfare proposed by Fraser *et al.* (1997) and incorporates within it the model of the five freedoms (FAWC, 1993). There are three broad concepts of animal welfare which, when taken as a whole, give a framework for assessing animal's needs and well-being. The first concept considers "the physical well-being of an animal" and includes issues such as health, disease, injury, malnutrition and dehydration. The second concept considers the "emotional (psychological) component". This relates to pain, fear and distress but may also involve states such as frustration, anxiety, depression and confusion. The emotional well-being of an animal is influenced not only by its physical condition but also potentially by its environment. The third concept in animal welfare is that of "naturalness". For the purposes of the domesticated animals, this can be considered as expression of normal behaviour. All three concepts interact to give an overview of animal welfare (Fig.1). There is a strong interrelationship between these concepts and any approach of assessing and improving animal welfare is obliged to consider both the physical and emotional well-being of the animal as well as its capacity to express normal behaviours (Fraser *et al.*, 1997).

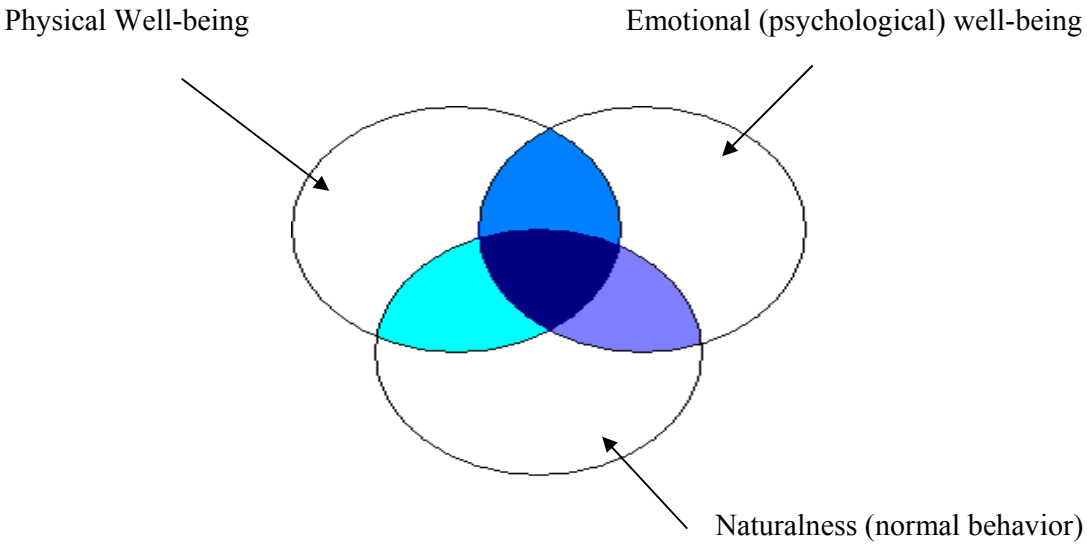

Fig.1 The interrelationship of the three concepts of animal welfare.
Source: Fraser *et al.* (1997)

2.2. The Socio-economic Role of Equines in Developing Countries

Working animals are important contributors to food security at the household level for the rural poor in Africa, Asia and Latin America. Horses, donkeys and mules transport water and cut-and-carry fodder for food-producing animals and provide draught power for cultivation, while the use of a pack donkey to move harvested crops from the fields into storage reduces food spoilage and losses compared to head-loading by farm labourers, who are usually women (Ayo-Odongo *et al.,* 1999). Animals are used to take farm produce from rural areas for sale locally or to a road-head for transfer onto the motorbikes and trucks which supply urban centers. They act as the spokes of a transport wheel, enabling the rural poor to gain access to otherwise inaccessible market hubs (Starkey, 2010). Working equines support households through transport of goods and people by cart or gharry carriage and provide additional income through hiring to other farmers. These animals also contribute to the income of a second group of service providers, including animal breeders, farriers, harness-makers, veterinarians and community animal health workers (Pritchard, 2010).

Dependency on fossil fuels for local transport contributes to pollution and climate change and makes local economies more susceptible to global market forces. Many people predict an increased demand for working animals as weather patterns are increasingly affected by climate change (Starkey, 2010). Where temperature rises, water tables fall and land becomes more arid, drought-tolerant donkeys could become increasingly important for transporting water over long distances. Changes in the timing and intensity of seasonal rains and floods and the frequency of cyclones will lead to deteriorating road conditions and increase the value of animal-powered transport, both for everyday journeys and in disaster relief situations (Pritchard, 2010).

The Ethiopian livestock system is the largest in Africa, with draught power, skins, hides, manure, meat, and milk all contributing significantly to the economy (Blench *et al.,* 2003). A specific recommendation which came out of the 2003 FAO report was that livestock policies in Ethiopia should concentrate on improving veterinary care and feed of work animals including camels, donkeys, mules and horses; species typically little-considered in the design of development projects. Additionally, it was recommended that policy concerning draught animals be developed in conjunction with larger agricultural policies in Ethiopia.

A number of charities are working to improve the welfare of working equines in developing countries. In Ethiopia, there are at least 4 international equine welfare NGOs (Annex-2)

operating (Helen, 2001). In general, the major equine charities seek to alleviate suffering and improve the welfare of working equines by providing curative treatment for the health problems caused by mismanagement. They also aim to improve the livelihoods of people dependant on these animals.

2.3. Equine Welfare and Its Assessing Methods

In addition to prescribing inputs (resources), good welfare standards now also look at outputs such as how the animal is behaving and its physical condition. It is helpful to consider both inputs/resources (indirect method) and outcomes (direct method) when thinking about animal welfare (OIE, 2010). The term "fit and feeling good" is used to illustrate that animal welfare includes both emotional and physiological components. Physical wellbeing includes health and is affected by injury and disease while emotional wellbeing encompasses minimizing negative mental states such as fear, pain and distress as well as maximizing positive states such as happiness and comfort. Naturalness, which overlaps with the previous two, in the context of working animal welfare, can be described as expression of normal behaviour (Webster *et al.,* 2004).

Indirect methods of evaluating the welfare of animals are based on measuring the adequacy of inputs, such as resources and management provision (Wood *et al*., 1998 and Bartussek, 1999). These methods indicate a risk of welfare problems rather than an actual measure of welfare state (Rousing *et al*., 2001). The advantage of such input-based assessment methods is that they are usually objective and repeatable; however, a positive score does not guarantee good welfare (Winckler and Willen, 2001 and Whay *et al*., 2003).

The use of direct animal-based measurements to assess the welfare of farm and laboratory animals has increased in recent years. Scoring systems have been developed to assess lameness in dairy cattle (Whay, 2002), skin lesions in pigs (Leeb *et al.,* 2001) and lameness in broiler chickens (Kestin *et al*., 1992). Direct observations provide the measure of welfare status that is most relevant to the animal itself. Although animal-based observations are often assessed subjectively, they provide a more direct and valid assessment of welfare than resource measurements. Repeatability (precision) of the observations is an important consideration and subjective health and behaviour assessments can be very repeatable.

Animal health is only one part of animal welfare, albeit an important one. When an animal's health is poor, so is its welfare, but poor welfare does not always imply poor health. Whereas animal health is an animal's state as regards its attempts to cope with pathology, animal welfare includes feelings and other brain mechanisms, behavioural and physiological responses and the functioning of the immune system (OIE, 2008). One important aspect of animal welfare is the degree to which animals are capable of fulfilling their behavioural needs. So a wide range of measures are required to assess welfare. Some measures of poor welfare are also indicators of poor health, such as body damage and symptoms of infectious disease. But other measures of poor welfare, while not being signs of poor health at that time, indicate a risk of poor health in the future. Examples of these include immunosuppression and the occurrence of injurious abnormal behaviours, such as bar biting in pigs or feather plucking in parrots (OIE, 2010).

Some of previous studies of equine welfare have used the direct method (Pritchard *et al*., 2005 and Burn *et al*., 2010) or a combination of direct and indirect indicators (Tadich *et al*., 2008 and Ireland *et al*., 2011). Most studies include body condition, sometimes with other animal based measures, plus indirect measures in the form of resource examination and/or an owner questionnaire (Christie *et al*., 2003 and Zanella *et al*., 2003). Animal-based measurements are particularly appropriate to situations where resource examination is not practical, as in the case of working equines. Housing, feed provision and other inputs cannot be measured during the working day; this would require a home visit for each animal.

Consideration of both health and behaviour is important when assessing welfare. Behaviour is the expression of an animal's perception and interaction with its environment. In horses, direct observations of behaviour have been used to assess recovery from intestinal surgery (Durham *et al*., 2003) and arthroscopic surgery (Price *et al.,* 2003). Behavioural observations used in farm animals include social behaviour, comfort behaviour, such as rising behaviour in dairy cattle, and standardized fear tests to measure the human-animal relationship (Sørensen *et al*., 2001).

Physical observations of particular relevance to equines include body condition score (Henneke *et al*., 1983 and Caroll and Huntingdon, 1988), hoof horn quality (Zenker *et al*., 1995) and skin turgor as an indicator of hydration status (Freeman *et al*., 1999). Dehydration and hyperthermia are also major welfare threats to working equines in developing countries,

where work continues in extreme temperatures (Pritchard *et al.,* 2006). Many owners lack the resources or knowledge to improve conditions for heat-stressed equines, and reliance on external sources such as veterinary advice can delay treatment, or result in their abandonment (Biffa and Woldemeskel, 2006 and Pritchard *et al.,* 2006).

According to Swann (2006), in India, brick making relies on animal power; pack donkeys carry bricks from the clay pit to the kilns, in ambient temperatures that may exceed 40ºC. The work is seasonal. Observation of working pack donkeys at the start of the season shows the typical apathetic working animal. At the end of the working day, donkeys are released from work to forage. On release, donkeys are seen to gather together, nuzzle and interact. Rolling is observed at this time. Following social interaction, the animals will seek out water and drink as a communal group. This repeatable observation suggests that socialization is the first priority for fatigued and dehydrated animals, followed by drinking. Animals will not usually drink alone, suggesting that drinking is also a social activity, even in dehydrated animals. Following further social interaction, animals begin to forage over nearby land and the appearance of depression and apathy gradually disappears. Swann (2006) stated that as the season progresses over 5–6 months, some animals become permanently apathetic, failing to socialize. They lose body weight and are likely to exhibit extensive skin lesions at pack contact points. Some of thesdde animals will die. This is supported by Biffa and Woldemeskel (2006) in their analysis of the multifactorial causes of external injuries.

Pritchard *et al.* (2005) showed many of the working equines assessed were non-responsive to external events in their environment, including human approach and interaction. Such animals were described as ‘apathetic’. Correlation with physical issues showed that apathy is associated with dehydration and chronic pain. There was also a suggested correlation with skin wounds, traditionally attributed to the direct effects of ill-fitting harness. The results indicated that there is an underlying state of poor welfare, caused by chronic pain and dehydration. A critical anthropomorphic judgment (Morton *et al*., 1990) concluded that many working equine animals suffer from chronic fatigue and depression as a result of poor welfare.

Fear was a highly significant aspect of poor welfare identified by the behavioural assessment (Swann, 2006). The relationship between reduced productivity and beating was clearly

illustrated by research carried out in an Egyptian brick kiln complex by O'Neill and Pearson (2003).

2.4. Causes of Poor Conditions in Working Equines

In the developing world, threats to the welfare and productivity of working equines are substantial, and the economic effects of health problems to these equines can be catastrophic to individual families (Kay, 2007). Drought, extreme temperature, poverty, ignorance, disease, increasing motorization and increasing environmental pollution are risk factors that cause significant morbidity of working equines. Studies from various countries including Mexico, Sudan and Ethiopia have shown that poor husbandry leading to harness sores, wounds, foot problems and heavy worm burdens is the significant cause of compromised welfare (El Dirdiri *et al.*, 1986; Rodriguez-Maldonado, 1991 and Yilma *et al.,* 1991).

In Ethiopia, Biffa and Woldemeskel (2006) studied the contributing causes of external injuries in working horses and donkeys, agreeing with Swann (2006) that multifactorial insults to equine welfare resulted in skin wounds. A combination of exhaustion, dehydration, poor body condition and underlying infections, exacerbated by lack of rest, are significant causes of external injuries (Biffa and Woldemeskel, 2006). Parasitic infections, for example, can chronically decrease host defences and allow injuries to manifest more severely (Pearson and Krecek, 2006). Swann (2006) also analyzed how associations between deteriorating welfare and skin pathology could occur, noting that upon loss of supportive adipose tissue and skin integrity, constant chronic pain leads to habituation of the equines to discomfort and a decrease in responsiveness to further lesion development.

It is difficult to generalize about the causes of poor condition in working equines. Prentis (1994) stated that lack of money, lack of information and lack of motivation are the main underlying causes. Fielding (1991) cited poverty and lack of awareness are more immediate priorities as reasons as to why poor husbandry or abusive practices may be taking place.

3. MATERIALS AND METHODS

3.1. Study Area Description

The study was conducted in and around Hosanna, capital town of Hadiya zone, Southern Nations Nationalities and People's Regional State (SNNPRS), Ethiopia. Hosanna is located at 7.58(7° 34' 60 N) Latitude and 37.88 (37° 52' 60E) Longitude, 232 Km away from Addis Ababa, in the south direction (Fig.2). The study included Hosanna town and surrounding 9 rural PAs (kebelles) from Lemmo wereda of Hadiya zone (Annex-3). The area has an altitude of 2100–2340masl and exhibit a bimodal rainfall system (long and short rainy seasons). The long rainy season extends from June to September, whereas the short rainy season ranges from March to April. The annual rainfall is 950–1200mm while the maximum and minimum annual temperature is 23^{o}C and 13^{o}C respectively (LWADO, 2011).

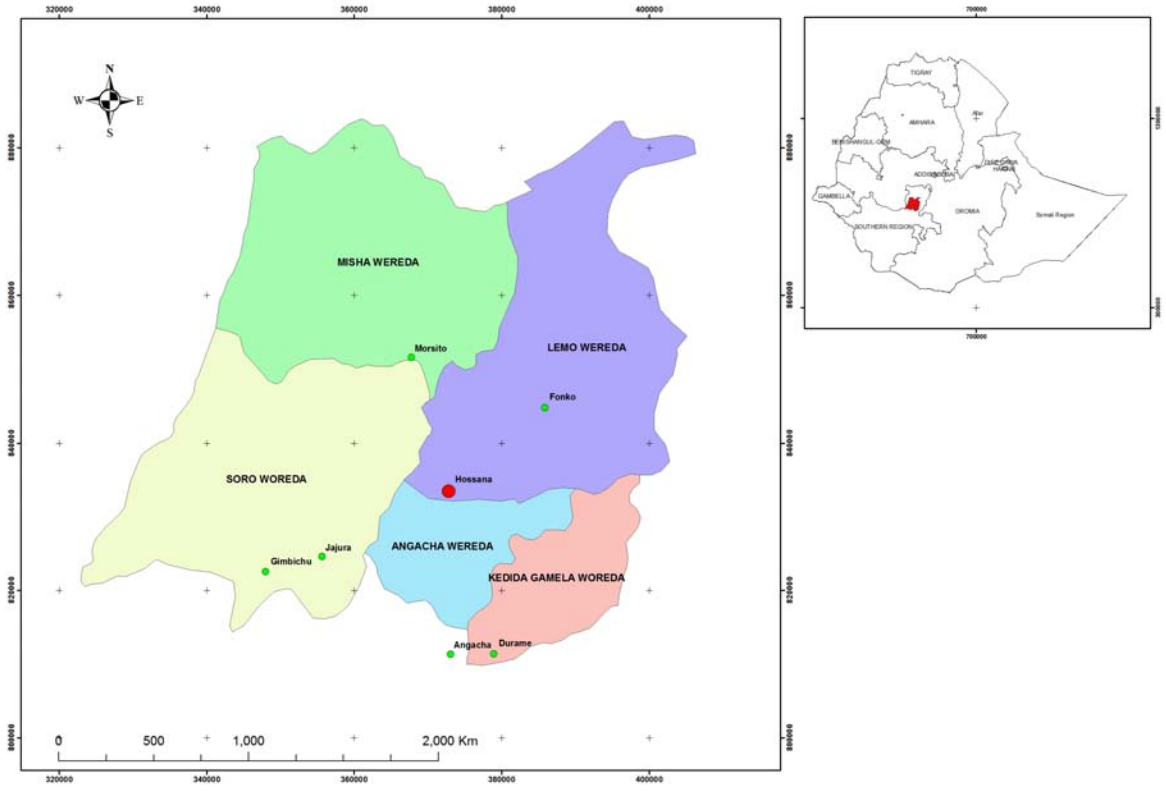

Fig.2 Map of the study area. Source: (LWADO, 2011).

The area is home for different types of livestock. The number of cattle population was the highest followed by the number of chicken (Table-1). The farming system of the area was

characterized by smallholder mixed agriculture dominated by crop. Enset, also known as "false banana" is a common traditional staple crop in the area. The major cereal crops grown include wheat, maize, barely, sorghum, bean and pea while livestock production was an integral part of crop production. The agricultural products are usually transported to the local markets mainly by working equines.

3.2. Study Population

The study was undertaken on working equines of the area. All equines were included in the study irrespective of their age, sex, body condition and work types. Significant numbers of their owners were also included for interview of the socio-economic assessment.

3.3. Study Design

A cross-sectional study was carried out to investigate the welfare status of working equines through direct observation of the animals and a questionnaire survey was conducted to assess the socio-economic importance.

3.4. Sampling Strategy and Sample Size Determination

The working equine population of the study area was stratified by species as horses, mules and donkeys. The sample size was set to be at least 10-15% of the total population number (Pritchard *et al.,* 2005 and Thrusfield, 1995) for each species. From horse and mule populations, 15% was sampled from each. But from donkey population, 10% was sampled due to their large numbers (Table-1). Observations were carried out on every 10^{th} animal in case of donkeys and on every 7^{th} animal in case of horses and mules; which were selected by using systematic random sampling technique. Sampling was carried out on streets, at field, markets, carriage/cart stands and homesteads.

Table-1 The livestock population of the study area and number of equines sampled

Type of livestock	Cattle	Sheep	Goat	Donkey	Horse	Mule	Chicken	Beehives
Total number	33120	8512	5699	3652	1022	616	19498	1418
% sampled	-	-	-	10%	15%	15%	-	-
Number sampled	-	-	-	365	153	92	-	-

Source: LWADO, 2011

Based on the types of work, animals were categorized as draught, pack, ridden and others. "Draught" animals are those used for transport of goods and people by carts. "Pack" animals are those used for transport of goods by pack. "Ridden" animals are those used by owners for ridding, whereas "others" category includes foals and non-functional animals. Age of the animals was recorded based on the observation of the animal's front teeth (incisors) according to Martin *et al.* (1999) (Annex-5) and from information given by the owners.

3.5. Data Collection

Using information obtained from published literatures (Pritchard *et al*., 2005; Tadich *et al*., 2008; Burn *et al*., 2010 and Ireland *et al*., 2011), a list of health and behaviour parameters (animal-based welfare indicators) was devised. The health and welfare assessment protocol included the date, observer, species and work type followed by observations of general health parameters, behaviour, body condition, skin lesions and a space for additional observations (Annex-4). Observations were recorded either as present/absent and/or as scores of severity. The draft welfare assessment check list and the questionnaire format were first field tested.

Training was given for one assessor and two handlers before data collection as how to handle, observe and collect data. Then the trained assessor and handlers together with the researcher observed each randomly selected animal. The assessor and the researcher were supplied with detailed guidance notes and photographs. The researcher carried out the assessment and the data were recorded by the assessor. These roles were alternated between the assessor and the researcher. Animals were held by head collar and lead rope before assessment began. Assessment of each animal took not more than ten minutes and without causing major interruption of equine routine work.

3.5.1. Body Condition Scoring

The scoring of body condition of selected animals was recorded based on the criteria described by Carroll and Huntington (1988) for horses and mules and scored as 0, 1, 2, 3, 4 and 5 for very thin, thin, fair, good, fat and very fat, respectively (Annex-6). For donkeys the BCS was recorded based on the standard developed by the Donkey Sanctuary (Annex-7). In this study, BCS was categorized as 'thin' (BCS of 0 or 1), 'fair' (BCS of 2), 'good' (BCS of 3) and fat (BCS of 4 or 5).

3.5.2. Assessment of Behavioral Parameters

A range of indicators were selected to be representative of behavior and health status. Measures of behavior in relation to human approach and handling were considered. The reaction of horses, mules and donkeys to human approach, proximity, and touch were assessed. A behavioral assessment test was done based on Pritchard *et al.* (2005) (Annex-8) and measured the responses to:

1) General attitude (alert or apathetic/depressed)
2) Response to the observer approaching the animal (no response, friendly approach or avoidance/aggression)
3) Walk down side (no response or responds)
4) Tail tuck test (donkeys only) (clamping down tail and/or tucking in hindquarters or no response)
5) Chin contact test (avoiding contact, withdrawing head or no response)

3.5.3. Investigation of General Health Parameters

Following general descriptions, different parameters such as body condition score, mucous membrane colour, hydration status (by skin tent test) according to Pritchard *et al.* (2006) (Annex-9), skin lesions, diarrhoea, hoof and coat conditions were assessed and lesions recorded. Oral examination was undertaken manually without a gag. Mucous membrane of the mouth was assessed based on the colour of upper gum. Pale, yellow, white, or purple colours were considered as abnormal, whereas pinkish was taken as normal. Ocular examination was also undertaken visually without access to shade and without the use of eye drops, fluorescein or ophthalmoscope.

The presence or absence of ecto-parasites was also assessed. The observed animals were considered positive for ecto-parasites when it was found to harbour at least one external parasite of any species (tick, lice, flea or nits). Lameness was assessed at walk for approximately 20 steps and was scored on a scale of 0 (sound) to 5 (non-weight bearing) according to the AAEP lameness grading system (Lynn *et al*., 2004) (Annex-10). Each limb was palpated at rest and lesions were recorded.

3.5.4. Skin Lesions and Injuries

Body lesions were recorded with regard to severity and anatomical location. Only lesions that cover a qualifying area were considered as lesion and recorded. A lesion with qualifying area is lesion larger on all sides than a 2x2cm square or 1x4cm rectangle or 2.3cm diameter circle (Dennison *et al.,* 2005). The lesions were scored according to Mejdell *et al.* (2010) (in 5 category; 0 no visible lesion and 5 extensive severe injury) (Annex-11). In this study, the lesions were categorized into three as mild (LS 1 or 2), moderate (LS 3) and severe (LS 4 or 5).

3.5.5. Socioeconomic Assessment

From the 9 rural PAs around Hosanna town, 5 PAs were selected by simple random sampling technique for the questionnaire survey. Due to the small number of equines in Hosanna town compared to the rural kebelles, the whole town was selected and considered as one kebelle. From each selected kebelles including Hosanna town, 12 equine owning households were also selected by simple random sampling technique making a total of 72 households. A semi-structured questionnaire was administered to the 72 equine owning households to collect relevant information about the socio-economic importance of equines. The questionnaire, after having been pretested, administered face to face in local language.

The questionnaire included a combination of open and closed ended questions (Annex-12) on owner demographics, livestock holdings, equine ownership and management, reasons for keeping them, income from equine services and use, fate of injured equines and constraints of keeping equines. The gross annual income generated from equine uses and services including equine sale, cart, gharry and renting were calculated in annual bases. The selected equine owners were asked about their annual income from these equine uses and services. The total income generated from each service/use was calculated with respect to the species of equine. This study did not include the monetary estimate of homestead and own uses of equines.

3.6. Statistical Analysis

The data from the equines examined and the owners interviewed were entered into Microsoft Office Excel 2003 for Windows and then transferred to statistical software SPSS v.16 for analysis. Descriptive statistics were used to commute mean, SDV and proportions. The

relationship between different sets of categorical data were examined using the Pearson Chi-squared or Fischer exact tests.

Groups of observations belonging to similar categories were aggregated for further analysis. Lack of responsiveness to environment/handling was examined by aggregating scores for apathy/depression, lack of response to observer approach and to the observer walking down the animal's side. A measure of 'limb problems' was derived from aggregated scores for firing lesions, tether/hobble lesions, swelling of tendons/joints, limb deformities and abnormal hoof wall. Spearman rank correlation was then used to relate the measurements.

For the socio-economic part, descriptive statistics were used to analyze proportions and one-way ANOVA, F-statistics was used to analyze the mean annual household income generated from equines. In all cases, $P < 0.05$ was considered to be statistically significant.

4. RESULTS

A total of 610 equines involving 365 donkeys, 153 horses and 92 mules were thoroughly observed for their welfare parameters including behavior and general health. There were more male donkeys, mules and horses than females or geldings, across all work types except in case of pack donkeys where number of females is greater than number of males. Only 13(2.9%) of male animals were gelded. Equines in the under five years of age category were 17.9%, while 65.9% were between 5 and 15 years and 16.2% were over 15 years of age. Across all species, the majority of animals observed were in the 5–15 years age group. Among the work types, draught work is the work type involving the largest number of animals (70%) followed by pack (21.9%). The ridden and 'other' (which include foals and non functional animals) work types were only 4.5% and 3.4% respectively (Table-2).

Table-2 The work types, sex and age groups of the observed equines

	Work types				
Equine categories	Draught	Pack	Ridden	Other	Total (%)
Species					
Donkey	276	77	-	12	365(59.8)
Horse	114	17	13	9	153(25.1)
Mule	37	40	15	-	92(15.1)
Sex					
Male	357	67	8	15	447(73.3)
Female	70	67	20	6	163(26.7)
Age (years)					
< 5	65	27	6	11	109(17.8)
5-15	294	85	18	5	402(65.9)
> 15	68	22	4	5	99(16.2)

4.1. Results of Body Condition Score

The observation of body condition showed that about 34.8% of the donkeys, 32.6% of mules and 27.5% of the horses had a thin body condition (BCS of 0 or 1) and 59.5%, 66.3% and 69.9% of donkeys, mules and horses, respectively had a body condition score of 2 (fair) (χ^2 = 8.73, P > 0.05). Across all species, 32.6% of animals were thin, having a body condition score of 1 or 0 and 63.1% of the equines had a body condition score of 2 (fair) whereas only

4.3% had good body condition (BCS of 3) (Fig.3). None of the equines were fat (BCS of 4 or 5). No statistically significant difference was observed ($P > 0.05$) among species in body condition score.

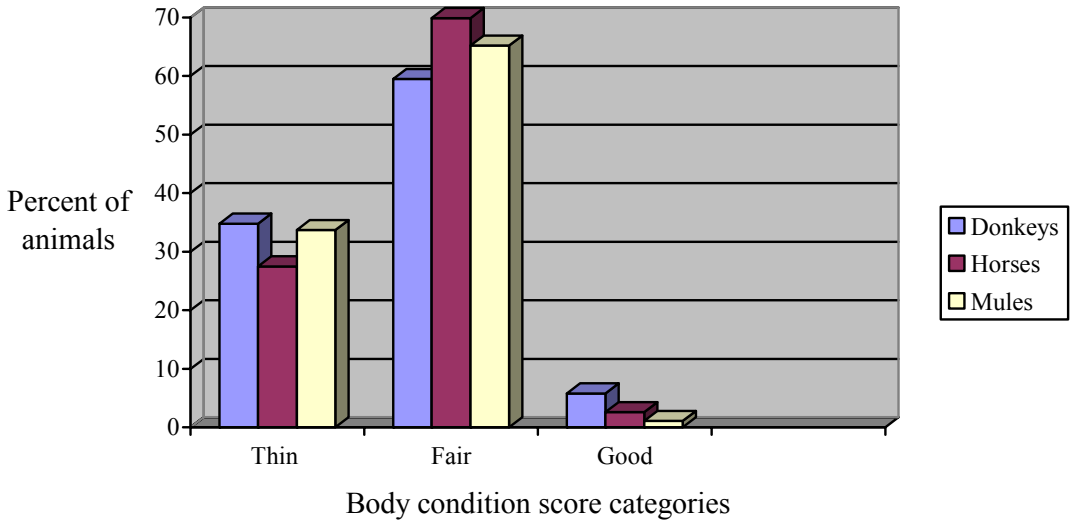

Fig.3 The body condition categories of the observed equines.

4.2. Results of Behavioral Assessment

The different behavioral conditions shown by donkeys, horses and mules examined during the study period are shown in Table-3. Relatively large proportions of donkeys (21.6%) were apathetic compared to horses (19.6%) and mules (17.4%) with no statistically significant variation ($\chi^2 = 0.83$, $P > 0.05$) in general attitude among the three species of equines. To an observer approaching the animal's head, 69% of donkeys showed no response, 23.6% responded with avoidance (turning head away or moving away from the observer) or aggressive behavior and 7.4% of showed a friendly approach (turning head towards the observer). Nearly twenty three percent of the horses showed friendly approach, 56.9% showed no response and 20.3% showed avoidance or aggression to the observer approach. This implied horses significantly showed higher proportions of friendly approach and a lower proportion of avoidance or aggression than donkeys and mules ($\chi^2 = 29.52$, $P < 0.05$). Mules showed the lowest proportion of friendly approach (4.3%) and the highest proportion of avoidance/aggression (38%).

To the observer walking down their side, significantly higher proportions of mules (91.3%) responded than horses (86.3%) or donkeys (81.1%) (χ^2 = 6.50, P < 0.05). To the observer walking down their side and back again, 20% of donkeys responded by clamping down their tail and/or tucking in the hindquarters. The proportion of mules avoiding chin contact by the observer's cupped hand was significantly higher than that of donkeys or horses (χ^2 = 98.42, P < 0.05).

Table-3 Behavioural parameters of the observed equines

	No. showing the condition (% within each spp)				
Observations of behavior	Donkey (n=365)	Mule (n=92)	Horse (n=153)	χ^2	P-value
General attitude					
Alert	286(78.4)	76(82.6)	123(80.4)	0.830	0.660
Apathetic/depressed	79(21.6)	16(17.4)	30(19.6)		
Response to observer approach					
No response	252(69)	53(57.6)	87(56.9)		
Friendly approach	27(7.4)	4(4.3)	35(22.9)	29.51	0.000
Avoidance/aggression	86(23.6)	35(38)	31(20.3)		
Walk down side					
No response	69(18.9)	8(8.7)	21(13.7)	6.508	0.039
Responds	296(81.1)	84(91.3)	132(86.3)		
Tail tuck (donkeys only)	72(19.7)	-	-	n/a	n/a
Avoiding chin contact	31(8.5)	44(47.8)	35(22.9)	98.42	0.000

n/a: not applicable.

The association of behavioural parameters and body condition categories with work types is shown in Table-4. General attitude showed statistically significant variation (P < 0.05) among the work types. The pack animals were more alert compared to either the draught or ridden animals. Statistically significant variation (P < 0.05) was also observed to the observer approach test where the draught equines showed the lowest proportion of friendly approach. Most equines responded to the walk down side test and no statistically significant variation (P > 0.05) was observed by this test. Significantly high proportion of ridden equines (P < 0.05) avoided chin contact compared to the rest work types.

Table-4 Behavior and body condition categories of all equines by work types

Observation	No. showing the condition (% within each work type) Draught (n=427)	Pack (n=134)	Ridden (n=28)	Other (n=21)	χ^2	P-value
General attitude						
Alert	322(75.4)	121(90.3)	25(89.3)	17(80.9)	16.2	0.000
Apathetic/depressed	105(24.6)	13(9.7)	3(10.7)	4(19.1)		
Response to observer approach						
No response	296(69.3)	82(61.2)	8(28.6)	6(28.6)	37.47	0.000
Friendly approach	36(8.4)	18(13.4)	6(21.4)	6(28.6)		
Avoidance/aggression	95(22.2)	34(25.4)	14(50)	9(42.9)		
Walk down side						
No response	66(15.5)	25(18.7)	3(10.7)	4(19)	1.5	0.67
Responds	361(84.5)	109(81.3)	25(89.3)	17(81)		
Avoiding chin contact	60(14.1)	33(24.6)	12(42.9)	5(23.8)	27.16	0.000
Body condition category						
0-1(thin)	138(32.3)	52(38.8)	5(17.9)	4(19)	9.69	0.138
2(fair)	272(63.7)	78(58.2)	20(71.4)	15(71.4)		
3(good)	17(4)	4(3)	3(10.7)	2(9.5)		

The detail of association of behavioral welfare indicators and BCS with work types is presented for each species according to their work types. Table-5 illustrates the behavioural conditions in donkeys in relation to the work types. Pack donkeys were most likely to be alert ($\chi^2 = 8.26$, $P < 0.05$) in general attitude, more friendly ($\chi^2 = 30.6$, $P < 0.05$) in response to observer approach and avoid chin contact ($\chi^2 = 9.25$, $P < 0.05$) compared to draught donkeys. Small proportion of pack donkeys tucked in their tails than the draught donkeys but no statistically significant variation was observed ($P > 0.05$) in tail tucking among the work types. Considering the BCS, no statistically significant difference ($P > 0.05$) was observed among the work types though 41.6% of pack donkeys had BCS of 0 or 1 compared to 33.3% of draught donkeys.

Table-5 Behavioral parameters and body condition by work types in donkeys

Observation	No. showing the condition (% within each work type) Draught (n=276)	Pack (n=77)	Other (n=12)	χ^2	P-value
General attitude					
Alert	208(75.4)	69(89.6)	9(75)	8.268	0.016
Apathetic/depressed	68(24.6)	8(10.4)	3(25)		
Response to observer approach					
No response	196(71)	52(67.5)	4(33.3)		
Friendly approach	16(5.8)	9(11.7)	2(16.7)	31.54	0.000
Avoidance/aggression	64(23.2)	16(20.8)	6(50)		
Walk down side					
No response	46(16.7)	20(26)	3(25)	3.51	0.173
Responds	230(83.3)	57(74)	9(75)		
Tail tuck	59(21.4)	11(14.3)	2(16.7)	2.09	0.351
Avoiding chin contact	16(5.8)	13(16.9)	2(16.7)	9.25	0.01
Body condition category					
0-1(thin)	92(33.3)	32(41.6)	3(25)		
2 (fair)	167(60.5)	42(54.5)	8(66.7)	2.68	0.616
3 (good)	17(6.2)	3(3.9)	1(8.3)		

The horses observed were also in different BCS categories and showed diverse behavioral conditions. These conditions are summarized in relation to the work types in Table-6. High proportions of pack horses were in thin condition compared to draught and ridden equines. Conversely, more ridden horses were in good body condition showing statistically significant variation ($P < 0.05$). No statistically significant variation ($P > 0.05$) was observed in general attitude, chin contact and walk down side tests. Significant variation was observed to observer approach in which high proportion of the pack horses showed friendly approach relative to draught and ridden horses whereas most of the ridden horses showed avoidance ($\chi^2 = 14.36$, $P < 0.05$).

Table-6 The behavioral parameters and body condition by work types in horses

Observation	No. showing the condition (% within each work type) Draught (n=114)	Pack (n=17)	Ridden (n=13)	Other (n=9)	χ^2	P-value
General attitude						
Alert	88(77.2)	15(88.2)	12(92.3)	8(88.9)	2.907	0.407
Apathetic/depressed	26(22.8)	2(11.8)	1(7.7)	1(11.1)		
Response to observer approach						
No response	73(64)	8(47.1)	4(30.7)	2(22.2)		
Friendly approach	19(16.7)	7(41.2)	5(38.5)	4(44.4)	14.36	0.026
Avoidance/aggression	22(19.3)	2(11.7)	4(30.8)	3(33.3)		
Walk down side						
No response	15(13.2)	3(17.6)	2(15.4)	1(11.1)	0.321	0.956
Responds	99(78.1)	14(82.4)	11(84.6)	8(88.9)		
Avoiding chin contact	25(21.9)	3(17.6)	4(30.7)	3(33.3)	1.276	0.735
Body condition category						
0-1(thin)	34(29.8)	6(35.3)	1(7.7)	1(11.1)		
2(fair)	80(68.4)	10(70.6)	10(76.9)	7(77.8)	16.74	0.010
3(good)	0	1(5.9)	2(15.4)	1(11.1)		

The observation on the general attitude of the mules showed a statistically significant variation ($P < 0.05$) among the work types. The pack and ridden mules were alert compared to those engaged in draught work. Similar to the horses, pack mules were likely to show friendly approach than draught and ridden mules though they also showed high avoidance/aggression next to the ridden mules. No statistically significant variation ($P > 0.05$) in the body condition was observed among the different work types (Table-7).

Table-7 Behavioural parameters and body condition by work types in mules

Observation	No. showing the condition (% within each work type)			χ^2	P-value
	Draught (n=37)	Pack (n=40)	Ridden (n=15)		
General attitude					
Alert	26(70.3)	37(92.5)	13(86.7)	6.891	0.032
Apathetic/depressed	11(29.7)	3(7.5)	2(13.3)		
Response to observer approach					
No response	27(72.9)	22(55)	4(26.7)		
Friendly approach	1(2.7)	2(5)	1(6.7)	6.841	0.145
Avoidance/aggression	9(24.3)	16(40)	10(66.7)		
Walk down side					
No response	5(13.5)	2(5)	1(6.7)	1.825	0.401
Responds	32(86.5)	38(95)	14(93.3)		
Avoiding chin contact	19(51.4)	17(42.5)	8(53.3)	0.605	0.739
Body condition category					
0-1(thin)	12(32.4)	14(35)	4(26.7)		
2(fair)	25(67.6)	26(65)	10(66.7)	3.913	0.418
3(good)	0	0	1(6.7)		

4.3. Results of General Health and Skin Lesions

4.3.1. Results of General Health

The observation of general health showed that 5.2%, 14.9% and 19.8% animals had abnormal mucous membranes, diarrhea under tail and ecto-parasites, respectively with no statistically significant variation ($P > 0.05$) in each case among the species. Large proportion of the equines (79.6%) had eye lesions and 6.1% had missing teeth or poor coat without statistically significant difference ($P > 0.05$) among species in each case. Nearly fourteen percent of donkeys, 16.3% of mules and 23.5% of horses showed an increased skin tent duration ($\chi^2 = 7.08$, $P < 0.05$) showing a high body water conserving ability of donkeys compared to horses and mules. Gait abnormalities were highly prevalent across all species, with 91.5% of working donkeys, 90.2% of mules and 86.9% of horses showing mild to severe lameness without statistically significant variation ($P > 0.05$). Hoof problems, limb deformities and

swelling of tendons/joints were present in 91.5%, 87.8% and 76.9% of all animals observed respectively (Table-8), the latter two showing a significant variation ($P < 0.05$) among equine species.

Table-8 General health parameters of the observed equines

General health parameters	No. with lesion (% within each spp)			χ^2	P-value
	Donkey (n=365)	Mule (n=92)	Horse (n=153)		
Mucous membrane abnormal	18(4.9)	3(3.3)	11(7.2)	1.965	0.374
Teeth missing	15(4.1)	3(3.3)	3(2)	0.569	0.752
Eyes lesions	321(87.9)	61(66.3)	104(67.9)	4.50	0.126
Coat staring/matted/uneven	11(3)	2(2.2)	3(2)	0.573	0.751
Ecto-parasites	79(21.6)	14(15.2)	28(18.3)	1.807	0.405
Diarrhea under tail	44(12.1)	18(19.6)	29(19)	4.930	0.085
Skin tent(loss of elasticity)	50(13.7)	15(16.3)	36(23.5)	7.084	0.029
Swelling of tendons/joints	273(74.8)	64(69.6)	132(86.3)	12.00	0.002
Limb deformity	328(89.8)	72(78.3)	136(88.9)	9.979	0.007
Hoof wall(s) abnormal	338(92.6)	81(88)	139(90.8)	2.061	0.357
Gait abnormal	334(91.5)	83(90.2)	133(86.9)	2.54	0.280

4.3.2. Skin Lesions and Injuries

The overall prevalence of skin lesions was 63% among all equines examined (Table-9). No statistically significant variation was observed among species ($P > 0.05$) though higher prevalence was recorded in donkeys (66.3%) than in horses (56.9%) and mules (59.8%). The occurrence of the lesions showed statistically significant variation ($\chi^2 = 41.68$, $P < 0.05$) among the age categories, being very high in the age group of 5-15 years. Further; analysis of the data revealed that the occurrence of skin lesions had statistically significant variations among the work types and body condition score categories ($P < 0.05$).

Table-9 The prevalence of skin lesions in different categories of equines

Equine category	No. examined	No. with lesion (prevalence)	χ^2	P-value
Species				
Donkey	365	242 (66.3)		
Horse	153	87 (56.9)	4.58	0.101
Mule	92	55 (59.8)		
Total	610	384(63)		
Work type				
Draught	427	282(66)	21.12	0.000
Pack	134	86(64.2)		
Ridden	28	9(32.1)		
Other	21	7(33.3)		
Age categories				
<5 years	109	41(37.6)	41.68	0.000
5-15 years	402	285(70.9)		
>15 years	99	58(58.6)		
Sex				
Male	447	289(64.2)	2.079	0.149
Female	163	95(55.2)		
BCS category				
0 or 1 (thin)	202	173(85.6)	67.05	0.000
2 (fair)	382	199(52.1)		
3 (good)	26	12(46.2)		

Injuries and different lesions were unevenly distributed on body parts. Skin lesions were most prevalent on the tail/tail base, withers, hind legs, forelegs and girth regions of all species. Significantly high proportion of donkeys had lesions on their hindquarters ($\chi^2 = 12.14$, $P < 0.05$), tail/tail base ($\chi^2 = 9.13$, $P < 0.05$), breast/shoulder ($\chi^2 = 10.69$, $P < 0.05$) and spine ($\chi^2 = 6.10$, $P < 0.05$) areas of the body compared with mules and horses. As it is shown Table-10, in all species, the proportion with injured tail/tail base was higher than those of other injured body parts.

Table-10 Skin lesions on various body in each species

Skin lesion	No. with lesion (% within each spp)				
	Donkey (n=365)	Mule (n=92)	Horse (n=153)	χ^2	P-value
Head/ears/neck	51(13.9)	9(9.8)	15(9.8)	2.372	0.306
Breast/shoulder	51(13.9)	2(2.2)	15(9.8)	10.69	0.005
Withers	159(43.6)	41(44.6)	54(35.3)	3.42	0.181
Spine	33(14.5)	4(4.3)	21(13.7)	6.103	0.047
Girth	77(21.1)	26(28.3)	34(22.2)	2.173	0.337
Belly/ribs/flank/	35(9.5)	5(5.4)	14(9.2)	1.594	0.451
Hindquarters	56(15.3)	6(6.5)	9(5.9)	12.14	0.002
Tail/tail base	226(61.9)	48(52.2)	79(51.6)	9.13	0.01
Forelegs	114(31.2)	27(29.3)	46(30.1)	0.156	0.925
Hindlegs	132(36.2)	36(39.1)	43(28.1)	4.082	0.130
Lip lesions	145(39.7)	48(52.2)	68(44.4)	2.56	0.277
Tether/hobble lesions or scars	200(54.8)	54(57.6)	87(56.8)	0.324	0.851
Firing lesions or scars	25(6.8)	3(3.3)	9(5.8)	1.921	0.383

4.3.3. Health Parameters and Skin Lesions in Relation to Work Types

Across all species, the work types of the equines significantly influenced the occurrence and distribution of skin lesions and injuries. The draught equines had higher prevalence of lesions at commissures of lips ($\chi^2 = 92.07$, $P < 0.05$), on forelegs ($\chi^2 = 8.53$, $P < 0.05$), girth ($\chi^2 = 18.57$, $P < 0.05$) and breast/shoulder ($\chi^2 = 19.3$, $P < 0.05$) regions. Furthermore, draught equines had the highest prevalence of swollen tendons/joints and deformed limbs ($P < 0.05$). On the other hand, the pack equines showed significantly higher prevalence of lesions on wither ($\chi^2 = 26.35$, $P < 0.05$) and tail/tail base ($\chi^2 = 47.92$, $P < 0.05$) body parts. In addition, lesions at spine, the hindquarters and hind legs were most likely to be associated with the pack work ($P < 0.05$). Table-11 shows the occurrence of health parameters and skin lesions according to the work types in donkeys.

Table-11 Health parameters and skin lesions by work types in donkeys

Lesions observed	No. with lesion (% within each work type)			χ^2	P-value
	Draught (n=276)	Pack (n=77)	Other (n=12)		
General health					
Mucous membrane abnormal	16(5.8)	2(2.6)	0	1.95	0.376
Teeth missing	11(3.9)	2(2.5)	2(16.7)	6.25	0.044
Eyes abnormal	263(95.2)	48(62.3)	10(83.3)	198.1	0.000
Coat staring/matted/uneven	4(1.4)	6(7.8)	1(8.3)	7.86	0.020
Ecto-parasites	57(20.6)	19(24.6)	3(25)	2.044	0.360
Diarrhea under tail	37(13.4)	5(6.4)	2(16.7)	6.70	0.035
Skin tent(loss of elasticity)	44(15.9)	5(6.5)	1(41.7)	5.26	0.072
Swelling of tendons/joints	214(77.5)	55(71.4)	4(33.4)	7.46	0.024
Limb deformity	255(92.4)	67(87)	6(50)	10.79	0.005
Hoof wall(s) abnormal	258(93.5)	74(96.1)	6(50)	17.50	0.000
Gait abnormal	257(93.1)	73(94.8)	4(33.4)	26.80	0.000
Skin lesions					
Lip lesions	137(49.6)	8(10.4)	0	56.50	0.000
Head/ears/neck	47(17)	4(5.2)	0	9.03	0.01
Breast/shoulder	49(17.8)	2(2.5)		15.52	0.001
Withers	110(39.9)	47(61)	2(16.7)	14.64	0.001
Spine	18(6.5)	14(18.2)	1(8.3)	9.96	0.007
Girth	74(26.8)	3(3.9)	0	29.84	0.000
Belly/ribs/flank	29(10.5)	6(7.8)	0	2.985	0.225
Hindquarters	41(14.9)	15(19.5)	0	4.998	0.082
Tail/tail base	158(57.2)	67(87)	1(8.3)	7.00	0.030
Forelegs	97(35.1)	16(17.4)	1(7.6)	9.831	0.007
Hindlegs	96(34.8)	34(44.2)	2(15.4)	4.536	0.104
Tether/hobble lesions or scars	157(56.9)	38(49.4)	5(41.7)	2.05	0.359
Firing lesions or scars	16(5.7)	8(10.3)	1(8.3)	3.48	0.175

Like donkeys, draught horses had a relatively high prevalence of lesions on commisures of lips, forelegs, head/neck, breast/shoulder and girth areas. In addition, Eye lesions, lesions at lips and limb deformity were mostly observed in draught horses. These health parameters showed a statistically significant variation ($P < 0.05$) among the work types (Table-12). On

the other hand, lesions on the tail/tail base, spine and hind quarters were significantly associated ($P < 0.05$) with the pack work.

Table-12 Health parameters and skin lesions by work types in horses

	No. with lesion (% within each work type)					
Lesions observed	Draught (n=114)	Pack (n=17)	Ridden (n=13)	Other (n=9)	χ^2	P-value
General health						
Mucous membrane abnormal	8(7)	1(5.8)	1(7.6)	1(11.1)	0.236	0.972
Teeth missing	2(1.7)	0	0	1(11.1)	3.116	0.374
Eye(s) abnormal	89(78.1)	8(47.1)	4(30.7)	3(33.3)	33.15	0.000
Coat staring/matted/uneven	1(0.9)	2(11.8)	0	0	5.753	0.124
Ecto-parasites	18(15.8)	5(29.4)	3(23.1)	2(22.2)	2.010	0.570
Diarrhea under tail	24(21.1)	3(17.6)	1(7.7)	1(11.1)	2.066	0.559
Skin tent(loss of elasticity)	31(27.2)	3(17.6)	2(15.4)	0	6.527	0.089
Swelling of tendons/joints	102(89.4)	14(82.4)	8(61.5)	8(88.8)	3.880	0.275
Limb deformity	106(92.9)	15(88.2)	9(69.2)	6(66.7)	13.63	0.003
Hoof wall(s) abnormal	107(93.8)	16(94.1)	11(84.6)	5(38.5)	9.877	0.020
Gait abnormal	101(88.5)	15(88.2)	10(76.9)	7(77.8)	1.846	0.605
Skin lesions						
Lesions at lips	58(50.9)	3(17.6)	6(46.2)	1(11.1)	15.085	0.002
Head/ears/neck	15(13.2)	0	0	0	9.372	0.025
Breast/shoulder	11(9.6)	1(5.9)	0	3(33.3)	6.741	0.081
Withers	41(35.9)	9(52.9)	3(25)	1(11.1)	5.904	0.116
Spine	17(14.9)	4(23.5)	0	0	7.804	0.050
Girth	27(23.7)	3(17.6)	2(15.4)	2(22.2)	0.739	0.864
Belly/ribs/flank	10(8.8)	2(11.8)	2(15.4)	0	2.391	0.495
Hindquarters	5(4.4)	1(7.7)	0	3(33.3)	8.349	0.039
Tail/tail base	62(54.4)	12(70.5)	4(30.7)	1(11.1)	11.64	0.009
Forelegs	36(31.5)	4(23.5)	3(23.1)	3(33.3)	8.480	0.838
Hindlegs	31(27.2)	6(35.3)	3(23.1)	3(33.3)	0.750	0.861
Tether/hobble lesions or scar	66(57.8)	8(47.1)	12(92.3)	1(11.1)	31.83	0.000
Firing lesions or scars	5(4.3)	2(11.7)	1(7.6)	1(11.1)	2.483	0.487

Draught mules had significantly higher prevalence of lip and eye lesions. Draught mules also showed significantly higher prevalence of lesions and injuries on girth, belly/flank and head/neck (Table-13). On the other hand, pack mules had a significantly ($P < 0.05$) higher prevalence of abnormal hoof wall(s), lesions of wither, spine, hind quarters and tail/tail base compared to draught and ridden work types.

Table-13 Health parameters and skin lesions by work types in mules

Lesions Observed	No. of animals (% within each work type)			χ^2	P-value
	Draught (n=37)	Pack (n=40)	Ridden (n=15)		
General health					
Mucous membrane abnormal	2(5.4)	1(2.5)	0	1.527	0.466
Teeth missing	2(5.4)	1(2.5)	0	1.527	0.466
Eyes abnormal	31(83.8)	27(67.5)	3(20)	19.48	0.000
Coat staring/matted/uneven	0	2(5)	0	3.390	0.184
Ecto-parasites	7(18.9)	6(15)	1(6.7)	1.411	0.494
Diarrhea under tail	9(24.3)	7(17.5)	2(13.3)	1.021	0.600
Skin tent(loss of elasticity)	7(19)	7(17.5)	1(6.7)	1.482	0.477
Swelling of tendons/joints	29(78.3)	27(67.5)	8(53.3)	3.261	0.196
Limb deformity	31(83.8)	33(82.5	8(53.3)	1.792	0.408
Hoof wall(s) abnormal	34(91.9)	37(92.5)	10(66.7)	6.125	0.047
Gait abnormal	34(91.9)	36(90)	13(86.7)	0.321	0.852
Skin lesions					
Lesions at lips	24(64.9)	17(42.5)	7(46.7)	6.434	0.040
Head/ears/neck	9(24.3)	0	0	14.82	0.001
Breast/shoulder	2(5.4)	0	0	3.71	0.156
Withers	16(43.2)	22(55)	3(20)	5.45	0.065
Spine	0	4(10)	0	6.90	0.032
Girth	15(40.5)	11(27.5)	0	12.54	0.002
Belly/ribs/flank	5(13.5)	0	0	9.540	0.008
Hindquarters	2(5.4)	4(10)	0	11.56	0.003
Tail/tail base	18(48.6)	28(70)	2(13.3)	4.677	0.096
Forelegs	13(35.1)	11(27.5)	3(20)	1.325	0.515
Hindlegs	12(32.4)	20(50)	4(26.7)	3.659	0.160
Tether/hobble lesions	21(56.7)	19(47.5)	14(93.3)	11.13	0.004
Firing lesions or scars	0	2(5)	1(6.7)	3.211	0.201

4.4. Correlations of Aggregated Health and Behavioural Parameters

Table-14 shows correlations between aggregated behavior and health parameters in the working equines observed. Most of the aggregates showed strong correlation signifying the association of some health and behavioral parameters. Correlation coefficients exceeding r = 0.3 included low body condition score with systemic health abnormalities (r = 0.552), limb problems with abnormal gait, low body condition score with lesions of skin (r = 0.331) and lack of responsiveness with dehydration (r = 0.346) and with low body condition score (r = 0.332).

Table-14 Correlations between aggregated behavior and health parameters

Behavior and health parameters	Correlation coefficient	P-value
Lack of responsiveness to environment/handling[a]		
Low body condition score	0.332	0.000
Skin lesions	0.195	0.000
Abnormal gait	0.084	0.038
Systemic health abnormalities[b]	0.3	0.000
Limb problems[c]	0.021	0.611
Dehydration	0.346	0.000
Low body condition score		
Skin lesions	0.331	0.000
Systemic health abnormalities[b]	0.552	0.000
Abnormal gait	0.045	0.264
Limb problems[c]	0.057	0.158
Skin lesions		
Systemic health abnormalities[b]	0.230	0.000
Abnormal gait	0.168	0.000
Limb problems[c]	0.106	0.009
Limb problems[c]		
Abnormal gait	0.550	0.000

[a]: Aggregated score of general attitude + responsiveness to observer approach + responsiveness to observer walking down side.

[b]: Aggregated score of mucous membranes + coat condition + diarrhea + skin tent.

[c]: Aggregated score of firing lesions + tether/hobble lesions + swelling of tendons/joints + deformed limbs + abnormal hoof wall.

4.5. Results of Socio-economic Survey

4.5.1. Demographic Characteristics of Equine Owners

The data were collected by administering questionnaire to 72 households who owned equines. The demographic characteristics of the respondents are summarized in Table-15. The number of female household heads who owned equines was very small (15.3%) as compared to male household heads giving a high sex ratio (11F/61 M). The average age of the household heads was found to be 40.5±9.7 years and the minimum and the maximum age recorded were 25 and 64 years respectively. The average family size recorded in this study was 6.5±2.8.

Table-15 Demographic characteristics of equine owners

Parameter	Frequency of households	Percentage (%)
Age		
24-45	56	77.8
46-59	11	15.3
≥ 60	5	6.9
Gender		
Male	61	84.7
Female	11	15.3
Education		
Illiterate	11	15.1
Elementary	4	5.6
Junior high school	6	8.3
High school	51	70.8
No. of household members		
1-5	35	48.6
6-10	26	36.1
≥ 11	11	15.3

4.5.2. Herd Structure: Equines, Cattle, Sheep and Goat

The households kept different species of livestock, including equines. Table-16 summarizes the type and number of livestock owned by the households. All the sampled households (n= 72) owned at least one equine species. The number of households that kept cattle was highest (97.2%) followed by that of chickens (95.8%) and donkeys (93.1%). The numbers of chickens, cattle and sheep per household were the highest as compared to donkeys, horses and mules. Regarding the population of equines, more donkeys were kept (61.8%) followed by horses (28.3%) and mules (9.9%). Out of the 72 equine holders, 97.2%, 95.8% and 91.7% of them reported having one or more cattle, poultry and sheep, respectively in their houses. Again information given by the respondents revealed that 21 (29.2%), 6 (8.3%), 1 (1.4%) and 44 (61.1%) of them do have one, two, three and none beehives in their households, respectively.

Table-16 Interviewed households' livestock holdings

Number of animals	Number of households owning each livestock type (%)						
	Donkey	Horse	Mule	Cattle	Sheep	Goat	poultry
0	5(6.8)	31 (43.1)	58 (80.6)	2 (2.8)	6(8.3)	24(33.3)	3(4.2)
1	42 (58.3)	39 (54.2)	13 (18.1)	7 (9.7)	22(30.6)	34 (47.2)	3(4.2)
2	23 (31.9)	2 (2.78)	1(1.4)	18 (25)	31(43.1)	9(12.5)	13(18.1)
3	2 (2.8)	-	-	19(26.4)	11(15.3)	3(4.2)	19(26.4)
4	-	-	-	16(22.2)	2(2.8)	2 (2.8)	15(20.8)
5	-	-	-	8 (11.1)	-	-	12 (16.7)
6	-	-	-	2 (92.8)	-	-	7(9.7)
Average N.	1.3± 0.64	0.59± 0.54	0.21±44	3±1.35	1.7±0.91	0.95±0.71	3.4±1.8

4.5.3. Equine Acquisition, Ownership and Use

The results of the socio-economic study revealed that 67(93.2%), 41(56.9%) and 14(19.4%) of the respondents owned at least one donkey, horse and mule respectively in their

households. The reason of keeping equines is summarized in Fig.4. Over 46% of households kept donkeys mainly for cart and 29.8% mainly for pack services. Though these purposes were pointed out as the main reasons for keeping donkeys; households in the study area kept them for multipurpose uses. All households used donkeys for homestead purposes and own uses (the use of equines to provide pack, cart or gharry services for transportation of household members and/or their goods) alongside other uses. Donkeys were used for transporting grain/crop, vegetables, water, *etc*. from farm/field to household/market and vice versa. Threshing crops was also reported to be one of the uses of donkeys.

About 39% households kept horses mainly for pack, 17.1% for gharry and 9.7% for riding while mules were kept mainly for pack services (42.9%) and riding (28.5%). These were not the only uses of horses and mules; they were kept for multiple uses including pack services to transport all sorts of household produce and goods to and from the household or market and threshing crops.

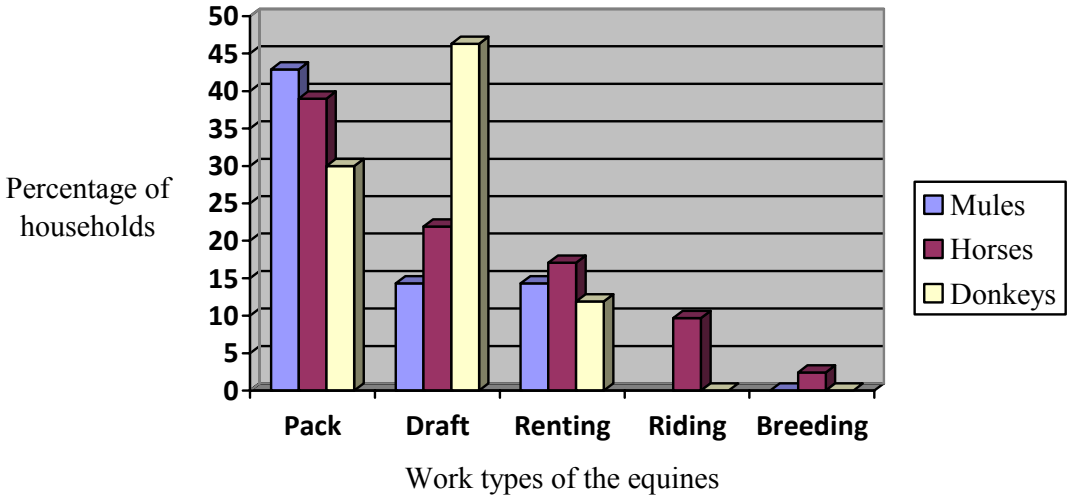

Fig.4 The uses of donkeys, horses and mules in the study area.

4.5.4. Income from Equine Uses and Services

From the 72 households selected for the study, 12 households were using their equines for exclusive homestead uses (equine use on homesteads and own uses such as water, firewood and charcoal collection for household purposes; transportation of different materials from household to market and vice versa) and the annual household income was not estimated in

monetary terms in such cases. Therefore; the annual household income was calculated for the rest 60 households who were using their equines for different income generating services and were able to estimate their annual income from equine uses and services. The number of households involved in using their donkeys, horses and mules for income purposes (sale, renting and cart/gharry services) and the mean annual household income is summarized in Table-17.

Households were able to generate income from sale, renting and cart/gharry services. There was statistically significant variation ($P < 0.05$) in mean annual household income from sale, renting out and cart/gharry services in donkeys and horses but not in case of mules. Donkeys generated higher income from renting out and cart services whereas the income from mule sale is larger compared to other equines. The overall average annual household income from all equines was 9645 ETB (584.5 USD) per household.

Table-17 Mean annual household income from equine uses and services in ETB

Type of equine use or service and income generated								
Equine species	n	Sale Mean±SE	n	Renting out Mean±SE	n	Cart/gharry Mean±SE	F	P-value
Donkey	28	1256.6±48.3	8	4146.6±343.2	33	9024.3±129.8	260	0.000
Horse	15	3504±19.9	7	4415.7±171.6	10	8245.6±826.1	30	0.000
Mule	12	3979.2±575.1	2	2787±27	2	1800±540	1.87	0.17

Note: One household can generate income from different equine use and services.
n = number of households.
SE= standard error.

4.5.5. Social Values of Equines

Equine owners were asked to list the most important social values of donkeys, horses and mules and the results of their responses are summarized in Table-18. The social values of equines were paramount, among which reducing women's work burden was the most important. Donkeys were the widely used animals for reducing women's work burden.

Donkeys were also used to establish good relationships with neighbors and local societies through lending them. Lending donkeys was most common during harvesting to transport agricultural produce from farm to household and also for threshing crops. The most common social contributions of horses were using them for festivals, lending to establish good relations with neighbors and local society, ambulance services for people and other social work. Mules were also used for different social purposes including reducing women's work burden and ambulance services for people.

Table-18 The social values of equines as listed by respondents

	Species of equine involved		
	Donkey	Horse	Mule
Social value	No. respondents (%)	No. respondents (%)	No. respondents (%)
Reduce women's work load	26 (36.1)	4 (5.5)	5 (6.9)
For festivals	-	8 (11.1)	-
Social work	17 (23.6)	5 (6.9)	2 (2.8)
Establish good relationship	11 (15.3)	6 (8.3)	2 (2.8)
As ambulance	-	5 (6.9)	1 (1.4)
Services during funeral	5 (6.9)	2 (2.8)	2(2.8)
Services during Wedding	-	2 (2.8)	1 (1.4)

4.5.6. Constraints of Equine Keeping and Use

The constraints to equine ownership and use are summarized in Table-19. The major constraints were shortage of fodder and grazing areas, overloading, health problems and poor harnessing and saddle. The major animal feed sources were fodder from grazing land and crop residues. In addition, grains are also used especially for draught equines. Other sources such as industrial by-products and fodder from improved forage were rare. Grazing land was very scarce in the area. The other main sources of feed were hay and crop residues. Straw from barley, teff and wheat constitute the major component of the equine diet.

Table-19 Major constraints of equine keeping in the study area

Constraints	Number of Households perceiving the problem	Percentage (%)
Feed and grazing area shortage	72	100
High cost of feed	51	70.8
Overloading	47	63.9
Health problems	28	38.9
Poor harnessing and saddle	15	20.8
Others	8	11.1

According to interviews, equines have a range of health problems, not all of which have been thoroughly investigated in this survey. Among the health problems reported, the most frequently encountered (94.4%) were respiratory problems (with common clinical signs such as cough and nasal discharge), colic, back sores, epizootic lymphangitis and strangles with their local names is presented in Table-20.

Table-20 Major health problems of equines as reported by owners

Health and welfare problem	Local (Hadiya) name	Number of respondents, n (%)
Respiratory problem	Salaqa	68 (94.4)
Back/leg sores	Gambata/mada	62 (86.1)
Colic	Gamima	59 (81.9)
Parasitism	Mure'e	40 (55.6)
Lameness	Dimima	38 (52.7)
Skin diseases	Betera	38 (52.7)
Epizootic lymphangitis	Chebchebsa	34 (47.2)
Eye disease	Eltiso	32 (44.4)
Strangles	Tusha	26 (36.1)
AHS	Ginbot beshita	18 (25)
Ulcerative lymphangitis	Nidifit	16 (22.2)
Others	-	22 (30.5)

4.5.7. Owners' Response about the Management of Lesions and Fate of Injured Equines

According to the interview of equine owners, high number of owners of donkeys (44.8%), horses (40.8%) and mules (35.7%) did not give any help for their equines at times of injuries where as only 11.9%, 19.5% and 21.4% of donkey, horse and mule owners respectively, have given conventional veterinary care. This shows that the largest proportion of donkey owners, horse owners and mule owners do nothing when their animals were injured. High proportions of donkey owners do nothing compared to horse and mule owners (Table-21).

Large proportions of owners of donkeys (77.6%), horses (75.6%) and mules (71.4%) reported that they used their animals continuously, regardless of the presence and severity of injuries, compared with fewer proportions of the owners (14.9%, 19.5% and 21.4% of donkey, horse and mule owners, respectively) who gave rest until recovery. The proportion of owners of donkeys who gave rest until recovery was relatively lower compared to owners of horses and mules. Over 7% of donkey owners, 7.1% of mule owners and 4.8% of horse owners reported that they left injured animals along the road side to let them survive on their own or die.

Table-21 Owners' responses about management of lesions and fate of injured equines

Owners' Responses	Donkey owners, n (%)	Horse owners, n (%)	Mule owners, n (%)
Management of lesions			
Take to nearby health Center	8(11.9)	8(19.5)	3(21.4)
Treat with medications (from local market)	7(10.4)	7(17.2)	1(7.1)
Take to local healer	18(26.9)	7(21.5)	3(21.4)
Treat with medicinal plants	4(5.9)	2(2.2)	2(14.3)
Do nothing	30(44.8)	17(40.8)	5(35.7)
Fate of injured equines			
Use continuously regardless injuries	52(77.6)	31(75.6)	10(71.4)
Give rest until recovery	10(14.9)	8(19.5)	3(21.4)
Leave on the road to survive on their own	5(7.4)	2(4.8)	1(7.1)

5. DISCUSSION

5.1. The Welfare of Equines

The results obtained from this study showed that equines working in and around Hosanna had a widespread welfare and health problems. In the current study, the observation on body condition of the animals (Fig.3) showed that 32.6% were thin (BCS of 0 or 1), 63.1% were fair (BCS of 2) but only 4.3% were in good condition (BCS of 3). None of the equines had a BCS of 4 or 5. Therefore; 98% of the equines had a thin or fair body condition (BCS below 3). This finding was in concurrence with publications on working equines in the developing world, which generally identify emaciation and malnutrition as major welfare problems (Pritchard *et al.,* 2005 and Kay, 2007). This indicates that there are management problems associated with poor nutrition and/or health care. Furthermore, heavy work burden coupled with nutritional deficiencies and internal parasites might be the reason for the observed high proportion of emaciated animals in this study. Moreover, the results of the socioeconomic part of this study revealed poor management practices of equine owners which also support the above stated assumptions.

The behavioral part of the welfare assessment was used to give some insight into the animals' emotional state in order to identify the responsiveness and fearfulness of animals. The behavior observation tests had limitation in that animals may have responded towards the observer in a different way than they would respond to their regular handler (Pritchard *et al*., 2005) as animals may present a fear response towards a possible danger, in this case the observer (Archer, 1988 and Broom, 1991). Response to an unfamiliar person may differ from the response to the regular handler, as observed in comparable tests on dairy calves (de Passille´ *et al*., 1996).

In this study, large proportions of the animals (21.6%, 17.4% and 19.6% of the donkeys, mules and horses, respectively) were apathetic/depressed in general attitude but no statistically significant variation ($P < 0.05$) was observed among the species. Working equines may be unresponsive due to disease, exhaustion or over-stimulation by a crowded and noisy environment (Pritchard *et al.,* 2005). According to Pritchard *et al.* (2005) report, apathy is associated with dehydration, skin wounds and chronic pain and leads to consequential injuries, such as broken knees caused by falls and road accidents.

The avoidance/aggression of an animal to an approaching observer may be an indication of fear of humans and has been previously tested in farm animals (Hemsworth *et al*., 1993). In the current study, 23.6% of donkeys, 38% of mules and 20.3% of horses ($P < 0.05$) showed such a behavior. This behavior could probably be associated to widespread beating of equines by owners that has been observed during this study. This kind of condition was reported by Swann (2006) in India; he reported that animals become frightened if they are beaten during work. Poor welfare, leading to apathy, depression and fatigue increases the chance of beating, because animals with poor welfare cannot meet the work expectations of the owner or user.

In donkeys, it was also observed that 19.7% of them clamped their tail/tucked in the hindquarter when an observer is approximately 30cm away from its hindquarters. This clamping down of tail or tucking in its hindquarters may also be an indicator of fear or pain, with the animal preparing to defend itself. Another indication of fear or pain was observed by chin contact test in which nearly 18% of the equines avoided chin contact. This could also imply that owners do often handle the heads of equines in order to carry out painful or stressing procedures, so the animals see this as a threat (Tadich *et al*., 2008).

Fear is a negative motivational affective state and in a strong or prolonged form constitutes 'suffering' (Fraser and Duncan, 1997). Animals displaying fear behavior are often exposed to adverse handling procedures because they react inappropriately to handling and fear behavior presents a serious risk of injury to handlers (Rousing *et al*., 2001 and Pritchard *et al*., 2005). Thus this fear is of concern as these animals work closely with humans on a daily basis. Fear and stress in animals has been implicated in causing immunosuppression and hence may have effects on an animal's physical health (Dennison *et al*., 2005).

Health has also important implications on the welfare of animals (Broom, 2006). Healthy animals are a prerequisite for the successful output of working animals (FAO, 2006) since disease can lead to a reduction in feed consumption, poor body condition and a subsequent decrease in working capacity. The present study demonstrated that there were missing teeth, eye lesions, abnormal mucous membranes, ecto-parasites and diarrhea under tail across all three species as it is depicted in Table-8. Over 79% of the animals had some lesions associated with their eyes, ranging from small amounts of ocular discharge to severe pathologies and blindness. But no statistically significant variation ($P > 0.05$) was observed in the prevalence of these health parameters among species. There was statistically significant

variation ($P < 0.05$) among the species in limb deformity, donkeys showing the highest prevalence. This may be due to the fact that donkeys are the most neglected animals in the study area; receiving less attention by owners. Thus they are kept under poor management conditions and are the most over worked and over loaded animals.

Donkeys showed the lowest prevalence of skin tent duration, a clinical indicator of dehydration and there was a statistically significant difference ($\chi^2 = 7.08$, $P < 0.05$) among the species. This indicates the fact that donkeys can conserve body water in conditions of water deprivation (Maloiy and Boarer, 1971 and Yousef, 1991). Tadich *et al.* (2008) reported 13% of increased skin tent duration in horses in Chile. However; Pritchard *et al.* (2005) reported 37.1%, 45.9% and 50.2% of increased skin tent duration in donkeys, mules and horses, respectively in tropical countries. In the current study, small percentage of animals (13.7% of donkeys, 16.3% of mules and 23.5% of horses) showed this parameter compared with the high numbers encountered in Pritchard *et al.* (2005). Most probably these differences were due to the season of study and environmental factors. The countries (Egypt, Pakistan and India) where Pritchard *et al.* (2005) conducted their research are dry with high heat stress.

The effects of dehydration on welfare of equines were the subjects of some authors; for example, inadequate water availability has been reported as a risk factor for colic (Reeves *et al.,* 1996) in horse, while Rose (1986) concluded that exercise-related problems including exhaustion could be prevented by adequate electrolyte and water intake. Again, Dahlborn *et al.* (1995) reported that as little as 3% dehydration can decrease performance capacity of animals. In working equids, decreases in work capacity will affect the owner's income adversely and thereby reduce the amount of food and care provided to the animal (Pritchard *et al*., 2006).

In this study, 90.2% of equines showed a gait abnormality over 12 paces at walk; these varied from uneven gait through mild to severe lameness. This is of concern because it is likely that these animals experience pain on a daily basis. Lameness can be associated with suffering through pain (Whay *et al.,* 2005). In this study, the owners' responses about the management of lesions and fate of injured equines showed that most of the owners did not give rest until recovery. Therefore, there was little chance for the animals to fully recover from their injuries. Lameness is a complex problem and can be caused by both the environment in which the animal works and by interactions with other health problems. It is thought to result

from a combination of risks, including developmental issues, conformation, breed, nutrition, work related concussion on dry hard roads and resource issues such as farriery and foot care (Dennison *et al*., 2005).

In the present study, it was also observed that the majority of the examined donkeys, horses and mules had hoof problems (Table-8). There was a statistically significant variation among the work types ($P < 0.05$), the pack animals showing the highest prevalence. This is most probably associated to the fact that pack equines are mostly found in remote areas far from veterinary health centers, do not get hoof health care and are the most ill managed. The prevalence of hoof problem(90.8%) recorded in horses in this study is found to be comparable with the 90% prevalence of crumbled and fissured hooves prevalence reported in stallions at the Spanish riding school (Josseck *et al*., 1995) and the 90% hoof problem reported in horses in Iran (Bigham and Tabatabaei, 2007). On the contrary, Slater and Hood (1997) reported a very less (28%) prevalence of hoof problem in racing horses. The reason for higher prevalence of hoof problems observed in the current study can be related to untrimmed and unshod hooves, poor housing and nutrition. In addition we have been able to observe most working horses were left unshod and work on hard ground surfaces that could predisposed them to splitting of the hoof wall and consequently toe cracks.

In addition to the behavioral and general health parameters, skin lesions were observed to highly affect the welfare of working equines. The skin lesions and injuries showed varied distribution and prevalence among different species, work types, age groups, and BCS categories as shown in Table-9. The records of skin lesions showed statistically significant variation ($P < 0.05$) among the work types; the draught animals being highly affected compared to the pack or ridden work types. This is attributed to the use of ill fitting and ragged harness and a bit (which is used for steering and braking animals) in draught animals which are not usually used in pack animals.

The 5-15 years age group showed significantly ($P < 0.05$) higher records of skin lesions compared to other age groups. This is associated to the work burden of the age group because this is the age time in which the animals are regularly engaged in hard and tedious work which exposes them to lesions on different body parts. Considering the BCS categories, the 'thin' body condition category (BCS of 1 or 0) showed significantly higher ($P < 0.05$) occurrence of skin lesions. This is probably associated to the fact that low body condition

score is an indicator of reduced body fat (Henneke *et al.,* 1983); consequently, equines with a low body condition score may have less natural padding protecting them from pressure, friction and shear lesions caused by harness (Pritchard *et al*., 2005).

As it is shown in Table-9, among the examined equines, 66.3% of donkeys, 56.9% of horses and 59.8% of mules (overall 63% of the equines) had skin lesions. This prevalence is lower than that of Biffa and Woldemeskel (2006) who reported an overall prevalence of 72.1% in donkeys and horses (79.5% in donkeys and 64.5% in horses) in Hawassa, Ethiopia. But it is higher than the reports of Tadich *et al.* (2008) in Chile and Sells *et al.* (2010) in Morocco who reported 13% and 54% of wounds in urban draught horses and pack donkeys, respectively. These variations in prevalence may be attributed to differences in lesion consideration, grading and regional differences in equine uses. In this study, the equines assessed presented a high percentage of wounds and scars, most of them being located on tail/tail base, harness related and tethering/hobbling areas. This is in agreement with the observation made by Hovell (1998) on the fact that wounds are mainly caused by badly fitting or poorly maintained equipment.

In donkeys, the prevalence of body lesions (66.3%) was higher compared to the 44% prevalence reported from central Ethiopia (Pearson *et al*., 2000), but it is lower than that of Biffa and Woldemeskel (2006) who reported 79.4% external injuries in donkeys in Hawassa, Ethiopia. As it is depicted in Table-10, the occurrence pattern of body lesions observed on donkeys had significantly higher records ($P < 0.05$) on breast/shoulder, hind quarters and tail/tail base compared to horses and mules. Though donkeys are tolerant to hardship conditions, it seems the inappropriate management and neglect of this species highly contributed to high prevalence of injuries and the overall low welfare status. Despite a wide array of works they perform, little attention is given to them; they were made carry heavy loads over long distances and hours. Donkeys tend to be owned by the poorest people, so they might be more overworked, have lower quality husbandry (de Aluja, 1998) and might be less likely to receive food supplementation in the dry season (Biffa and Weldemeskel, 2006)

Tether/hobble lesions on the limbs were highly prevalent across all species, work types and age groups. In horses and mules, the ridden type of work was significantly associated ($P < 0.05$) with this type of lesion as shown in Tables 12 and 13. This is directly associated to the fact that ridden horses and mules were regularly kept by tethering/hobbling along the

homesteads. Though most of the tether/hobble lesions were mild, there were cases in which the skin was damaged causing much suffering and pain. Thus this practice made the animals suffer and cause lesions regularly. It was also mentioned by Alujia and Lopez (1991) and Mohammed (1991) that some method of hobbling to restrain equine cause discomfort and even wounds. Pritchard *et al.* (2005) also reported similar findings where ridden animals showed significantly higher ($P < 0.05$) prevalence of tether/hobble lesions than those doing draught and pack works.

The results depicted in Tables 11, 12 and 13 for the work types of donkeys, horses and mules, respectively showed the prevalence of general health parameters and skin lesions. Most health parameters including eye lesions, swelling of tendon/joints and limb deformities were more prevalent in draught animals compared to either pack or ridden animals. This is most probably associated to the harsh work of the draught animals which exposes them to different trauma, mostly due to beating or cart injuries.

The distribution of body lesions according to the work types of each species is shown in Tables 11, 12 and 13. As it can be understood from these tables, the distribution and prevalence of skin lesions were so varied in different body parts. Tail/tail base lesion was the mostly prevalent lesion (57.9% in all equines) and showed a statistically significant variation among work types ($\chi^2 = 26.61$, $P < 0.05$), equines used as pack animals had significantly higher tail base lesions. These lesions were usually induced by excessive rubbing on this site by a tail crupper (a rope made from old clothes and other local materials) that passes under the tail of animals during packing, running from the rear of the pack to the base of the tail, in order to stop the pack slipping forward. This creates frequent movement and rubbing; as the packed animals move forward. Thus it causes injury mainly contributing for the highest prevalence of tail/tail base lesions in this study. Swann (2006) had similar report, when pack animals move long distance and frequently, the chance of tail/tail base lesion occurrence was very high.

In contrast to the current report, Pritchard *et al.* (2005), in a multi-national study involving donkeys, mules and horses reported that wounds of skin and deeper tissues were most prevalent on the breast/shoulder, withers and girth regions of all 3 species. In Pritchard *et al.* (2005), the prevalence of tail/tail base lesions was only 5.5%, 9.1% and 5.3% in donkeys, mules and horses, respectively whereas the wither lesions were seen in 10.2%, 21.3% and

13.2% of donkeys, mules and horses, respectively. On the other hand, Sells *et al.* (2010) in Morocco reported high prevalence of wounds on withers and tuber coxae rather than on the tail/tail base. These differences may be due to the variations in use of equines, type and design of saddles and carts. In addition, environmental factors can cause such variations (Burn *et al.,* 2010). According to Sell *et al.* (2010), Moroccans didn't use a tail crupper that passes under the tail of animals during packing. Thus very few tail base wounds were encountered in their study. The high prevalence of tail/tail base, wither and spine wounds is of concern because as well as being painful, there is potential for the wounds to become infected resulting in further health complications. Both scars and wounds have higher levels of neurotransmitters than normal skin (Henderson *et al.*, 2006) indicating that wounds at all stages of the healing process may be painful.

As the tail/tail base lesion was to pack animals, the lip lesion was significantly higher ($P < 0.05$) in draught animals. Lesions at the commissures of lips, on the breast/shoulder and girth were observed more frequently on draught animals than pack animals. This is mostly attributed to a bit and ill-fitting and ragged harness commonly used in draught animals which are not usually used in pack animals. Nawaz *et al.* (2007) supports this; where the presence of lip lesions, size of superficial lesion and size of skin broken lesion measurements were found to be closely related to the bit characteristics.

The correlations between the aggregated health and behavioral parameters are presented in Table-14. The correlation coefficients indicate the presence of some complex interactions between groups of parameters. Lack of responsiveness to the environment/handling showed higher correlation with dehydration ($r = 0.346$). This showed that apathy is highly associated with dehydration. Another higher correlation coefficients were those correlating low body condition score with skin lesion ($r = 0.331$) and with lack of responsiveness to the environment/human interaction ($r = 0.332$). As it can be expected, the correlation coefficient of limb problems with abnormal gait was also high ($r = 0.550$) showing that animals with limb problems will most likely have also abnormal gait. In addition, the highest correlation coefficient was that between low body condition score and systemic health abnormalities ($r = 0.552$). This shows that emaciated animals whose disease resistance may be lower, are most likely to have systemic health abnormalities compared to those in good body condition. Negative correlation between body condition and burden of internal parasites was reported by another work in Ethiopia (Ayele *et al.,* 2006).

5.2. Socio-Economic Survey

The equine owners' family size recorded in this study was large with average 6.1 members per household. The area is one of the densely populated areas in the country (CSA, 2010). The majority of interviewed household heads were male and the numbers of female household heads were few. In this study, the highest numbers of animals kept were cattle followed by chicken and donkeys. In the total livestock population (including chicken) of interviewed households, equines constituted 6.6%. More donkeys were kept compared to horses and mules. This could probably be due to low price to purchase, ease of management, draught tolerance, less susceptibility to diseases, relative income and diverse socioeconomic use of donkeys (Croxton, 1993).

Equines were used for transport as pack animals or for pulling carts and gharries which enabled the poor households to generate income and participate in the market economy (Admassu and Shiferaw, 2011). The communities used equines for fetching water and carrying a variety of goods. Equine transportation was used in agricultural production, mainly to transport fertilizer/manure and seed to the farm fields and the harvest from the fields to the homestead and to the market. A study in Tanzania reported that the use of donkeys had enabled farmers to transport larger harvests from the field to market; and farmers with donkeys were able to use more fertilizer, because it could be transported easily from market place to the homestead and from the homestead to the fields (Sieber, 1997). More importantly, studies have shown that most of the transport activities of rural households take place within the community and are related to subsistence tasks such as the collection of firewood, and water and transport to and from the fields (Dawson and Barwell, 1993).

The transport functions of equines were vital in the study area where land was more intensively cultivated and where, consequently, households were highly dependent on income from marketing cash crops. Horses and mules were used to transport people from their residence to nearby local market places, towns and administrative centers to accomplish different social and economic activities. They were also used for carrying the sick to clinic or hospital. Similar reports from different African countries had been published. For example; Mutharia (1995) reported that the Maasai community in Kenya uses donkeys for fetching water, for household shifting (during migration), for transporting shopping and for pulling fencing materials needed for constructing. In Botswana, donkeys are used for transporting

people and goods, for transporting sand for building houses, and for fetching water and firewood (Aganga *et al*., 1994).

Equines provided employment opportunities for many people who hired out or who use them on a commercial basis for a transport service. Reports from India showed that, transportation of various commodities, such as agricultural and horticultural inputs/outputs, major and minor forest produce and building materials were the important activities offering employment (Chauhan, 2008). In the present study, the major ways of income generation by equines were sale, renting out and cart/gharry use. In the study area, the main town (hosanna) with a high human population (89,300) and high relative demand for transportation of goods and other equine services created good opportunity for income generation by equines.

The overall average annual household income from all equines was 9645 ETB (567.4 USD). The analysis of the annual income of the households showed a statistically significant variation ($P < 0.05$) in mean annual household income generated from sale, renting out and cart/gharry services in case of donkeys and horses but not in case of mules (Table-17). Donkeys generated higher income from renting out and cart services followed by horses. This is due to the diversified uses of donkeys. In the study area, as we observed during the study period, it is common to see more donkeys than horses or mules transporting various goods. Furthermore; transporting of different goods by donkey cart still remained important while the income from horses by transporting people by gharries highly decreased due to the availability of motorized vehicles, especially the three wheeled vehicle (bajaj) in Hosanna town.

The larger income from sale of mules in this study is due to the price difference between mules and other types of equines. In the area, mule, especially the riding mule is considered as an animal of higher status (H. Tadesse, pers. comm.) thus its price is much higher than that of other equines. The estimate of income from equine use did not include the monetary estimate of equine use on homesteads and own uses such as water, firewood and charcoal collection for household purposes; transportation of different materials from household to market and vice versa. If these were taken into consideration, the income from equine use could be much more than that reported.

Similar reports witnessed the importance of equines as a means of income generation for households. For instance, a study in Hadiya and Gurage zones of SNNPR, Ethiopia, reported an overall mean annual output of 10,595.7 ETB (790.7 USD) per household in Lemmo Woreda (Admassu and Shiferaw, 2011). The mean annual household income in the mentioned study is higher than the present report because the study included the monetary estimate of equine homestead and own uses which the present study didn't consider. Another study in India reported total annual gross returns from equine-rearing through different activities, at the overall level, per household/annum of INR 47,974 (about 904 USD or 14461 ETB) (Chauhan, 2008). The annual gross returns reported by Chauhan (2008) was higher than the current report. This may be due to the regional differences in equine uses and services as well as price differences in equine services.

In the present study, it was found that the social contributions of donkeys, horses and mules in the area were enormous. The social contribution of donkeys in reducing the work burden of women was the most common of all social contributions and was more common for donkeys than for mules or horses. Donkeys have reduced the domestic transport burden of rural women and have created employment and income-generating opportunities for many poor people. For women, donkeys were often multipurpose animals, since they can be used for activities like water and firewood collection, transporting cereals to the grinding mill and for generating income through provision of transport services (Sylwander, 1994; Bwalya, 1997 and Marshal *et al*., 1997). Thus donkeys highly assisted women with income-generating opportunities and contributed towards changing gender power relations.

People who did not own equines had access to them through various local hiring relationships. Hiring out donkeys, horses and mules and/or their carts were good source of income. Such use of equines was also reported from Limuru, Kenya, where 43% of households own donkeys, an additional 20% of households use them (Njenga, 1993). A similar research in Ethiopia showed that donkeys are used daily for hauling water from a distant source, members of community who do not own donkey borrow animals from neighbors to transport water; the water is then shared for no cost or repayment (Marshal *et al*., 1997)

Various constraints of equine rearing exist in the study area. Shortage of fodder and grazing areas and rising costs of feeds were identified as important limiting factors for equine keeping

(Admassu and Shiferaw, 2011). Feed shortage was one of the major constraints to productivity and work performance of equines in the area. In the surveyed kebelles, insufficient grazing was a problem in all villages. According to respondents, the shortage of livestock feed was primarily attributed to the small farmland holding per family and the resulting limited crop residues which are vital source of animals' feed.

Equine health problems were among the most important equine keeping constraints. Respiratory problems were frequently mentioned (94.4%) by the respondents. The respiratory problems reported were complex and likely to be related to infections, dry season dust and parasites. Colic, defined by rolling and other signs, was reported as an important health problem by 81.9% of the equine owners. This was likely to be due to a number of causes including poor feeding and watering practices, high parasite burdens and eating of rubbish. Wounds, especially on the back, were reported with relatively high frequency. The back and leg sores were presumably associated with inappropriate harness and saddle materials, overloading, overworking and traditional cauterization (Admassu and Shiferaw, 2011) as it is already discussed in the welfare part of this study.

From Table-21 it is easy to understand the grave situation of equine health and welfare in the study area. High proportion of equine owners (44.8% donkey owners, 40.8% horse owners and 35.7% mule owners) did not provide any treatment to their equines, regardless of the presence and severity of injuries. Similarly, Biffa and Woldemeskel (2006) reported that only 21.4% of the respondents take wounded horses to the nearby veterinary clinic while 40.2% do nothing. Shelima *et al.* (2007) made similar observation, where 38.3% of wounded horses treated using traditional medicine and 36.2% of wounded horses had no chance to go to veterinary clinic. Similar situations have been reported in the country that only a few people look for veterinary advice on treatment of sores in donkeys (Pearson *et al*., 2000).

During the interview, it was reported that the equine health problems continued to have major impacts on the equine users' livelihoods, either through direct loss of the animal, reduced production or through reduced capacity to work. Some of these diseases can be prevented by proper management, deworming and vaccination. Vaccines are inexpensive relative to the economic value of equines. The high prevalence of equine diseases as a major constraint to equine ownership and use indicates weak veterinary services and lack of capacity to implement preventive health programmes.

6. CONCLUSIONS AND RECOMMENDATIONS

Equines play an important economic and social role in the societies, especially the poor, in terms of creation of employment opportunities, access to finance and local transportation. Despite the great contributions made by equines to the daily life and livelihoods of the people who solely or partly depend on them, they suffer from negative impacts of poor health and welfare. This study showed that working equines generally had poor welfare status. Behavioral indicators of poor welfare like depression/apathy and fear; and general health indicators of poor welfare like abnormal mucous membrane and gait, swelling of tendon/joints, eye lesions and limb/hoof wall problems were observed in all species and work types but the occurrence of these parameters showed varied prevalence across species and work types. The prevalence and distribution of skin lesions were also varied and observed to be associated with species and work types. Large proportions of donkeys showed high records of skin lesions compared to horses and mules. Equines engaged in draught work showed highest lesions at harness related body parts whereas the pack animals had highest lesion records at tail/tail base.

Equines assisted poor households with income-generating opportunities and have contributed in improving access to finance. Beyond the immense homestead and own uses, equines assisted households with income generation through sale, renting and cart/gharry services. Furthermore; equines inevitably had great social importance. They are used for reducing the work burden of women, for societal work, strengthening relationship between households through lending, wedding ceremonies and services during funerals. The equine sector had several constraints among which shortage of feed, grazing land and health problems were the most important. Based on the above conclusions, the following recommendations are forwarded:

- An awareness creation and training agenda on equine welfare for grassroots users and policy makers at the higher level is of paramount importance.
- The concerned governmental or non-governmental institutions should support non-agriculture income generating opportunities, such as those involving use of equines.
- People involved in decision making, policy formulation, research, training and education are required for better positive images of the value of equine contribution towards food security, improved livelihoods and the national economy.

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ANNEXES

Annex-1 The five freedoms

Freedom	Influencing factors
1. Freedom from hunger and thirst	By ready access to fresh water and a diet to maintain full health and vigor
2. Freedom from discomfort	By providing an appropriate environment including shelter and a comfortable resting area
3. Freedom from pain, injury or disease	By prevention or rapid diagnosis and treatment
4. Freedom to express normal behavior	By providing sufficient space, proper facilities and company of the animal's own kind
5. Freedom from fear and distress	By ensuring conditions and treatment that avoid mental suffering

Source: (OIE, 2008)

Annex-2: Equine Charities, Aims, Interventions and Area of Operations

Name	Mission Statement	Main Management Interventions	Main Countries of Operation
The Brooke Hospital for Animals (UK)	To improve the condition and well being of equine animals overseas by providing free veterinary treatment for the working horses, donkeys and mules of poor people worldwide and by advising and educating owners and users.	Free veterinary treatment in animal hospitals, field clinics and mobile teams. Owner/user education programmes in animal management	Egypt Ethiopia Jordan India Pakistan Mongolia
Society for the Protection of Animals Abroad (UK)	To improve standards of animals care wherever the need arises working amongst some of the poorest people in North and West Africa and the Middle East.	Free veterinary first aid in rural and semi rural communities. Education in schools and of owners on animal welfare and environmental issues. Small self-contained animal welfare projects funded by outreach programme.	Ethiopia Morocco Tunisia Algeria Jordan Syria Mali
The Donkey Sanctuary (UK)	The Donkey Sanctuary's aim is to prevent the suffering of donkeys worldwide through the provision of high quality, professional advice, training and support on donkey welfare. In the UK and Ireland permanent sanctuary is provided to any donkey in need of refuge.	Free veterinary treatment with mobile clinics, sanctuaries. Worming programmes. Advice on management and nutrition, harnessing education.	Ethiopia India Kenya Mexico Egypt Spain
International League for the Protection of Horses (UK)	To protect horses from misuse, by providing relevant education and practical training throughout the developing world.	Saddlery and farriery training. Nutrition advice to owners. Veterinary training and treatment.	Fiji Mexico El Salvador Kenya Ukraine
Animal Assistance and Education League (US)	To improve human self-sufficiency through the proper health care and humane treatment of animals.	Free veterinary treatment. Considerate handling training. Watering programme. Traction animal provision and training.	Ethiopia Ghana

Source: (Helen, 2001)

Annex-3 Details of the study area

PA/Town	Total Populatin	Number of livestock							
		cattle	sheep	goat	donkey	horse	mule	chicken	Beehive
Hosanna	89300	8287	2523	1263	505	33	8	-	
T/Ambicho	4726	2205	844	700	177	65	89	1422	192
Hayise	3335	2914	458	665	239	54	73	3889	167
Bobicho	1979	2599	697	198	289	157	58	1943	135
Lereba	3146	2881	463	617	451	49	82	3903	153
Shacharoma	2866	3347	552	677	521	52	39	3349	158
A/Gode	5187	2978	963	390	593	154	71	566	201
Kalisha	1491	2018	334	450	159	30	41	807	70
Alela	1393	2924	674	254	234	49	45	1049	168
Kidigsa	5109	2967	1004	485	484	379	110	2570	174
Total	118532	33120	8512	5699	3652	1022	616	19498	1418

Source: (LWADO, 2011)

Annex-4: Equine welfare assessment by direct observation (checklist)

1. General descriptions

Date _____Species _____

Work type: Draught ☐ pack ☐ ridden ☐ other ☐ (specify) _____

Sex: Mare/filly ☐ Stallion/colt ☐ or Gelding ☐

Age category: < 5 ☐ 5-15 ☐ >15 ☐

2. Observations of general health parameters

2.1. Oral examination

2.1.1. Mucous membrane: Color: Normal (pinkish) ☐ abnormal (Pale, yellow, white, purple) ☐

2.1.2. Teeth: Completeness of the teeth: Complete ☐ missing ☐

2.1.3. Mouth and lips

Lesions of the external corners (commissures) of the mouth including scars, hairless and broken skin: Absent ☐ Present ☐

2.2. Ocular examination

Any lesion of the eye including ocular discharges, signs of ocular pain, keratitis, uveitis and blindness: present ☐ absent ☐

2.3. Hydration status

Skin tent duration: Normal ☐ abnormal ☐

2.4. Diarrhea under tail (fecal soiling): present ☐ absent ☐

2.5**.** Ecto-parasites **(**Tick, lice, flea or nits**):** absent ☐ present ☐

2.6. Coat condition: Normal ☐ abnormal (staring, matted, dry or uneven)

3. Behavior

3.1. General attitude

Alert ☐; Apathetic/depressed ☐

3.2. Response to the observer approaching the animal

No response ☐ friendly approach ☐ avoidance/aggression ☐

3.3. Walk down side: No response☐ responds ☐

Tail tuck test (donkeys only): Clamping down tail and/or tucking in hindquarters ☐ no response ☐

3.5. Chin contact test: avoids ☐ allows ☐

4**.** Body condition score: 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

5. Gait

5.1**.** Nature of gait**:** Normal/even ☐ abnormal/uneven ☐ (grade 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐)

5.3. Conformation

Abnormality of limbs including lateral abnormalities and flexural or angular abnormalities of the limbs: present ☐ absent ☐

Swelling of tendons/joints: yes ☐ no ☐

Hoof wall(s): Normal ☐ abnormal ☐ (cracks, splits, horizontal grooves and long toe)

6. Table-4: Lesions of skin and/deeper tissues

Anatomical position	Lesions			
	Present			Absent
	Mild	Moderate	Severe	
Head				
Ears				
Neck				
Breasts/shoulder				
Withers				
Spine				
Girth				
Belly				
Ribs/flank				
Hindquarter				
Tail/tail base				
Foreleg				
Hind leg				

7. Tethering/hobbling or firing lesions

Lesions on the limbs caused by tethering/hobbling (hobbling problems):

Absent ☐ Present ☐

Firing lesions or scars: Absent ☐ Present ☐

Annex-5: Age Categories according to Martin *et al.* (1999):

1) Under 5 years

The first age group to be discussed is the group age 5 and under. This age group has a deciduous UCI from 8 months to 4.5 years. Eruption times of the central, middle, and corner incisors (2.5, 3.5, 4.5 years) are the primary source of information in this age group.

2) 5 to 9 years

Age group 5 to 9 has a UCI that progressively changes from wider than tall to square. The upper central incisors should be taller and wider than the middle incisors when viewed from the labial surface. The incisor profile angle should be near 180°.

Fig.1 Permanent upper corner incisor wider than tall (age 5-9 years)

Fig.2 Upper central incisors taller and wider than middle (intermediate) viewed from labial surface (under 10 years old).

3) 10 to 14 years

Age group 10 to 14 has a UCI that is square to slightly taller than wide in shape. The occlusal surface of the lower central incisor should begin to resemble a triangle in shape, and the incisor profile angle should begin to change toward a more acute angle.

Fig.3 Upper corner incisor square-shaped (age 10–14 years).

Fig.4 Upper central incisors same size or slightly smaller than middle incisors (middle age; 10–15 years).

4)15 to 20 years

Age category 15 to 20 has a UCI that is taller than wide. The occlusal surface of the lower central incisor should be from triangular to oval. The incisor profile angle in the upper limit of this group should be significantly acute. The upper central incisors commonly are significantly smaller than the middle incisors when viewed from the labial surface.

Fig.5 Upper corner incisor taller than wide (age 15 years or above).

Fig.6 Upper central incisors significantly narrower and shorter than middle incisors (older horse; usually older than 15 years).

Annex-6 Description of anatomical differences between body condition scores (Carroll and Huntington, 1988)

Condition	Neck	Withers	Back & Loin	Ribs	Hind Quarters
0 Very thin	bone structure easily felt - no muscle shelf where neck meets shoulder	bone structure easily felt	3 points of vertebrae easily felt	each rib can be easily felt	Tail head and hip bones projecting
1 Thin	can feel bone structure- slight shelf where neck meets shoulder	can feel bone structure	spinous process can be easily felt - transverse processes have slight fat covering	slight fat covering, but can still be felt	can feel hip bones
2 Fair	fat covering over bone structure	fat deposits over withers - dependent on conformation	fat over spinous processes	can't see ribs, but ribs can still be felt	hip bones covered with fat
3 Good	neck flows smoothly into shoulder	neck rounds out withers	back is level	layer of fat over ribs	can't feel hip bones
4 Fat	fat deposited along neck	fat padded around withers	positive crease along back	fat spongy over and between ribs	can't feel hip bones
5 Very fat	bulging fat	bulging fat	deep positive crease	pockets of fat	pockets of fat

Annex-7 Body Condition Scoring of Donkeys

C/S	Neck and shoulders	Withers	Ribs and Belly	Back and Loins	Hind quarters
1 Poor	Neck thin, all Bones easily felt. Neck meets shoulder abruptly, shoulder bones easily felt, angular	Dorsal spineof Withers prominent and easily felt.	Ribs can be seen from a distance and felt with ease. Belly tucked up	Backbone prominent, can feel dorsal and transverse processes easily.	Hip bones visible and felt easily (hock and pin bones). Little muscle cover. May be cavity under tail.
2 Moderate	Some muscle development overlying bones. Slight step where neck meets shoulders	Some cover over dorsal withers. Spinous processes felt but not prominent	Ribs not visible but can be felt with ease	Dorsal and transverse processes felt with light pressure. Poor muscle development either side midline	Poor muscle cover on hindquarters, hip bones felt with ease
3 Ideal	Good muscle development, bones felt under light cover of muscle/fat. Neck flows smoothly into shoulder, which is rounded	Good cover of muscle/fat over dorsal spinous processes, withers flow smoothly into back.	Ribs just covered by light layer of fat/muscle, ribs can be felt with light pressure. Belly firm with good muscle tone and flattish outline	Cannot feel individual spinous or transverse processes. Muscle development either side of midline is good.	Good muscle cover in hindquarters, hip bones rounded in appearance, can be felt with light pressure.
4 Fat	Neck thick, crest hard, shoulder covered in even fat layer.	Withers broad, bones felt with firm pressure	Ribs dorsally only felt with firm pressure, ventral ribs may be felt more easily.Overdeve loped belly	Can only feel dorsal and transverse processes with firm pressure. Slight crease along midline.	Hindquarters rounded, bones felt only with firm pressure. Fat deposits evenly placed.
5 Obese	Neck thick, crest bulging with fat and may fall to one side. Shoulder rounded and bulging with fat.	Withers broad, unable to feel bones	Large, often uneven fat deposits covering dorsal and possibly ventral aspect of ribs. Ribs not palpable. Belly pendulous in depth and width.	Back broad, unable to feel spinous or transverse processes. Deep crease along midline bulging fat either side.	Cannot feel hip bones, fat may overhang either side of tail head, fat often uneven and bulging.

Source: www.thedonkeysanctuary.uk.org

Annex-8: Behavioral assessment tests according to Pritchard *et al.* (2005)

1. General attitude: As viewed/examined by the observer, the animal can be: Alert or apathetic/depressed.

2. Response to the observer approaching the animal (no response, friendly approach, avoidance/aggression)

Is the response of the animal to the observer approaching its head from 3 to 5 m away, at angle of approximately 45°c (more acute if animal is wearing blinkers).

The animal may show:

- No response,
- Friendly approach (If the animal turns head towards observer) or
- Avoidance/aggression: If the animal does one or more of following: turns head away, moves away, flattens ears, attempts to bite or kick.

3. Walk down side (no response, responds)

The response of the animal to observer walking down side of its body at distance of 30 cm from its side, turning at tail and walking back to head.

We say the animal responds if: any acknowledgment of observer's presence, e.g. ear turn, head turn, move away, kick.

4. **Tail tuck test** (donkeys only)

Clamping down tail and/or tucking in hindquarters when observer was level with hindquarters during 'walk down side'.

5. **Chin contact test**

Avoiding contact or withdrawing head when hand was placed lightly under the chin.

Annex-9: Assessment of skin tent (Pritchard *et al.,* 2006)

The skin tent test is standardized by specifying that the animal's head up in a natural position and pointing straight ahead. The right hand of the observer rests at the base of the animal's neck, with the knuckle at the base of the little finger lying against the cranial margin of the animal's left scapula. Pinch vertical fold of skin overlying the *brachiocephalicus* muscle, without rolling, squeezing or pulling the skin. It is considered normal if the skin returned to a normal position immediately after it is pinched and released. This represented a latency of approximately 0.75 sec or less. It is abnormal if there is any delay in return of the tented skin to its normal position.

Annex-10: Lameness grading system according to the AAEP (Lynn *et al*., 2004)

Many vets often assess the degree of lameness in horses using the American Association of Equine Practitioner's (AAEP) lameness grading system. This subjective grading system is based on a five-point scale ranging from 0 to 5. In the AAEP's system, the five grades are as follows:

Grade 0: is defined as no detectable lameness under any circumstances.

Grade 1: is defined as lameness that is difficult to observe and is inconsistently apparent regardless of the circumstances (e.g., in hand or under saddle, hard surface, incline, circling).

Grade 2: lameness is difficult to detect at a walk or trot in a straight line, but is consistently apparent under particular circumstances (e.g., under saddle, hard surface, incline).

Grade 3: lameness is consistently observed at a trot in all circumstances.

Grade 4: lameness is obvious with a marked head nod, hip hike, and/or shortened stride.

Grade 5: lameness is obvious with minimal weight bearing either during motion or at rest. The horse might be unable to move.

Annex-11 The wound scoring system according to Mejdell *et al*. (2010)

Category	Injury description	Example picture
0	No visible lesions	
1	Lesion involving hair loss only (alopecia) (e.g. superficial bite)	
2	Lesion involving a moderately sized contusion (bruise) with or without hair loss and/or a abrasion (scrape) in the skin	
3	Lesion involving a minor laceration (cut) and/or a larger contusion (bruise) with obviously swollen parts with or without hair loss	
4	Laceration involving injury to deeper tissues (e.g. muscle, tendon) or a laceration without visible damage to underlying tissues but of a size that normally requires surgery	
5	Extensive and severe injury that may lead to long lasting loss of function (e.g. laceration with extensive soft tissue damage, seriously injured tendon, serious joint damage, fracture) or even death (euthanasia).	

Annex-12: Questionnaire Survey format

Owner demographics :

1. Date of interview_____

2. Kebele _____

3. Owners name_____ Sex_____ Age_____

3.1. Owners education level _____

3.3. Marital status: married ☐ not married ☐

3.3. Number of family members _____

3.2. (Table-8) Livestock composition

Species	Cattle	Sheep	Goat	Horse	Donkey	Mule	Poultry	Beehives
Total number								

4. Equine acquisition, ownership and use

4.1. How did you acquire your equine(s)

Purchased ☐ Born at home☐ Other ☐ (specify_____)

4.2. For how long have you been rearing equine(s)?

Less than 10 yrs ☐ 5-10 yrs ☐ More than 10 yrs ☐

4.3. Was equine rearing your family profession or you started on your time?

4.4. For what type of work you use your equine?

Horses for:

Pack service ☐ Cart service ☐ Gharry service ☐ riding ☐ Renting out ☐ exclusive homestead use ☐ breeding ☐ other ☐ (specify) _____

Donkeys for:

Pack service ☐ Cart service ☐ Gharry service ☐ riding ☐ Renting out ☐ exclusive homestead use ☐ breeding ☐ other ☐ (specify) _____

Mules for:

Pack service ☐ Cart service ☐ Gharry service ☐ riding ☐ Renting out ☐ exclusive homestead use ☐ breeding ☐ other ☐ (specify) _____

5. Household income from equines

5.1. How much income you got from your equine(s) use, services and sale last year in ETB?

Annual income from equine uses/services

Species	From sale	From renting out	From cart/gharry services	Total
Donkey				
Horse				
Mule				

5.2. Equine own use

For what homestead services you use your equine(s)?

6. How do you feed your equine(s)?

Own grazing area ☐ communal grazing area ☐ graze on open public fields/at road side ☐

Cultivated pasture ☐ Cereal straws (Teff, barley, wheat...) ☐ Stover (sorghum and maize) ☐ Concentrates (grains) ☐

7. Social values of equines

7.1. What are the social values of your equine(s) do you think?

Reducing women's work burden ☐ establishing good relations with society through lending ☐

Decoration of funeral ceremony ☐ wedding ceremony ☐ Ambulance services for people ☐ societal work ☐ Festivals ☐ sports/entertainment ☐ Other ☐ (specify)_____

8. Constraints to equine ownership and use

What are the constraints to equine ownership and use do you think?

_____

_____

_____

8.1. What types of main diseases encountered in your equine(s) last year?

_____

_____

_____

What were the indications/symptoms of the disease(s)?

_____

_____

_____

8.2. How these diseases affect your livelihoods?

8.3. How do you prevent your equine from diseases including endo-parasites and ecto-parasites?

Vaccination ☐ Deworming ☐ Spraying/dipping ☐ do nothing ☐

Other measure ☐ (specify) _____

9. Wound management

9.1. How do you manage your equine(s) if wounded?

Take to nearby health center ☐

Treat with medications purchased from local market ☐

Take to local healer ☐

Treat with medicinal plants ☐

Do nothing ☐

9.3. Fate of Injured Equines

What do you do to your equine once it is injured?

Used continuously regardless of the presence and severity of injuries ☐

Given long-term rest until recovery ☐

Given short-term rest ☐

Left on the road to survive on its own ☐

Thank you for taking the time to complete this interview

STATEMENT OF AUTHOR

First, I declare that this thesis is my confide work and that all sources of materials used for the thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. Degree, to Jimma University College of Agriculture and Veterinary Medicine and is deposited at the University Library to be made available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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The author was born in August1984 in Hadiya Zone, in Southern Nations Nationalities and People's Regional State, Ethiopia. He attended elementary education at Betara Junior Elementary School from 1991 to 1998. Then he completed his senior education at Morsito Senior Secondary High School in June 2002.

In December 2002, the author joined Mekelle University and graduated in 2008 with a Degree, Doctor of Veterinary Medicine (DVM) in Veterinary Medicine. Soon after his graduation, he was employed by the SNNPR (Southern Nations, Nationalities and People's Region) Agricultural and Rural Development Bureau and served as Veterinary Doctor for one year and the other year as Head of the Agricultural and Rural Development office in Gibe Woreda, Hadiya Zone.

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