ANIMAL WELFARE: A COMPARATIVE STUDY OF WORKING DONKEYS IN RURAL AND URBAN/PERI-URBAN AREAS OF MWINGI CENTRAL SUB-COUNTY KITUI COUNTY.

BY

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DECLARATION AND RECOMMENDATION

I Joseph Kilonzi Kamonzo declare that the work contained in this thesis is my original work and has not been presented in part or as a whole for any academic award in any other university.

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Recommendation by supervisors

This thesis is towards a Master's of Science Degree in Livestock Production Systems and has been submitted to the Board of Post graduate Studies with our approval as supervisors.

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DEDICATION

I dedicate this work to my wife Dorcas and children Emmanuel, Grace, and Abigael.

Thank you for your support and understanding, I'm deeply grateful.

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ABBREVIATIONS

ACTH	Adrenocorticotropic Hormone
KNBS	Kenya National Bureau of Statistics
KSPCA	Kenya Society for the Protection and Care of Animals
ANAW	African Network for Animal Welfare
KENDAT	Kenya Network for Dissemination of Agricultural Technologies
KVA	Kenya Veterinary Association
FSK	Farming Systems Kenya
KLR	Kenya Law Review
ANOVA	Analysis of Variance
SPSS	Statistical Package for Social Sciences
HH	Household head
CRT	Capillary Refill Time
OIE	World Organization of animal Health (Office Internatinale des Epizooties)
KIHBS	Kenya Integrated household budget survey.
IgA	Immunoglobulin A
TBM	Substrate solution Tetra methylbenzidine

ABSTRACT

A cross sectional study was conducted to compare the welfare of working donkeys in the rural and urban/peri-urban areas of Mwingi Central Sub-County of Kitui county in Kenya. The assessment of welfare was based on physical welfare indicators, pathological and external parasite infestation, and physiological welfare indicators including the determination of free fecal cortisol concentration. From a total population of 35,361 donkeys in the study area, a sample size of 396 donkeys was obtained. The sample size was proportionately allocated between urban/peri-urban and rural areas at 215 and 181animals based on household distribution in the study area. For cortisol assay 40 donkeys representing 10% of the sample size calculated were used with 22 for the urban/peri-urban and 18 donkeys for the rural areas. Fecal samples were collected once per week for four weeks and taken to the laboratory for cortisol assays by use of a commercial human Elisa kit used to determine free cortisol in human urine (DNOVO10, a product of Novatec)). The kit was validated and pre-tested before use for donkey fecal cortisol. 396 questionnaires were administered to households owning a donkey. The first part of the questionnaire captured the demographic data of the donkey owners while the second part captured data on donkey welfare parameters. The statistical package for social sciences (SPSS) version (15.0) was used to analyze the data. Descriptive statistics was used to present the result in form of charts, graphs and tables. On demographics of the respondents; the study established that 67.7% of the households were male headed and that 80% of the respondents had formal education. The gender of the person working with the donkey was 82% female and majority of these had primary school level of education. The work performed by donkeys was mainly fetching water at 64.6%. In the urban/peri-urban areas majority of donkey worked for between 4-7hours per day while in the rural majority at 51.4% worked for between 1-3 hours. Overall 81%of donkey owners provide veterinary Medicare when the need arises and veterinary Medicare service is provided by government officers at 53%. Only 6.8% of the respondents used herbal medication to treat their animals. The most prevalent ailment affecting donkeys was gastro-intestinal conditions at 56.6% followed by skin conditions at 34.6%. Only 4% of the respondents provide housing to their donkeys and 17.7% of them provide mineral supplementation. On statistical analysis significant statistical differences were shown to exist between rural an urban/peri-urban donkeys $p<0.05$. Physical and pathological variables found to have significant statistical differences were namely, overgrown hooves ($p=0.042$), wounds ($p=0.012$), scars ($p=0.00$), eye discharges ($p=0.042$) and corneal opacity at ($p=0.016$). Differences in color of mucus membranes between the two groups of donkeys was also significant at ($p=0.010$). The study recommends that advocates of donkey welfare should channel their energies on training donkey handlers, particularly women since majority of the donkey handlers are women. The herbal plants mentioned and used in donkey treatment need further investigation to establish their ethno- veterinary value.

CHAPTER ONE

1.0 Introduction

1.1 Background to the study

Donkeys (*Equus asinus*) have been serving mankind for 5000 years (Rossel *et al.*, 2008). The phrase 'beasts of burden' describe their utility as pack animals in many parts of the world as they play a significant economic and social role in the transport of water, building materials, relief supplies, animal feeds and other critical supplies (Mrema, 2004).

It is estimated that there are about 90 million donkeys worldwide and they are especially wide spread in Central and South America, Africa and parts of Europe. China has the largest population with 11 million donkeys (Starkey and Starkey, 2000). Ethiopia has the largest population of donkeys in Africa and the second largest population in the world after China (FAO, 2007).There are over 1.8 million donkeys, two thirds of which play a major role in Kenya's economy especially in rural and urban poverty reduction by providing employment opportunities and income that supports people's livelihoods (The Brooke, 2015). Kitui County has a donkey population of over 120,000 donkeys (KNBS, 2009). Majority of these are working animals used in transportation of farm produce, farm inputs, and transportation of water and in provision of drought power. These activities play a key role in Kitui's agricultural economy and water availability to families across the County. According to the livestock census of 2009, the population of donkeys in Mwingi Central Sub County is 35,361(KNBS, 2009).

However, working donkeys suffer from various welfare issues that need to be investigated. These welfare issues such as lameness, wounds and poor body condition significantly reduce the work productivity and life of the donkey. Constraints such as poverty and lack of knowledge mean that animal welfare is being compromised internationally (Niraj, 2014). Donkeys working in rural areas and those working in the urban/peri-urban areas face welfare related issues but there are differences due to the types of work they perform.

1.2 Statement of the Problem

Animals especially donkeys suffer welfare related challenges which affect their health and physical wellbeing. This compromises their ability to work and perform optimally and this in turn affects the livelihoods of the owners. The welfare of working donkeys is therefore crucially important, not only for the health and survival of these animals, but also for the livelihoods of those dependent on them.

1.3 Research Objectives

1.3.1 General Objective

To compare the animal welfare of working donkeys in urban/peri-urban and rural areas of Mwingi Central Sub County-Kitui County

1.3.2 Specific Objectives

1. To determine and compare physical animal welfare indicators in urban/peri-urban and rural based working donkeys.
2. To examine and compare pathological conditions and external parasite infestation in urban/peri-urban and rural based working donkeys.
3. To asses physiological animal welfare indicators in rural and urban/peri-urban based working donkeys.
4. To asses stress levels by determination of free cortisol concentration in feces of rural and urban/peri-urban working donkeys

1.3.3 Hypothesis of the Study

The Null Hypothesis: H_o-There is no difference in animal welfare indicators between working donkeys in urban/peri-urban and rural settings.

1.3.4 Significance of the Study

Findings of this study will be of importance to various stakeholders among them animal welfare organizations that work in the field of donkey welfare in Kitui County and beyond. They will be able to get information on which donkeys need more attention in their welfare work, urban/peri urban or those in rural settings. These results should aid in the development and targeting of specific welfare interventions. To Policy makers this will help to formulate County and National donkey welfare policies. The donkey owners will be exposed to the welfare issues of their animals, and know where they are doing it right and if not what areas of short comings they need to work on.

The study will be of significance to Veterinarians and other animal health workers to pay more attention on the areas of intervention in donkey health and well-being. To research institutions and academia this study will contribute to the body of knowledge and lay a platform for future researchers with an interest in animal welfare and particularly donkey welfare.

1.4 Justification of the Study

Working donkeys in both urban/peri-urban and rural settings contribute to the livelihoods of poor communities. Poor welfare affects the work output of these animals and hence the income of the owners. The results of the study would aid in the development and targeting of specific welfare interventions towards the most vulnerable animals, improve their welfare and income of the owners. In addition this will improve productivity of the donkey due to positive interventions suggested.

CHAPTER TWO

2.0 Literature review

2.1 Background information

Animal welfare lacks a good universal definition and a satisfactory distinction from the term Wellbeing. However a consensual definition is essential for practical, legislative and scientific purposes .Without a clear definition, animal welfare cannot be effectively studied or conclusively assessed to provide remedial measures to its violation. (Broom, 1993)

Animal welfare is therefore defined as the ability of an animal to interact or cope comfortably with its environment, resulting in satisfaction of both its physical and mental state (Duncan, 2005). According to Nguhiu-Mwangi *et al.*, (2013), the assessment of animal welfare is based on the provisions of five freedoms which include;

a) Freedom from hunger, thirst, availed through provision of ready access to water and diet to maintain health and vigor.
b) Freedom from pain, injury and disease availed through disease prevention and treatment.
c) Freedom from fear and distress , availed through avoidance of conditions that cause mental suffering
d) Freedom to have normal behavior patterns, availed through provision of sufficient space and appropriate physical structures.
e) Freedom from thermal or physical discomfort availed through provision of a comfortable environment.

An animal is in a good state of welfare if it is healthy, comfortable and well nourished, safe, able to express innate behavior and if it is not suffering from unpleasant states such as pain, fear and distress (Bousfield and Brown, 2010). Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter/killing (Bousfield and Brown, 2010). Animal

welfare refers to the state of the animal. Treatment that an animal receives is covered by other terms such as animal care, animal husbandry and humane treatment (OIE, 2008).

2.2 Historical perspective of animal welfare globally

Systematic concern for the wellbeing of other animals probably arose in the Indus valley civilization as religious ancestors were believed to incarnate in animal form; therefore animals had to be treated with respect (Cox, 2009). Concern for animal suffering can also be found in Hindu thought, and Buddhist idea of compassion is a universal one, extending to animals as well as humans, but western traditions are very different. Their intellectual roots lie in the Judeo-Christian tradition. Neither is kind to those not of our species (Cox, 2009)

Among the legislation on animal welfare in Eastern and Southern Africa, the prevention of cruelty to animals Act, Cap 360 of the laws of Kenya, is one of the most comprehensive and inclusive pieces of legislation on animal welfare issues. The Act defines what constitutes an animal cruelty offence and the penalties. The Act also outlines regulations in relation to experimentation with animals, slaughter, transportation of animals, welfare of dogs and cats used for breeding purposes, destruction of animals and the power to enforce the provisions of the Act (Masiga and Munyua, 2005)

2.3 Animal Welfare in Kenya

In Kenya, the Kenya society for the Protection and Care of Animals (KSPCA) is the oldest charitable animal welfare organization which deals for the most part with domestic animals. It began sometime in 1910 in Nairobi and the surrounding areas when some ladies took pity on oxen bringing goods into Nairobi from surrounding districts (KSPCA, 2015). The organization exists to promote the protection of all types of animals, prevent cruelty to all animals and to rescue and relieve animals from all manner of suffering (KSPCA, 2012). The African Network for Animal Welfare (ANAW) is another organization in Kenya which focuses on humane treatment of all animals for human welfare. The organization promotes the understanding and appreciation that animals are sentient beings;

they have feelings, emotions and respond to psychological and physiological changes in the environment (Gathanga, 2011)

Kenya Network for Dissemination of Agricultural Technologies (KENDAT) promotes sustained rural and peri-urban development through advancing capacity for small holder farmers across all components of the agricultural value chains. KENDAT with the support of the Brooke Hospital for animals of UK advances the welfare of the donkey through the *Heshimu punda* (respect the donkey) programme (Gathanga, 2011).

The Brooke Hospital has been funding equine welfare programs in Kenya since 2001. These programs seek to improve provision of veterinary services through training of local health service providers and promote better and sustainable care by owners and users (The Brooke, 2012). Currently Brooke is working with seven partners in Kenya in the promotion of equine and especially donkey welfare. These partners are Kenya Network for Dissemination of Agricultural Technologies (KENDAT), Kenya veterinary Association (KVA), Farming Systems Kenya (FSK), Vet works Eastern Africa, Caritas-Kitui, Animal Welfare and Public Health (AWAPH), and VSF-Belgium (The Brooke, 2015).

The Government of Kenya has enacted a law (Chapter 360 laws of Kenya) to make better provision for the prevention of cruelty to animals, to control experiments on animals and for matters incidental thereto and connected therewith. The law was enacted in 1962 with revisions done in 1983 and 2012 (KLR, 2012)

2.4 Direct Animal – Based Measures of Welfare

Different experts tend to give priority to different aspects of an animals' state when assessing its welfare (Serpell, 2008). The best measures or indicators of an animal's welfare will also depend on the species of animals involved and the context in which it is being assessed. Animal Welfare scientists, therefore, tend to focus on a limited range of welfare 'indicators' when making their assessments (Serpell, 2008).The most widely used are the following:

i) Health

Although health and welfare are not synonymous, there is widespread agreement among experts that an animal's welfare is certainly compromised if it is injured, diseased, malnourished or in any sense unhealthy (Broom, 1991; Dawkins,1998; Fraser,1995).Since poor health also limits an animal's usefulness to people (e.g. by reducing its working ability, productivity or the quality of its products), health based indicators of animal welfare may carry more weight with animal users or producers than other measures (Scott *et al.*, 2001).

Overt signs of ill-health-wounds, lesions, abrasions, sores, coat or feather problems; parasite loads, lameness or abnormal gait, lethargy, difficulty standing up or labored breathing, physical deformities, overall body condition should therefore be in the forefront of any welfare assessment (Serpell, 2008).

Because they are overt and relatively simple to score or quantify, symptoms of poor health tend to be consistent both within and between rates and are therefore also likely to be useful as before and after measures of progress in animal welfare. Some good examples of use of health and body condition indices as both measures of welfare and of progress in Welfare have been provided by recent assessments of working equines (horses, mules and donkeys)in developing countries (Pritchard *et al*., 2005).

The basic wellbeing of a donkey can be observed by its body condition. A donkey is too thin if its ribs or backbone are very obvious, the neck is thin on top, the rump is pointed or the hip bones are sticking up like those of a cow (Oudman, 2004).

Comparable, though less comprehensive, health assessments have also been employed to evaluate welfare in dairy cattle (Whay, 2002), pigs (Leeb *et al*., 2001), dogs (Patronek, 1998) and broiler chickens (Krestin *et al.*, 1992)

ii) Productivity

As with health, the use of productivity for example growth rate, reproductive fertility and fecundity as a welfare indicator has the potential of appealing to animal users and producers. It is important to note that high productivity is not always indicative of

acceptable levels of welfare among individuals. Animals may coexist with exceptionally high levels of farm productivity and poor welfare (MClnerney, 2004)

A further limitation of this method is the lack of detailed long term records. The best known examples of the use of animal productivity as welfare indicators come from a series of studies that demonstrate that rough handling during routine husbandry procedures significantly retarded growth rates, pregnancy rates and sexual development in young pigs (Hemsworth, 2003; Hemsworth *et al*., 1986, Wailblinger *et al*., 2006)

Productivity indicators are more likely to be valuable for measuring progress in animal welfare situations such as commercial farms, laboratories or zoos where systematic records of production traits are reliably maintained (Curran *et al.,* 2005).

iii) Physiology

A variety of physiological indicators have been used to assess the welfare of animals short term physiological responses include elevated or variable heart and respiratory rates, body temperature increases, adrenaline and corticosteroid secretion in blood and saliva, plasma level of glucose, lactate or acute phase proteins; all of which may indicate charges in welfare status (Serpell, 2008)

Long term measures of welfare also include indicators such as elevated urinary, fecal and or hair cortisol, adrenal gland enlargement or suppressed IgA secretion and immune function (Accorsi *et al.*, 2007, Boissy *et al*., 2003; Broom and Fraser, 2007; Dawkins, 2003;Geers *et al*., 2003). All such measures present difficulties in interpretation since none is exclusively a symptom of poor welfare. For this reason most welfare scientists argue that physiological indicators are only useful in combination with other evidence (Broom and Fraser, 2007; Barnett and Hemsworth, 1990; Dawkins, 2003 and Rushen, 1991).

Physiological indicators may have an increasingly important role to play as before and after assessment tools. Until recently, the collection, storage and analysis of psychological samples was too expensive and labor intensive (Serpell, 2008). However, the development of standardized, low cost assay kits for most physiological markers is now making the

process easier and more accessible (Serpell,2008). Although still at an experimental stage of development, levels of hair/fur and feather glucocorticoids seem to provide a new and potentially valuable non- invasive measure of chronic stress in mammals and birds that may prove particularly useful for the assessment of progress in animal welfare (Accorsi *et al*., 2007)

iv) Behavior

Behavioral indicators are widely used in the assessment of animal welfare on the assumption that an animal's behavior provides an immediate reflection of its internal emotional and/ or motivational state (Serpell, 2008). The most basic types of behavioral evaluation generally focus on characteristics of posture, demeanor, or locomotion that are symptomatic of underlying pain or morbidity (Kestin *et al*., 1992). Most such studies attempt to score behavior using objective criteria and trained observers.

2.5 Working Donkeys

According to recent estimates there are over 100million equids working in developing countries (Anon, 2005). Even in the 21st century an estimated 50% of the world's population depends on animals as a source of energy (Wilson, 2003). In many rural areas, the use of power supplied by equines and other draught animals is not falling despite increase in mechanization and motorization, due to the cost of machinery (Sells, *et al*., 2010). A socio-economic study of donkeys working in Africa concluded that development professionals must recognize donkey use and management as an appropriate affordable technology for people with minimal resources (Fernando and Starkey, 2000). The use of equines in the context of provision of low cost transport, agricultural power and often as the sole means of generating income for their owners is expected to continue (Biffa and Woldemeskel, 2006).

Welfare of the working donkey is a major concern in many areas of the world. A well-managed, healthy donkey not only lives longer, but also is able to work more easily and regularly than one in pain, ill health or underfed (Pearson *et al*., 2000). A majority of these

working animals are owned by individuals who use them as their sole means of income to sustain large and extended families (Webber and Rodgers, 2006).

In Ethiopia, donkeys are used by women to assist in fetching water and firewood. A comparison of two Maasai women, one using a donkey to fetch water and the other carrying it herself indicated that the use of a donkey could save up to 25 hours per week for other activities. The women saw this time saved as valuable for carrying out other tasks, for rest, leisure and for more involvement in community work (Fernando and Keter ,1996). The use of donkeys has enabled women to overcome the cultural barriers to the use of work animals. In societies where donkeys are easily accessed by women, they find it easier to work with them and especially in relieving women domestic transport burden (Fernando, 2000).

2.6 Donkey husbandry practices and welfare

Donkeys need clean fresh water every day, especially when working in hot weather. Lack of water can cause colic, a fatal condition. Donkeys should have access to fresh water all the time, or at least in the morning and evening (Oudman, 2004).

Donkeys have lower water requirement per unit of weight than other domesticated animals except the camel (Aganga *et al.,* 2000). The water intake of a donkey is influenced by the amount of work being done, the temperature and humidity of the environment, the dryness of the feed consumed and the physiological status of the animal. Water requirement for an adult donkey ranges between 18-35litres per day according to the circumstances mentioned (Fielding and Krause, 1998). According to Aganga (2000), donkeys should be offered water at least once or preferably twice per day to ensure good functioning of the digestive system and provide opportunity for body water to evaporate, so maintaining body temperature. Donkeys should not be offered very cold water when they are still hot from working, and the water offered must be clean (Jones, 1997). However donkeys can still work withstanding severe dehydration. They do this by reducing water intake, sweating rate and water excretion and by maintaining feed intake (Ayo, 2013). They also maintain plasma volume by drawing substantial fluid reservoir in the hind gut especially the caecum

and the ventral colon. Mild chronic dehydration experienced by donkeys produces morphological and physiological adaptations in the hindgut, which enhance fermentation an absorptive capacity of the hindgut (Sneddon *et al.*, 2006).

The housing of donkeys can be kept at basic requirements though this depends on the climate and season of the area (Oudman, 2004). It should at least have a roof and three closed sides that face the prevailing wind directions. There should be enough space to lie down and the floor should not be damp or cold (Oudman, 2004). Improper housing and handling exposes the donkeys to wounds, which are commonly not attended to, leading to poor performance (Asha *et al*., 2006).

All donkeys need mineral salts. Commercial salt lick blocks or minerals licks can be provided to the donkeys as donkeys will need extra calcium and phosphorous needed for growth and reproduction. These minerals may be lacking in the local foliage (Oudman, 2004). According to Oloifa (2012a) donkeys need supplementation throughout the dry season, when they are increasingly used for traction. According to Aganga, (2000) mineral and vitamin supplementation are required for growth and development of the skeleton especially in growing donkeys. The skeleton is the load bearing structure for efficient working life, so then this must be optimally developed and strong. Working donkeys require mineral supplements to replace the minerals lost in sweat. Donkeys should be provided with a mineral lick of a mixture of di -calcium phosphate and salt. The salt will replenish the sodium lost in sweat.

A two layered padding material between the pack load and the donkeys back is required for protection of its skin. The layer that rests on the skin should be soft and absorbent to take up the sweat. The pack padding should be shaped in such a way that it prevents any direct pressure on the backbone. According to Oudman, (2004) cotton material is highly recommended while sacking gunny bags can be quite rough and plastic bags are not absorbent. Improper handling is considered a major stressor, adversely affecting farm animals (Knowles and Warris, 2000; Minka and Ayo, 2009). Poor management exerts deleterious effects on health, wellbeing, behavior performance and production quality

(Geverink *et,al* 1998).

2.7 Stress hormones ACTH and glucocorticoids

There is no standard definition of stress and no single biochemical test system to evaluate stressful conditions (Hofer, 1998), but the response to stress causes an increased release of adrenocorticotrophic hormone (ACTH) which leads to elevated levels of glucocorticoids in the blood. These steroids mainly cortisol and corticosterone are secreted by the adrenal cortex. They have profound effect on glucose metabolism (Gower 1975), act in a catabolic manner, induce lipolysis and cause involution of the lymphatic tissue (Thorn and Schwartz-porsche, 1994)

2.8 Non Invasive Monitoring of Hormones

Over the past decade, non-invasive monitoring of endocrine activity via feces, urine or saliva has become an important tool not only for reproductive management but also for the investigation of questions in the fields of animal welfare, animal husbandry and ecology and conservation biology. (Rattenbacher, *et al.,* 2012)

Ethology: The study of animal behavior is important in the development of understanding of animals. Whatever the research context, farming, wildlife management, pets or lab animals, animal welfare have become a mandatory priority. Measurement of markers such as cortisol, alpha amylase and melatonin in saliva provides a direct indicator of stress reactions. It can also be used for studies on depression or anxiety (Rattenbacher, *et al.*, 2012). In vertebrates, the frontline hormones in stressful situations are glucocorticoids and catecholamines. Their increased secretion enhances adaptive physiological responses (Wingfield and Ramenofsky, 1999; Sapolsky *et.al*., 2000). The two main "stress-axes" involved are the autonomic nervous system (Cannon, 1935) and the Hypothalamo-Pituitary-Adrenocortical axis (Selye; 1936). Glucocorticoids, or their metabolites, can be measured in several body fluids or excreta, including plasma, saliva, urine and feces (Mostl and Palme, 2000). Traditionally, Plasma has been used, but sample collection is difficult and stressful to the animals, which may confound the results (Hosper *et al*., 1999).

Therefore, in recent years the measurement of glucocorticoid metabolites (GCMs) in feces has gained increasing attention especially for wild populations (Heistermann *et al*., 2006), Wildlife management and conservation as well as behavioral biology (Mostl and Palme, 2002, Touma and Palme, 2005), largely because it uses a non-invasive and feedback free sampling method.

2.9 The Effect of Physical Injuries on donkeys

Physical injuries are defined as any grossly visible skin/tissue damage located on any part of the body (Payne, 1990; Biffa *and* Woldennskel; 2006). Injuries can be categorized as severe when the ulceration involves a pronounced contusion in wider areas, tissue hypertrophy and severe complication (Payne, 1990). Moderate injuries may involve a coalition of small wounds with tissue sloughing involving no complication and hypertrophy with chronic causes. Injuries are categorized as mild-severe when they involve only loss of epidermis and superficial layer with no further trauma (Houe, 2002). Physical welfare parameters consist of body condition score, abnormal limbs, impeded gait, eye abnormalities, sores, scars, hoof, and coat condition. (Geiger and Hovorka, 20 Lameness is a departure from the normal stance or gait resulting from a structural or functional disorder of one or more limbs. It is an indication of pain, weakness, deformity or other impediment in the musculo-skeletal system. Lameness and gait abnormalities are very common in working equids due to load pressures and walking on uneven and hard surfaces. Lameness is also caused by laminitis which is the inflammation of the laminae of the hoof. The most common causes of laminitis are ingestion of excess carbohydrates (grain overload), grazing on lush pastures and excessive exercise and concussion.

CHAPTER THREE

3.1 Research methodology

To determine the welfare of working donkeys both in rural and urban/peri-urban settings, the researcher used a welfare assessment protocol based on direct animal observation and laboratory measurement of free cortisol concentrations in feces of the donkeys

Physical animal based welfare indicators such as lameness, evenness of the hoof and body condition score were observed and recorded.

Pathological and external parasite infestation indicators were done by examination of the animal. Pathological indicators include- wounds, scars, eye problems and skin conditions. Parasites such as ticks, ked and lice were observed and recorded.

Physiological welfare indicators such as dehydration and heart rate were determined by direct examination of the animal.

3.2 Study Area

The study area was Mwingi Central Sub County of Kitui County. The study area was purposively sampled, it has the urban/peri-urban and rural component. The sub County is made of six wards i.e. Waita, Nguni, Nuu, Mui, Kivou ward and central ward. Each of the wards is further divided into sub-locations as shown in table 1. (IEBC, 2016). The total number of sub-locations in the sub-County was determined to be 37.Those falling in the rural areas were 20 while 17 sub-locations were located in the urban/peri-urban area.

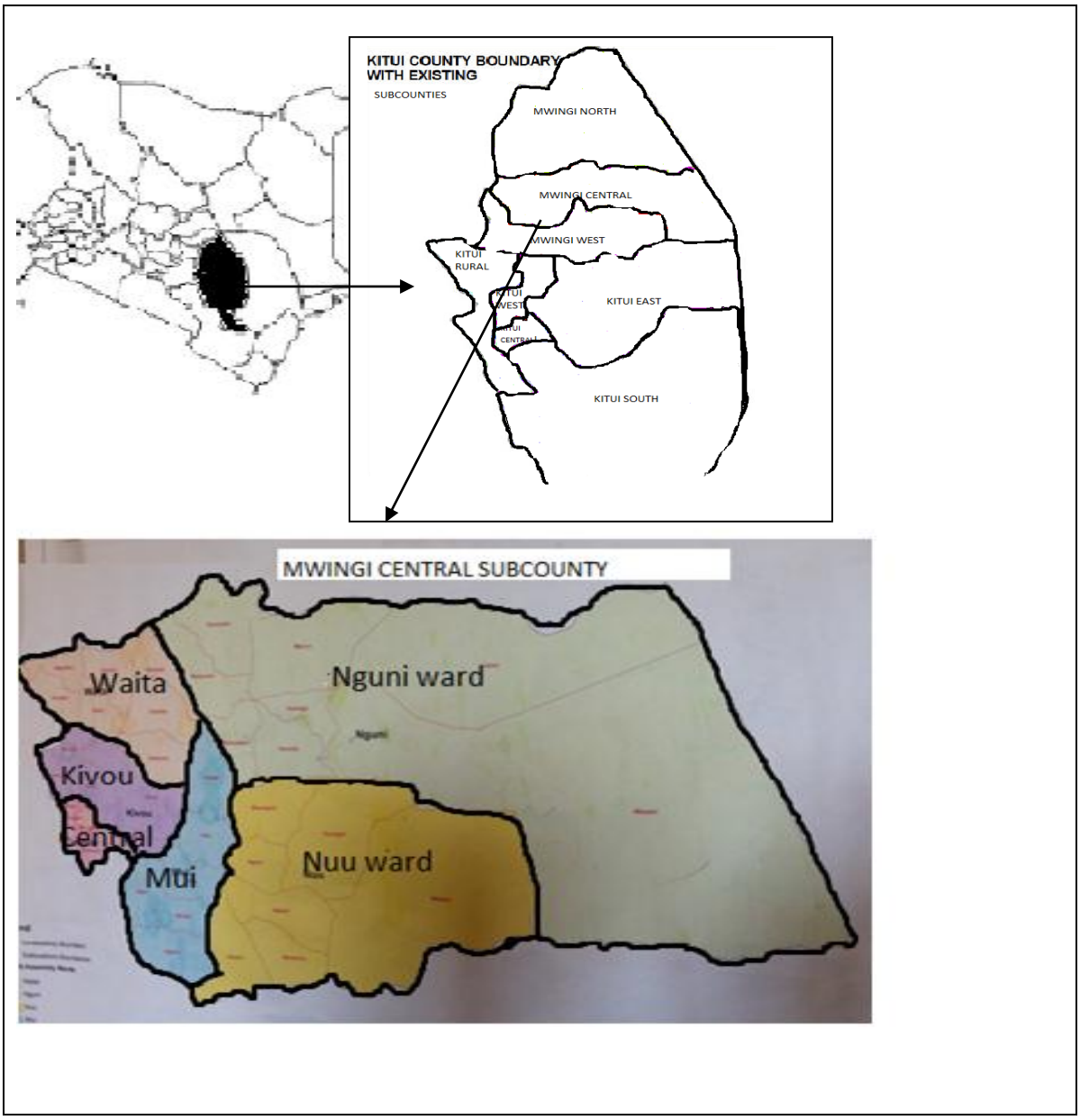

Figure 1: Mwingi Central sub County wards

The study was carried out in the urban/peri-urban centers of Mwingi town, Nguni, Nuu, Waita, Mui and their respective rural areas

3.3 Target Population

The population of donkeys in Mwingi Central Sub County is estimated to be 35,361(KNBS, 2009). The human population in the area according to the last census is 141,207 persons and is projected to be 151,510persons currently (KNBS, 2015). There is a total of 29752 households in the entire Mwingi Central Sub County. Urban/peri-urban households are 16,188 while those in the rural areas are 13,564, this represents 54% and 46 % respectively.

Table 1: Number of households by ward and Sub-Location of Mwingi Central Sub-County

Ward	Sub-location	Number of house holds	Totals
Waita	Mwambui	535	
	Ikusya	529	
	Thonoa	645	
	Waita	723	
	Nyanyaa	332	
	Katitika	628	
	Kathoka	805	
			4197
Nuu	Mwangeni	590	
	Ngieni	606	
	Malawa	1052	
	Ngaani	718	
	Nyaani	591	
	Mwambiu	577	
	Kyangati	1036	
			5170
Nguni	Kyavyuka	928	

	Mwasuma	1043	
	Mbuvu	892	
	Kalanga	304	
	Mathyakani	507	
	Kamutiu	432	
	Ukasi	770	
	Mwalali	638	
			5514
Mui	Yumbu	503	
	Itiko	529	
	Kitise	690	
	Ngoo	932	
	Ngungi	528	
	Ngiluni	859	
			4041
Kivou	Enziu	1311	
	Kanzui	432	
	Kivou	785	
	Ithumbi	850	
	Kyanika	2165	
			5543
Central	Mwingi	3924	
	Kanzanzu	498	
	Mathyakani	428	
	Kalisasi	358	
			5208

3.4 Household Sample Size

Sample size was calculated based on a formula by Israel (1992) as shown below.

$$n = \frac{N}{1+N(e)^2} = \frac{35361}{1+35361(0.05)^2} = 396$$

Where: N=total population, e= the level of precision/sampling error and n=the sample size.

Confidence level was selected at 95%.

Level of precision/or sampling error selected was 5%

The sample size was calculated to be 396 donkeys.

3.5 Study Design

A cross-sectional study was conducted with the objective of assessing the pathological, physical, and physiological welfare challenges affecting donkeys in the rural and urban/peri-urban areas of the study area. A total of 396 questionnaires were administered to households owning a donkey. The first part of the questionnaire was completed by the respondent and recorded by the researcher while part two was completed by the researcher through a detailed physical examination and direct observation of the donkey. Finally donkey fecal samples for laboratory examination were taken by the researcher for free fecal cortisol assay in the laboratory. The fecal samples were taken once per week for four weeks.

3.6 Study Animals

The study animals were the indigenous breeds of donkeys including both sexes of the working age.

3.7 Sampling Design

The study used multistage sampling design. All sub locations in each of the 6 wards in the study area were classified into either rural or urban/peri-urban. Then, one sub location in

rural and another in urban/peri-urban were randomly selected from each ward. The third stage was to select randomly 2 villages from each sub-location. The final stage was simple random sampling from the list of all households in each village to proportionately select the households with a donkey. For the free fecal cortisol in the feces of the donkeys 10% of the total sample size was calculated to come up with a smaller sample to run the hormone assay. This was a total 40 donkeys, which were allocated proportionately between urban/peri-urban and the rural working donkeys.

3.8 Sampling Frame

Mwingi Central Sub-County has 37 sub-locations 20 of which are in urban/peri-urban while 17 are in rural set up. Out of a total 29,752 households 16,188 households are in the urban/peri-urban and 13,564 are in the rural set up. This represents 54.4% and 45.6% of the households respectively and based on this, 215 questionnaires and 181 questionnaires were proportionately administered to urban/peri-urban and rural households respectively. The sampling for free fecal cortisol assay was done proportionately with 22 donkeys and 18 donkeys from urban/peri-urban and rural areas respectively.

3.9 Data Collection

3.9.1 Field Data Collection

Primary data collection was through direct animal observations, physical examination of the donkeys, photography and laboratory analysis.

Structured questionnaires for collection of data and pertinent information such as age, type of work it's used for, routine management practices such as deworming, feeding and veterinary care, how many days he/she works per week and nature of injuries was used.

3.9.2 Fecal sample collection and Processing

A modified laboratory procedure by Altmann *et al.,* and Khan *et al*., (2002) was adopted for fecal sample collection, processing and steroid hormones extraction.

Fecal samples were collected from 40 donkeys, 22 from urban/peri-urban and 18 donkeys from rural areas. From each donkey four fresh fecal samples were collected one collected in the morning every week for 4 weeks by hand and place in sample tubes. A total of 156 samples were collected at the end of the 4 weeks sampling period. The fecal sample, approximately 50gm were placed in plastic sample tubes prefilled with 95% ethanol, mixed properly, labeled and carried in cool boxes at temperatures of 15-25 degrees Celsius to the Reproductive Biology unit laboratory at the Department of Veterinary Anatomy and Physiology, University of Nairobi and stored at -20ºC degrees Celsius until processing for analysis was done.

3.9.3 Laboratory Processing and Cortisol Extraction

Ethanol evaporation

In the Laboratory the ethanol was evaporated from the fecal sample by removing the caps and placing the opened sample vials under a fume hood. Hood drying was done until samples were completely dry. The vials were recapped and stored at -20ºC until ready for freeze drying.

Freeze drying samples

The sample tubes were placed in the freeze –drying flasks, the flasks were then placed in the freezer to cool them down (30min at-20ºC) after which the samples were placed in the freeze drier. Once the samples were completely freeze dried, the sample vials were capped and stored at-20ºC until ready for sifting.

Sifting

The dried fecal sample was sifted through a mesh tea strainer onto a weighing paper. The first particles that come through were dry and fine dirt like material. Sifting was stopped once vegetative material started to pass through. The purpose of sifting was to separate the feces from the vegetative matter and not to mash up the vegetative part into finer pieces.

The vegetative matter was discarded while the fecal powder was transferred into a collection sample container and stored at -20ºC to await cortisol extraction.

Weighing

Weighing was done with a high precision balance instrument. 0.2 grams of the fecal powder was weighed into 16x100mm test tubes which were then capped. The spatula used between each sample weighing was rinsed using ethanol before being used on the next sample. Storage was always done at -20ºC ready for methanol extraction.

Cortisol extraction

2mls of 90% methanol was added into the tubes containing the weighed fecal sample by use of a pipette. The tubes were capped tightly and extraction done by mechanical shaking for 30minutes;followed by centrifugation at (2300 rpm) for 20 minutes at room temperature (25ºC).The supernatant was transferred into epperdorf tubes using Pasteur pipettes and centrifuged again at (3200 rpm) for 15 minutes. The final methanol supernatant was then transferred into micro- centrifuge tubes placed in a fume hood and samples evaporated to dryness over 36 hour period..

Validation and pre-testing the Elisa kit

A commercial urinary cortisol enzyme immunoassay for the quantitative determination of free cortisol in human urine was used. Product number (DNOVO10, a product of Nova Tec-Germany). To conduct this study therefore, there was need to validate and pre-test the kit for use to detect free cortisol in the donkey fecal samples. There was also need to determine the amount of steroid buffer most appropriate to reconstitute the hormone after methanol evaporation. The reconstitution was done with 100 micro-liters, (0.1mls) of steroid buffer. Part of this was then serially diluted as 1:10 and 1: 100. The test assay was then done using various volumes as follows: 40 micro-liters undiluted, 20 micro-liters undiluted, 10 micro-liters undiluted, 1:10 and 1; 100. The verdict was that the 40 micro-liter undiluted was found to be the most appropriate measure for detection of free cortisol in the donkey fecal samples. Two samples were used for pretesting and validation of the

kit. The donkey samples used were MWI. 2 (Mwingi town for urban/per-urban area) and KAN. 2 (Kanzui for rural area).

Free cortisol determination in the samples

The samples were run in duplicates as per the standard procedure in the protocol provided with the test kit. Prior to commencing the assay, distribution and identification plan for all standards, samples and controls were carefully established on the result sheet supplied in the kit.

1. Clean disposable tips were used to dispense the samples, standards and controls into the micro-wells.
2. 300 micro-liters cortisol –HRP conjugate was added into each well.
3. The wells were then covered in foil and incubated at 37ºC for one hour after which the wells were aspirated and washed 3 times with 350 micro-liters of diluted wash solution.
4. Then 100 micro-liters of TBM (substrate solution Tetra methylbenzidine) solution was added into the wells and incubated again for 15 minutes at room temperature in the dark after which 100microliters of the stop solution was added into the wells and the micro plate shaken gently. (Any blue color that developed during incubation turned into yellow.)
5. The micro plates were then inserted into Elisa reader and the absorbance of the samples read at 450nm wavelength against the blank.

3.10 Data Management and Analysis

Data was analyzed using statistical package for social sciences (SPSS) computer software to generate descriptive statistics. Data collected was edited then coded before being input into the SPSS software for analysis. Information was displayed by use of Bar charts, graphs, photography and tables.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter represents the results of data collected to achieve the set objectives. The first section characterizes the demographics, namely the gender of the household head, age, level of education of the household heads, gender of the persons working the donkey, the occupations of the household heads that influence the perceptions and practices that affect donkey welfare.

The second section describes the donkey specifics such as the sex of the donkey, age, source, numbers in the house hold and a comparison with other livestock species kept. The next section presents results on donkey health and welfare. The fourth section presents results regarding physical and pathological welfare indicators such as wounds, scars, lameness, body score and external parasite prevalence.

Finally this section will present the results of the cortisol Elisa assay used for quantitative determination of free cortisol in the donkey fecal samples.

4.2 Demographic Characteristics of the Respondents

4.2.1 Gender of Household Head

The gender of the house hold heads was categorized into two, female and male headed house heads. Majority of the households were headed by men at 67.7percent while female headed households were 32.3 percent. In the rural set up 67.4% of the households were headed by males while 32.6% were headed by females. In the urban peri-urban areas 67.9% of the households were male headed compared to 32.1% which were female (headed see table 2 below).

Table 2: Gender of household head.

Sex	study site		Total
	Rural=181	Urban/peri-urban. n=215	N=396
Male	122 (67.4)	146 (67.9)	268 (67.7)
Female	59 (32.6)	69(32.1)	128(32.3)

Figures in brackets are percentages

Source: Field results

4.2.2 Age of households heads

The ages of household heads were categorized into four groups. The first group 18 to 35 years, then 36 to 55 years, 56 to 75 years and finally those in the age bracket of 76 years and above. The basis of the categorization was to find out the proportion of the youth, middle aged and the aged who are household heads.

More than half of the household heads were in the age group of between 36-55 years at 54.5% with a large proportion being at the urban / peri- urban setup (table 3).

Table 3: Age of household head

Ages	Study site		Total
	Rural. n=181	Urban/peri-urban=215	N=396
18-35	29 (16)	33 (15.38)	62 (15.7)
36-55	98 (54.1)	118 (54.9)	216 (54.5)
56-75	44 (24.3)	52 (24.2)	96 (24.2)
76 and above	10 (5.5)	12 (5.6)	22 (5.6)

Figures in brackets are percentages

Source: field results 2016

4.2.3 Education of household head

In this study, education of house hold heads was categorized into non-formal education for those that never went into formal classroom education, primary education for those who attended primary school between class one to class eight , secondary education for those who attended form one to form four. Tertiary education and above was for those who attended post-secondary education in colleges and universities. In this study 80% of the household heads had attained formal education with 48.2% having primary school education as shown in table 4.

Table 4: Level of education of household heads

Level of education of household head.	study site		
	Rural n=181	Urban/peri-urban=215	Total.N=396
no formal education	35 (19.3)	44 (20.5)	79 (20)
Primary	85 (50)	106 (49.3)	191 (48.2)
Secondary	51 (28.2)	52 (24.2)	103 (26)
tertiary and above	10 (5.5)	13 (6)	23 (5.8)

Figures in brackets are percentages

Source: field results 2016

4.2.4 Occupation of household head

Various occupations were categorized into 3 main categories namely: farmers, *juakali* and formal employment, 46% of the household heads were farmers; few household heads were into formal salaried employment at 14% as shown in table 5 below.

Table 5: Occupation of Household heads

		Study Site		
		Rural n=181	Urban/Peri-urban n=215	Total N=396
Occupation of HH	Farmer	98 (54.1)	84 (34.1)	182 (46)
	Juakali	59 (32.6)	101 (47)	160 (40.4)
	Formal employment	24 (13.3)	30 (13.9)	54 (13.6)

Figures in brackets are percentages.
Source: Field results 2016.

4.2.5 Gender of the person working the Donkey

Gender of the person working the donkey was categorized into male and female categories. In this study Majority of those working with the Donkeys were females at 82.1 percent and 17.9 males as shown in table 6 and figure 2 below

Table 6: Gender of person working donkey

	Study Site		
Gender of the person working the donkey	Rural n=181	Urban/Peri-urban n=215	Total N=396
Male	27 (14.9)	44 (20.5)	71 (17.9)
Female	154 (85.1)	171(79.5)	325 (82.1)

Source: field results 2016. Figures in brackets are percentages.

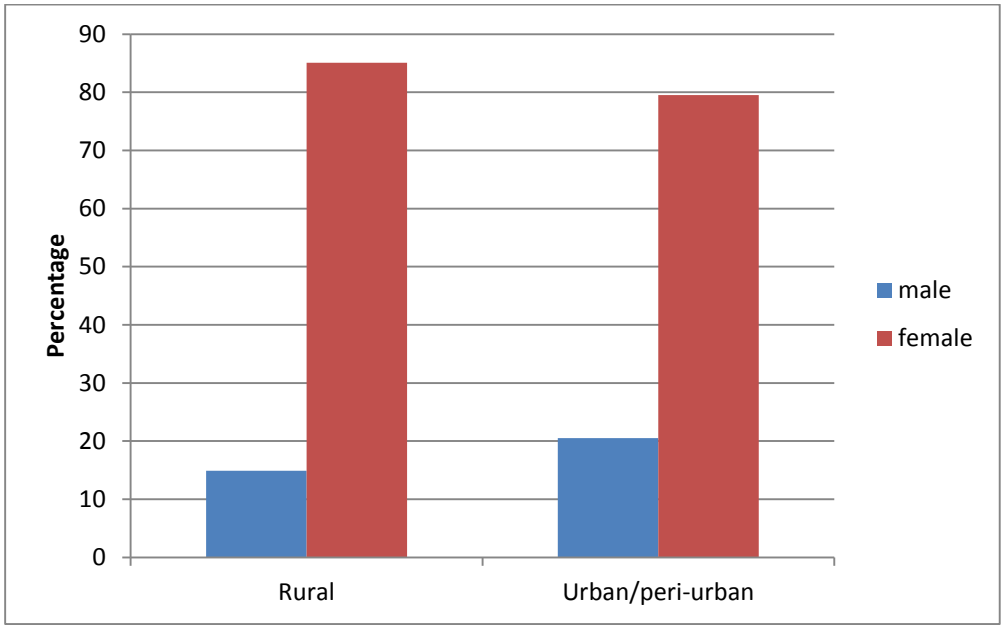

Figure 2: Gender of person working with donkey

4.2.6 Age of the person working the Donkey

The ages categories were in years as follows, 18-25,26-35,36-45, 46-55,56-65,and 66-75yrs.

Majority of the donkey handlers were aged between 36-45 years at 35.4%. Closely followed by those aged between 26-35years 28.8%.The trend was similar in the urban / peri –urban and the rural area. These results are shown in table 7 and figure 3

Table 7: Age of the donkey handler

Age of donkey worker	Study Site		Total
	Rural n=181	Urban/Peri-urban n=215	N=396
18-25	22 (12.2)	36(16.7)	58 (14.6)
26-35	46(25.4)	68(31.6)	114(28.8)
36-45	69 (38.1)	71 (33)	140 (35.4)
46-55	32(17.7)	24(11.2)	56 (14.1)
56-65	10(5.5)	16 (7.4)	26 (6.6)
66-75	2(1.1)	0	2 (0.5)

Figures in bracket are percentages.

Source: field results 2016.

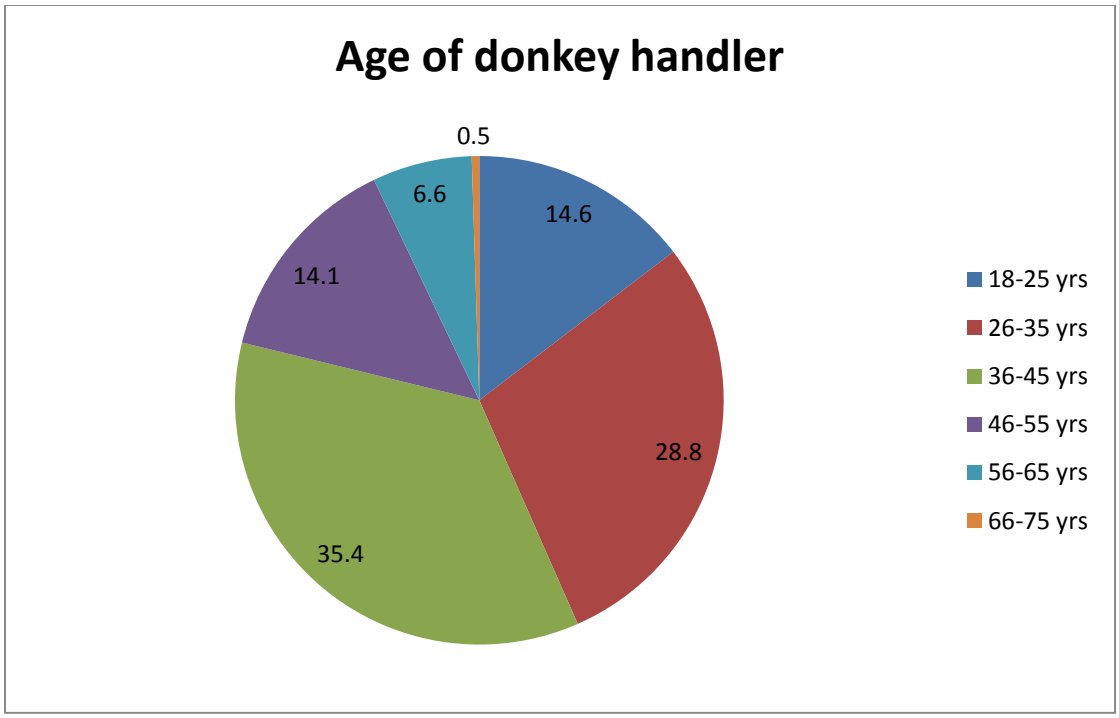

Figure 3: Age of donkey handler in both study sites.

4.2.7 Education of the Donkey handlers

Education for the person working the donkey was categorized into non-formal education for those that never went into formal classroom education ,primary education for those who attended primary school between class one to class eight , secondary education for those who attended form one to form four. Tertiary education and above was for those who attended post-secondary education in colleges and universities

Majority of the workers had Primary education at 68.7% overall .With the rural workers having a larger proportion of those with primary education at 70.2%. A substantial number of donkey workers had no formal education at 16.4% overall (see table 8 and figure 4).

Table 8: Education of donkey handler

education level		study site		Total
		Rural	Urban/Peri-urban	
		n=181	n=215	N=396
	no formal education	28 (15.5)	37 (17.2)	65 (16.4)
	Primary	127 (70.2)	145 (67.4)	272 (68.7)
	Secondary	25 (13.8)	32 (14.9)	57 (14.4)
	tertiary and above	1 (0.5)	1 (0.5)	2 (0.5)

Figures in brackets are in percentages

Source: field results 2016

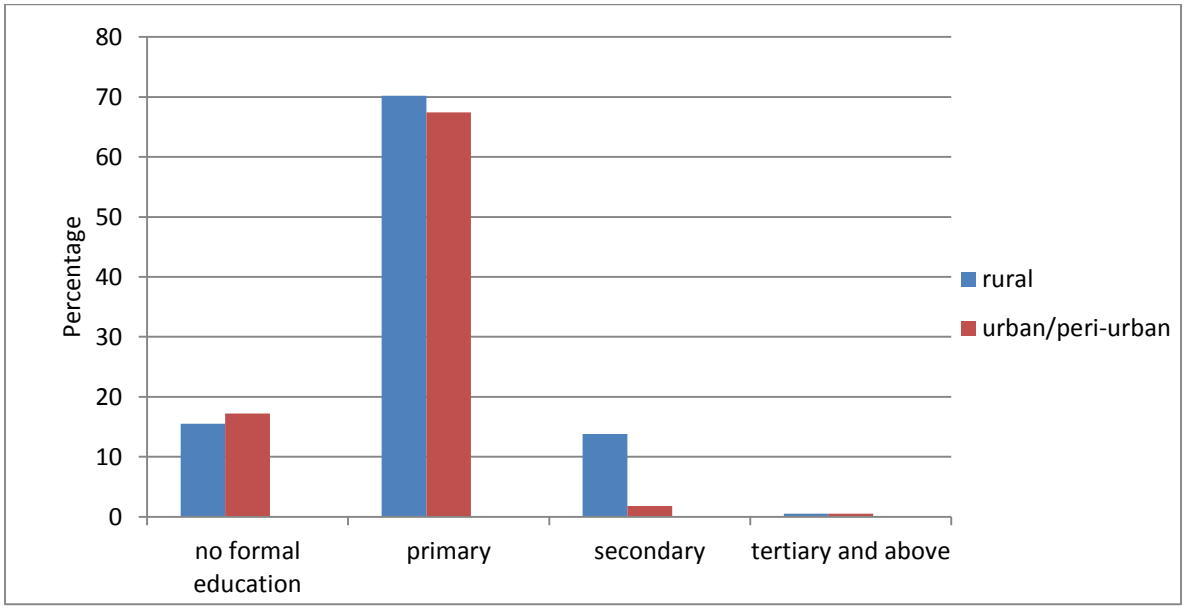

Figure 4: Education level of person working the donkey

4.3 Donkey Ownership Dynamics

4.3.1 Other Animals owned by the household

Respondents were asked to indicate other domestic animals they have apart from the donkey. The other animals were indicated as cattle, goats, sheep, poultry and others (such as dogs and cats) The Donkey owners indicated that they had other animals in their households in addition to the Donkeys such as cats and dogs. The most popular livestock kept was the poultry owned by 94% of the respondents followed by goats at 91%, cattle were owned by 58% of the households as shown in table 9.

Table 9: Other animals owned by the household

Other animals kept	study site		Total
	Rural n=181	Urban/Peri-urban n=215	N=396
Cattle	111 (61.3)	122 (56.7)	233 (58.8)
Goats	163 (90.1)	198 (92.1)	361 (91.2)
Sheep	16 (8.8)	7 (3.3)	23 (5.8)
Poultry	170 (94)	201 (93.5)	371 (93.7)
Other animals(dogs and cats)	46 (25.4)	46 (21.4)	92 (23.2)

Figures in brackets are percentages

Source: field results 2016

4.3.2 Number of Donkeys in the households

The respondents were to indicate whether they had one, two, three, four or five and above. Majority of the Donkey owners had between one and two donkeys. However urban / peri-urban households had a higher number of donkeys compared to the rural households. In both study sites majority of households had two donkeys at 45.9% for rural and 35.3% at the urban/peri-urban. The urban /peri-urban households had a higher percentage of ownership of three, four and five and above donkeys compared to their rural counterparts. Overall 40.2% of the respondents had two donkeys as shown in table 10 and figure 5.

Table 10: Number of donkeys per household

Number of donkeys in the household	study site		N=396
	Rural n=181	Urban/Peri-urban n=215	
1	64(35.4)	73(34)	137(34.6)
2	83(45.9)	76(35.3)	159(40.2)
3	28(15.5)	47(21.9)	75(18.9)
4	4(2.2)	14(6.5)	18(4.5)
5 & above	2(1.1)	7(2.3)	7(1.8)

Figures in brackets are percentages

Source: field results

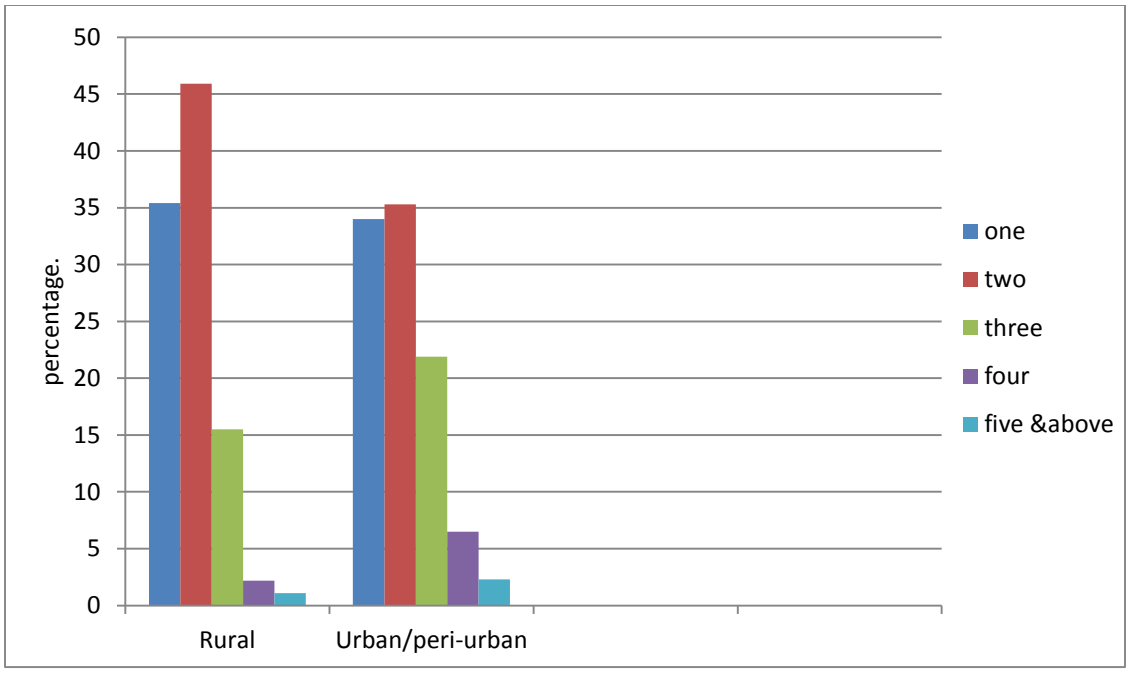

Figure 5: Number of donkeys in the household

4.3.3 Source of donkeys

The study wanted to establish where the donkey owners sourced their animals. The possible source of the donkey were that the animal was bought from the market, borne in the household, was paid to the family as dowry or was given as a gift to the household.

Majority donkey owners acquired them from the market (76 percent) while those born at households were 21percent (see table 11).

Table 11: Source of donkey:

Source of donkey		Study Site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
	Market	130 (71.8)	171 (79.5)	301 (76)
	born at hh	46 (25.4)	37 (71.2)	83 (30)
	Dowry	1 (0.5)	1 (0.5)	2 (0.5)
	Gift	4 (2.2)	6 (2.8)	10 (2.5)

Figures in brackets are percentages.

Source: field results 2016

4.3.4 Sex of the donkey

Respondents were asked to indicate the sex of the donkeys sampled for the study, either female or male. In this study, 54percent of the sampled donkeys were female and 46 percent male as in table 12.

Table 12: Sex of the donkey

Sex of donkey	study site		
	Rural n=181	Urban/Peri-urban n=215	N=396
Male	82 (45.3)	100 (46.5)	182 (46)
Female	99 (54.7)	115 (53.5)	214 (54)

Figures in brackets are percentages.

Source: field results 2016

4.3.5 Age of donkey

Ages of donkeys were categorized as between 1-3years,4-7 years,8-11years, 12-15years and 16years an above. Majority of donkeys at 40.7% were aged between 4-7 years followed by those aged 8-11years at 36.1%.The rural households used young donkeys aged between 1-3years the most at 7.7% while the urban / peri-urban households used the oldest donkey at 16 years and above the most at 4.7 %.(table 13).

Table 13: Age of donkey

Age of donkey	study site		
	Rural n=181	Urban/Peri-urban n=215	N=396
1-3	14 (7.7)	11(5.1)	25(6.3)
4-7	71(39.2)	90(41.9)	161(40.7)
8-11	67(37)	76(35.3)	143(36.1)
12-15	22(12.2)	28(13)	50(12.5)
16 and above	7(3.9)	10(4.7)	17(4.3)

Figures in brackets are percentages

Source: field results 2016

4.3.6 Tasks for which donkeys were used

Work performed by donkeys was listed as fetching water, ploughing, and multipurpose work. Majority of donkeys at 64.6% were used for fetching water while 34.8% of the donkeys were used for multipurpose kind of work like carrying farm produce to the market and from the farms. Only 0.5 percent of the donkeys were used for ploughing as shown in table 14 and figure 6.

Table 14: Tasks for which donkeys were used

Tasks done by donkey		study site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
	fetching water	129 (71.3)	127(59.1)	256(64.6)
	Ploughing	0(0.0)	2(0.9)	2(0.5)
	multipurpose	52(28.7)	86(40.0)	138(34.8)

Figures in brackets

Source: field results 2016

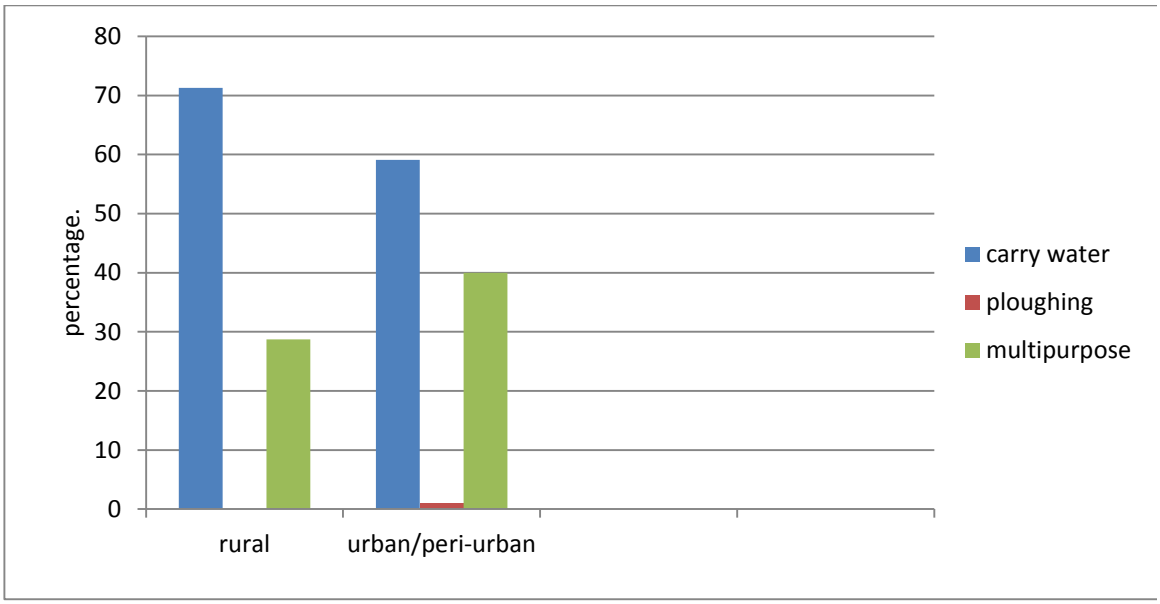

Figure 6: Work donkey performs

4.3.7 Days worked in a week

A large proportion of donkey worked for seven days at 42.4%. Majority of these works in the urban / peri-urban areas. Nearly half of the donkeys working in the urban/peri-urban areas work for 7 days. This therefore means that Donkeys working at the urban –peri urban areas worked for more days on average than those working in the rural areas. This information is shown in table 15 and figure 7

Table 15: Days worked in a week

Days worked in a week	study site		Total
	Rural n=181	Urban/Peri-urban n=215	N=396
1	7 (3.9)	2 (0.9)	9(2.3)
2	17(9.4)	7(3.3)	24(6.1)
3	29(16.0)	20(9.3)	49(12.4)
4	20(11)	12(5.6)	32(8.1)
5	10(5.5)	12(5.6)	22(5.6)
6	37(20.4)	55(25.6)	92(23.2)
7	61(33.7)	107(49.8)	168(42.4)

Figures in brackets are percentages

Source: field results 2016

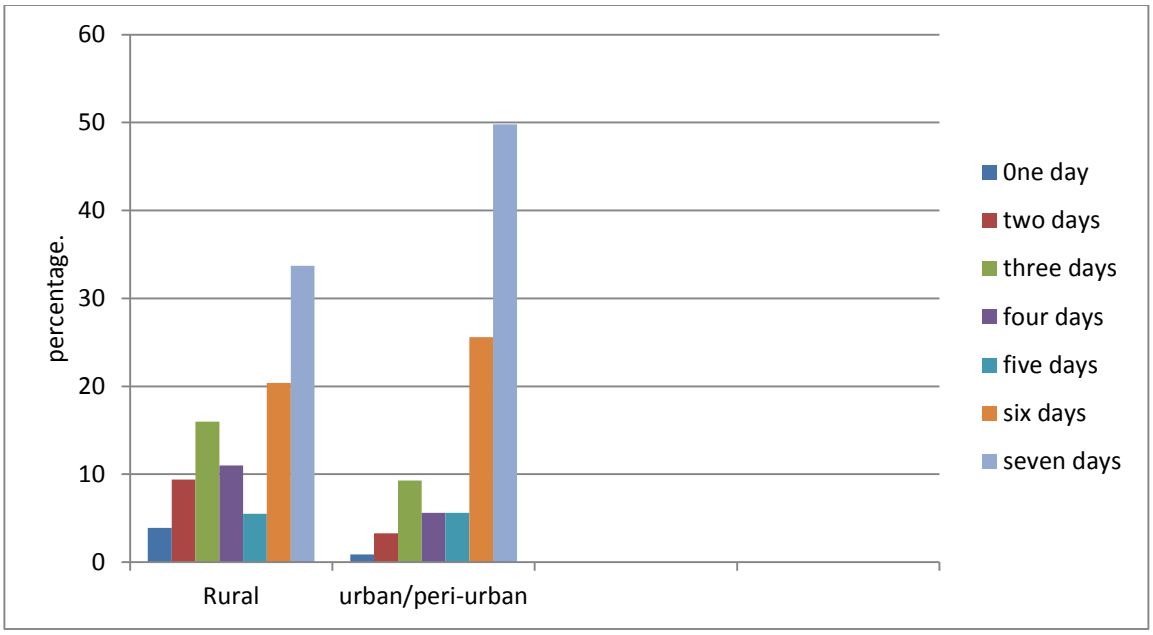

Figure 7: Days worked in a week

4.3.8 Hours Worked In a Day

Majority of donkeys worked for between 4-7 hours (53.2%) per day with those in the urban / peri-urban making the larger proportion while 39% work between 1 – 3 hours a larger proportion being those in the rural setup, of which more than half work for 1-3 hours (table 16 and figure 8).

Table 16: Hours worked in a day

Hours worked in a day	study site		Total
	Rural n=181	Urban/Peri-urban n=215	N=396
1-3	93 (51.4)	62(28.8)	155(39.1)
4-7	85(47)	126(58.6)	211(53.2)
8-12	3(1.7)	27(12.6)	30(7.7)

Figures in brackets are in percentages.

Source: field results 2016

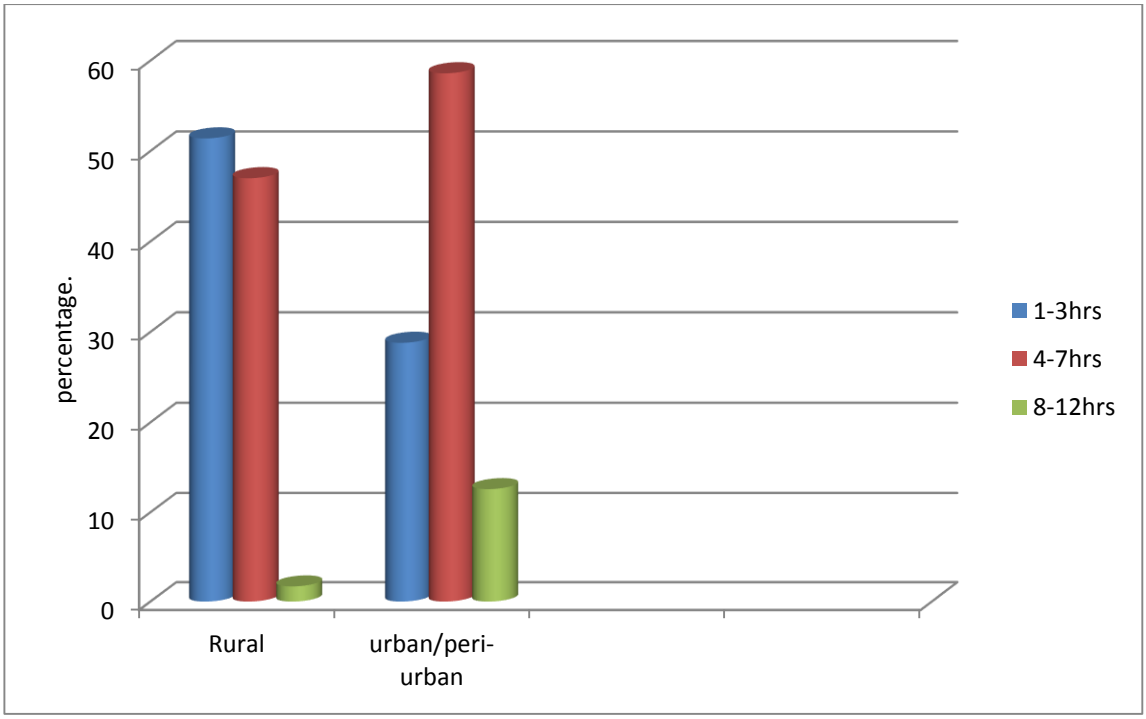

Figure 8: Hours worked in a day

4.3.9 Hours donkey is rested

The categories for resting hours were 1-3 hours, 4-7hours and 8-12 hours. The study found out that up to 48.7 percent of donkeys were rested for between 8-12 hours with majority of these being rural at 22%. This is followed by donkeys rested for between 4-7 hrs.at 47%. Majority of these were urban / peri-urban donkeys of which 38.1% rested for between 4-7hrs as shown in table 17. Plate 1 shows a group of donkeys resting after delivery of goods to town.

Table 17: Hours donkey is rested

Hours rested in a day	study site		
	Rural n=181	Urban/Peri-urban n=215	N=396
1-3	4 (2.2)	13 (6)	17(4.3)
4-7	69(38.1)	117(54.4)	186(47)
8-12	108(59.7)	85(39.5)	193(48.7)

Figures in brackets are in percentages.

Source: field results 2016

Plate 1: Donkeys resting in Mwingi town

4.4 Donkey Health and Welfare

4.4.1 Provision of water

The donkey owners were asked to whether they provide their animals with water or not and if they responded in the affirmative ,how often they provided the water per day categorized as once, twice or thrice per day. All those under the study responded to the affirmative on giving water. Majority of these gave water only once at 58.6 % while 35.6% of donkey owners give water twice per day while only 5.8% of the donkeys are given water three times or more as shown in table 18.

Table 18: Provision of water

provision of water		study site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
	+ve	181(100)	215(100)	396 (100)
times given water in a day	Once	119 (65.7)	113(52.6)	232(58.6)
	Twice	54(29.8)	87(40.5)	141(35.6)
	Thrice or more	8(4.4)	15(7)	23(5.8)

Figures in brackets are percentages

Source: field results 2016

4.4.2 Donkey health and frequency of sickness

A majority of donkey owners at 62.1% were not sure if their animals get sick or not. For 21.7% of the donkey owners their donkey get sick while 16.2% reported that their donkeys do not get sick as shown in table 19. For those who responded in the affirmative that their donkey get sick; majority at 82% got sick every 6 months.

Table 19 : Perception of health of donkey

Does donkey get sick	study site		
	Rural n=181	Urban/Peri-urban n=215	N=396
Yes	34(18.8)	52(24.2)	86(21.7)
No	31(17.1)	33(15.3)	64(16.2)
Not sure	116(64.1)	130(60.5)	246(62.1)

Figures in brackets are percentages.

Source: field results 2016

4.4.3 Provision of veterinary Medicare and service providers

A high proportion of donkey owners provide veterinary Medicare to their animals at 81.1% with a majority of these at 87.9% being those in the urban / peri-urban setup. The provision of the veterinary Medicare is done mainly by government officers at 43.7% and private animal health service providers at 37.4% as shown in table 20, 21 and figure 9.

Table 20: Provision of vet Medicare

Provision of vet Medicare		study site		
		Rural n=181	Urban/Peri-urban n=215	N=396
	+ve	132(72.9)	189(87.9)	321(81.1)
	-ve	49(27.1)	26(12.1)	75(18.9)

Figures in brackets are percentages.

Source: field results

Table 21: Veterinary Medicare providers

Veterinary care providers	study site		
	Rural (n=181)	Urban/Peri-urban (n=215)	N=396
private practitioners	70 (38.6)	78(36.3)	148(37.4)
government officers	62(34.3)	111(51.6)	173(43.7)
Ngo's officers	0	1(0.5)	1(0.3)
No Medicare	49(27.1)	25(11.6)	74(18.7)

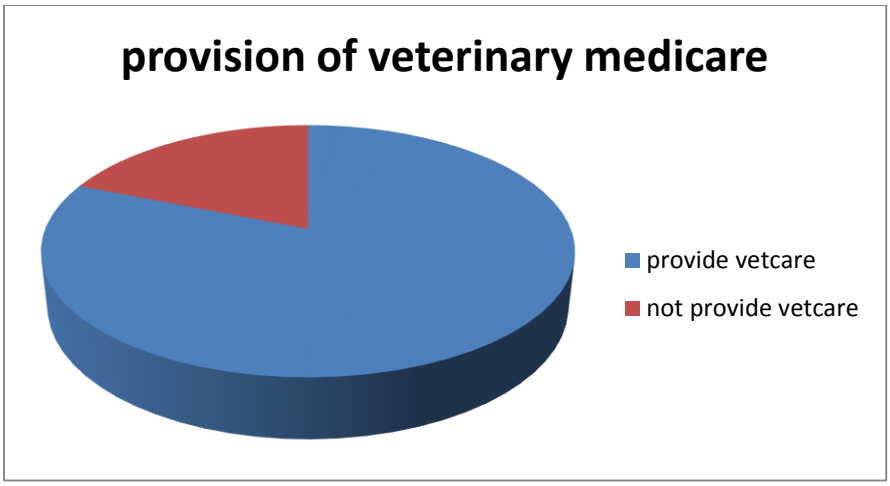

Figure 9: Provision of veterinary Medicare overall in both study sites.

4.4.4 Use of herbal medicine

In this study the plants commonly used were trees followed by shrubs. For the trees the bark and leaves and were commonly used while for the shrubs, the roots were commonly used. Three commonly mentioned and used plants were the *albiziaanthelmintica-brogn* whose bark is boiled and the cooled liquid drenched as a dewormer to the donkeys. The second most mentioned plant used was the *aspiliapluriseta*. The leaves of this plant are pounded, a little water added and the resultant juice is squeezed onto fresh wounds to stop bleeding and act as a disinfectant. The next mentioned plant was the *salvadorapersica* plant whose roots are boiled and the resultant liquid is drenched to relieve colic like symptoms in donkeys.

Among the donkey owners only 6.8% use herbal medication for treatment of donkey ailments, a larger proportion of these being in the in rural setup. Among the rural donkey owners 7.7% of them use herbal medication while 6% do so in the urban/peri-urban areas as shown in table 21.

Most of those who use herbal medication use it in boiled form (73%) a far majority of these being in the rural setup where (42%) of donkey owners use the herbal medication in boiled form.

Plate 2:Albiziaanthelmintica-brongn plant

Donkey owners use it to treat their animals against worms.

Plate 3:Aspiliapluriseta plant (*muuti)*

Used by donkey owners as an antiseptic to treat fresh wounds and to stop bleeding.

Table 22: Use of herbal medication

Use of herbal medication		Study site		
		Rural n=181	Urban/Peri-urban n=215	N=396
	Yes	14(7.7*)	13 (6.0)	27 (6.8)
	No	167(92.7)	202 (94)	369 (93.2)

Figures in brackets are percentages

Source: field results 2016

4.4.5 Types of plants

For the respondents who affirmed to the use of herbal medication to treat their donkey, the researcher wanted to find out the types of plants that they used. The plants were categorized as trees, shrubs, runners, climbers or weeds. Trees were commonly used plants in use at 4.55% followed by shrubs at 1% as shown in table 22. The part of the plant mostly used was the bark followed by leaves at 30%.Plant use for gastro-intestinal tract ailments was the bark at 70% and the leaves at 22%.

Table 23: Types of plants commonly used

Types of plant commonly used	study site		
	Rural n=181	Urban/Peri-urban n=215	N=396
Trees	9 (5)	9(4.2)	18(4.55)
Shrubs	3(1.7)	1(0.5)	4(1)
Runners	0	1(0.5)	1(0.3)
Climbers	2(1.1)	0	2(0.5)
Weeds	0	1(0.5)	1(0.3)

Source: field results 2016

Plate 4: Salvadorapersica plant

The roots of this plant are used to manage colic in donkeys.

Some common plants used by donkey owners to treat their animals were identified and the respondents shared information on how the plants were prepared and used. The table below summarizes the information.

Table 24: Commonly used herbal plants.

Scientific name	Local name	Use
Aspiliapluriseta. Plate 3	*Muuti*	The leaves are pounded, added some little water and the resultant juice used on fresh wounds after injuries and deep bruises. The respondents said that the juice acts as a disinfectant and stops bleeding.
Albiziaanthelmintica-brongn. Plate 2	*Mwoa*	The bark of the tree is boiled and the liquid after cooling is administered to animals as a dewormer.
Salvadorapersica. Plate 4	*Kisaki*	The roots are boiled and the resultant liquid is used as a drench to relieve colic like symptoms.

4.4.6 Awareness of Animal welfare

Donkey owners were asked on their knowledge regarding donkey welfare and their source information relating to donkey welfare. The possible sources of information regarding animal welfare were listed as animal health personnel, the local government chief, NGO staff, mass media e.g. radio, police, KSPCA and others.

The urban / peri-urban households had a better awareness of donkey welfare issues at 74% while their counterparts of the rural setup had an awareness rate of 56.4%.Overall majority respondents were aware of donkey welfare issues at 65.9%.Information regarding animal welfare was largely obtained from no-governmental staff officers at 30.8% while 19.7% of

the respondents get the information through mass media mainly the radio this is shown in table 24 and figure 10.

Table 25: Information regarding animal welfare

		Study site		
		Rural n=181	Urban/Peri-urban n=215	N=396
Awareness of animal welfare	Yes	102(56.4)	159(74)	261(65.9)
Information regarding animal welfare	animal health personnel	26 (14.4)	35 (16.3)	61(15.4)
	Chief	4(2.2)	1(0.5)	5(1.3)
	NGO staff	43(23.8)	79(36.7)	122(30.8)
	Radio	32(17.7)	46(21.4)	78(19.7)
	Police	0	1(0.4)	1(0.3)
	Others	76 (42)	53(24.7)	129(32.6)

Figures in brackets are percentages.

Source: field results 2016.

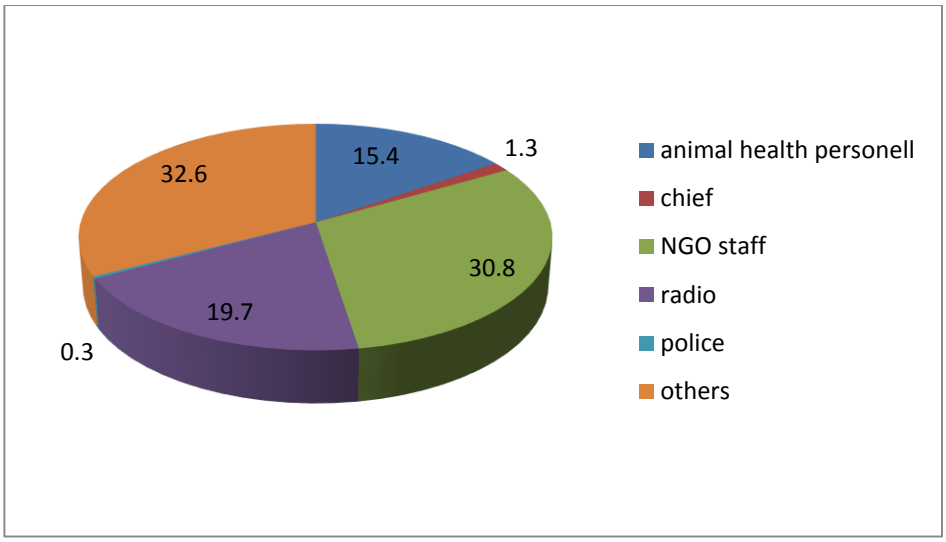

Figure 10: Source of information on animal welfare

4.4.7 Ailments commonly affecting donkey

Respondents were asked to indicate the most common ailment that affect their donkeys among a list of the following, skin conditions, respiratory conditions, gastro-intestinal conditions, muscular-skeletal conditions and eye conditions. Donkeys are commonly affected by gastro –intestinal conditions especially colic at 56.6% followed by skin conditions at 34.6% prevalence. This is illustrated in table 25 and figure 11.

Table 26: Common conditions affecting donkeys reported by the respondents.

Conditions commonly affecting donkeys	Study Site		
	Rural n=181	Urban/Peri-urban=215	N=396
Skin ailments	57(28.7)	80(37.2)	137(34.6)
respiratory	2(1.1)	1(0.5)	3(0.8)
gastro intestinal	109(60.2)	115(53.5)	224(56.6)
muscular skeletal	8(4.4)	15(7)	23(5.8)
eye conditions	5(2.8)	4(1.9)	9(2.3)

figures in brackets are percentages

Source: field results 2016

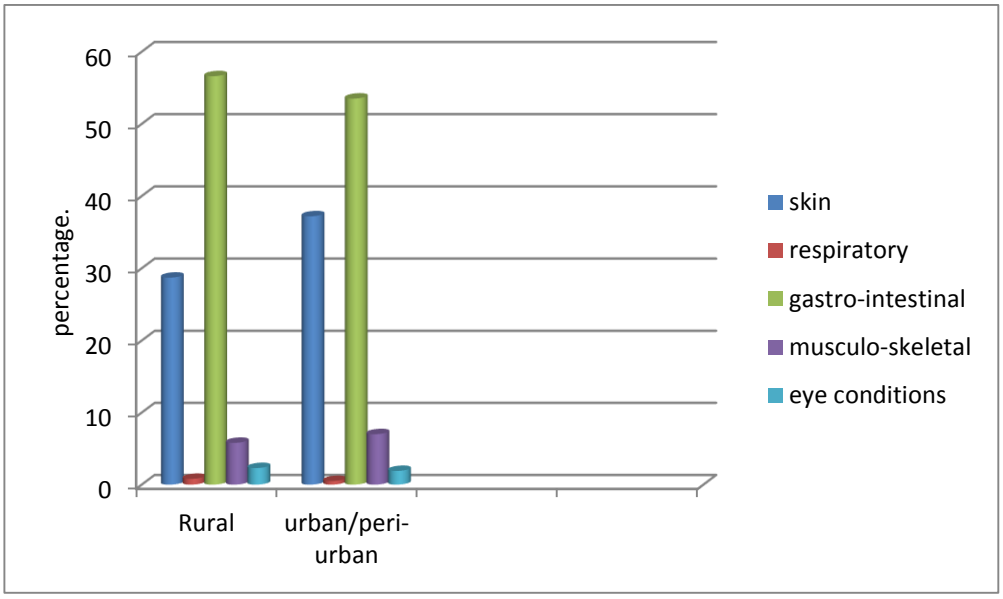

Figure 11: Common conditions affecting donkeys

4.4.8 Deworming of Donkeys

It was established that 78% of donkey owners deworm their animals with a majority of these being in the urban peri-urban areas. Those who deworm their animals do it at different frequencies, with 34.8% of them doing it after every 3 months. Another 22.7% of the donkey owners does it every 6 months and18.2% did it annually. Donkey owners preferred to use drench / suspension form of a dewormer at 58.6% and many of them gave the dewormer using the oral route 69.9% as shown in table 26 and 27.

Table 27: Donkey deworming

	Donkey deworming	Study site		
		Rural n=181	Urban/Peri-urban n=215	N=396
	+ve	128 (70.7)	180 (83.7)	308(77.8)
Frequency of deworming.	every 3 months	58 (32)	80(37.2)	138(34.8)
	every 6 months	39(21.5)	51(23.7)	90(22.7)
	every 9 months	5(2.8)	8(3.7)	13(3.3)
	once every year	28(15.5)	44(20.5)	72(18.2)

Figures in brackets are percentages

Source: field results 2016

Table 28: preferred deworming formulation and route

		Study Site		
preferred deworming formulation		Rural n=181	Urban/Peri-urban n=215	N=396
	Bolus	28(15.4)	17(7.9)	45(11.4)
	drench or suspension	90(49.7)	142(66)	232(58.6)
	Injectable	12(6.6)	26(12.1)	38(9.6)
	Not sure	51(28.2)	30(14)	81(20.5)
preferred deworming route	Oral	118(65.2)	159(74)	277(69.9)
	subcutaneous	12(6.6)	26(12.1)	38(9.6)
	Not sure	51(28.2)	30(14)	81(20.5)

Figures in brackets are percentages.

Source: field results 2016

4.4.9.1 Donkey housing

Of the respondents only 4% provide housing to their donkeys, most of these were in the urban / peri-urban areas table see 28.

Table 29: Donkey housing

		Study Site		Total
provision of donkey housing		Rural n=181	Urban/Peri-urban n=215	N=396
	Yes	4(2.2)	12(5.6)	16(4)
Regularity of housing	Always	4(2.2)	11(5.1)	15(3.8)
	During rainy season	1(0.6)	0	1(0.3)
	Sometimes	0	1(0.5)	1(0.3)

Figures in brackets are percentages

Source: field results 2016

4.4.9.2 Provision of mineral supplementation.

The study established that only 18% of the donkey owners gave mineral supplementation to the donkey mainly those in the urban / peri- urban areas. Majority of the respondents preferred using mineral supplements inform of powder14.6% while 3% used the mineral blocks (table 29).

Table 30: Provision of mineral supplementation

		Study Site		
provision of mineral supplementation		Rural n=181	Urban/Peri-urban n=215	N=396
	Yes	29(16)	41(19.1)	70(17.7)
preferred mineral form used	block	3(1.7)	9(4.2)	12(3)
	powder	26(14.4)	32(14.9)	58(14.6)

Figures in brackets are percentages.

Source: field results 2016

4.4.9.3 Harnessing and back padding

On use of harnessing, 33% responded in the affirmative on the use of the harness while a big majority of respondents used back padding at 96%. The commonly used material for padding was the sisal sack (40.7%) followed by cloth material (39.1%) and finally the nylon / polysack (16.9%) as shown on table 30.

Table 31: Harnessing, back padding and material used for back padding

		Study Site		
		Rural n=181	Urban/Peri-urban n=215	N=396
use of harness	+ve	65(35.9)	66(30.7)	131(33.1)
use of back padding	+ve	171(94.5)	209(97.2)	380(96)
material used for padding	Cloth	71(39.2)	84(39.1)	155(39.1)
	sisal sack	66(36.5)	95(44.2)	161(40.7)
	nylon sack	34(18.8)	33(15.3)	67(16.9)

Figures in brackets are percentages

Source: field results 2016

4.5 Physical and Pathological Welfare Indicators

4.5.1 Donkey lameness / Condition of hooves / Evenness

Lameness in donkeys was recorded at 13% of all the sampled animals with many of these being in the urban / peri urban areas at (14.4% in the urban/peri-urban group). Majority of lameness affected one limb of the donkey. Majority had even hooves (81%) with only 19% reported to have uneven hooves, while16.7% of the donkeys had cracked hooves with most of these being at the rural areas at 20.4% in the group. On being subjected to a t-test to determine significant difference at $p<0.05$, the hoof evenness and overgrown hooves were found to have statistically significant difference. Hoof evenness was statistically different ($p=0.039$) between the urban/peri-urban donkeys (85.1%) and rural (76.8%) donkeys. The

overgrown hooves were statistically different (p=0.042) between rural (8.8%) and urban peri-urban donkeys. overall overgrown hooves were recorded in 7.4% of the donkeys, again mainly being at the rural setup. This is illustrated in table 31, plate 5 and figure 12.

Plate 5: A donkey with cracked hoof

Table 32: Physical welfare indicators

		Study Site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
Lameness	Yes	21(11.6)	31(14.4)	52(13.1)
	No	160(88.4)	184(85.6)	344(86.9)
Limbs affected	One	19(10.5)	26(12.1)	45(11.4)
	Two	2(1.1)	7(3.3)	9(2.3)
	Three	0	1(0.5)	1(0.3)
	Four	0	0	0
Hoof evenness	Even	139(76.8)	183(85.1)	322(81.3)*
	uneven	42(23.2)	32(14.2)	74(18.7)
Condition of hooves	cracked	37(20.4)	29(13.5)	66(16.7)
	Not cracked	144(79.6)	186(86.5)	330(83.3)
Overgrown hooves	Yes	16(8.8)	13(6)	29(7.3)*
Number of hooves affected	One	8(4.4)	1(0.5)	9(2.2)
	Two	6(3.3)	10(4.7)	16(4)
	Three	0	1(0.5)	1(0.3)
	Four	1(0.6)	1(0.5)	2(0.5)

*Statistically significant at $p<0.05$

Figures in brackets are percentages

Source: field results 2016

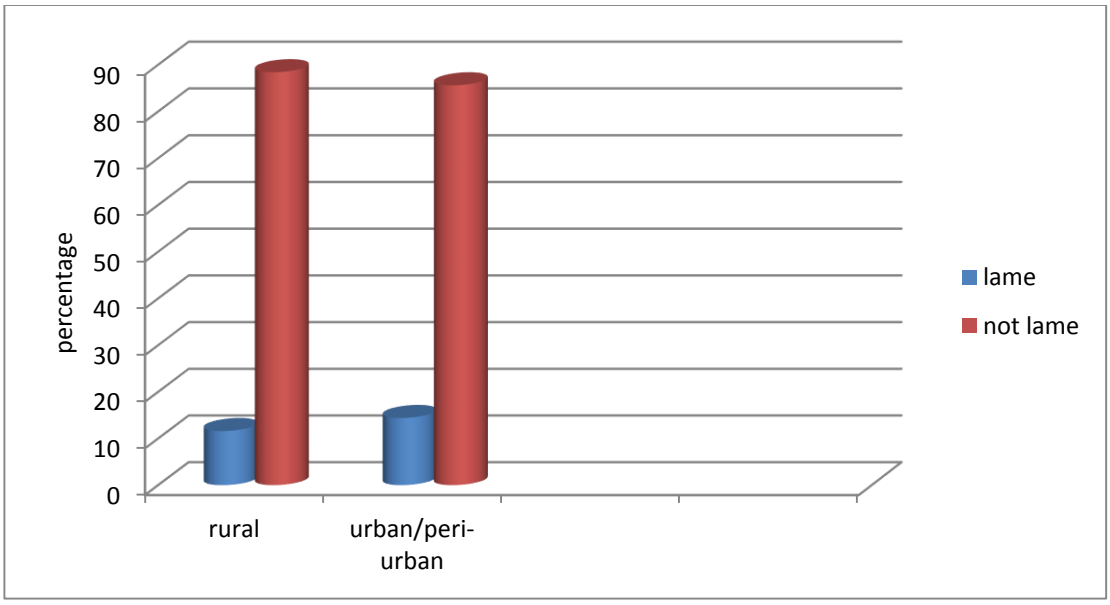

Figure 12: Lameness in rural and urban/peri-urban donkeys

4.5.2. Body condition / Hair coat appearance

A majority of donkeys at 64% had a medium body condition score with more than half of these being at the urban peri-urban settings. Those with a body condition score of fat were 28% while the thin ones were 8.8% in the urban / peri-urban animals while in the rural areas 7.7% of the donkeys were thin as shown in table 32, plate 6 and figure 13. On hair coat appearance 42% of the donkeys had smooth and shiny hair coat, while 37% had a starring hair coat appearance. Those with matted hair coat were 11% with 9% having uneven hair coat appearance table 33 and figure 14.

Plate 6: A donkey with a poor body condition (thin)

Source: field results 2016

Table 33: Body condition score

Body condition score	Study Site		Total
	Rural n=181	Urban/Peri-urban n=215	N=396
Thin	14(7.7)	19(8.8)	33(8.3)
medium	115(63.5)	138(64.2)	253(63.9)
Fat	52(28.7)	58(30)	110(27.8)

Figures in brackets are percentages

Source: field results 2016

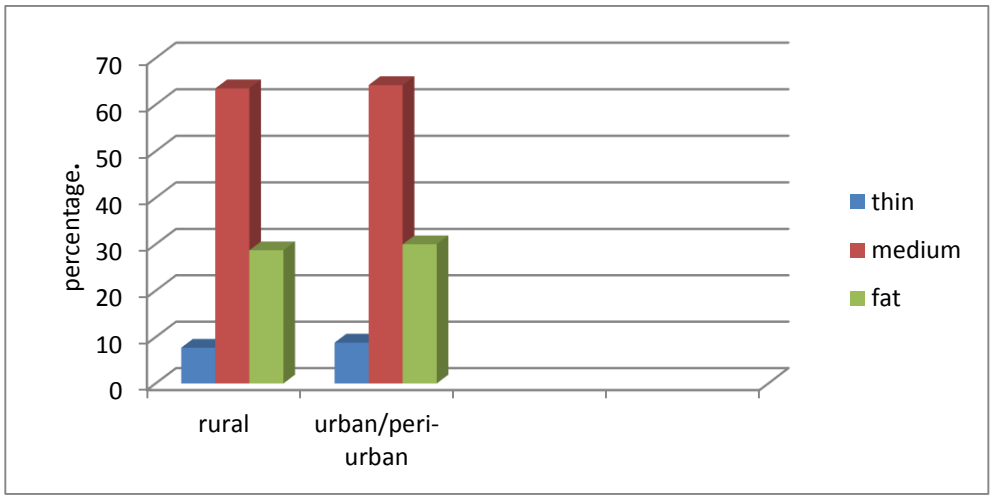

Figure 13: Body condition score. Rural versus urban/peri-urban donkeys

Table 34: Hair coat appearance

Hair coat appearance		Study Site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
	Smooth & shinny	73(40.3)	95(44.2)	168(42.4)
	starring	72(39.8)	76(35.3)	148(37.4)
	matted	19(10.5)	26(12.1)	45(11.4)
	uneven	17(9.4)	18(8.4)	35(8.8)

Figures in brackets are percentages

Source: *field results 2016*

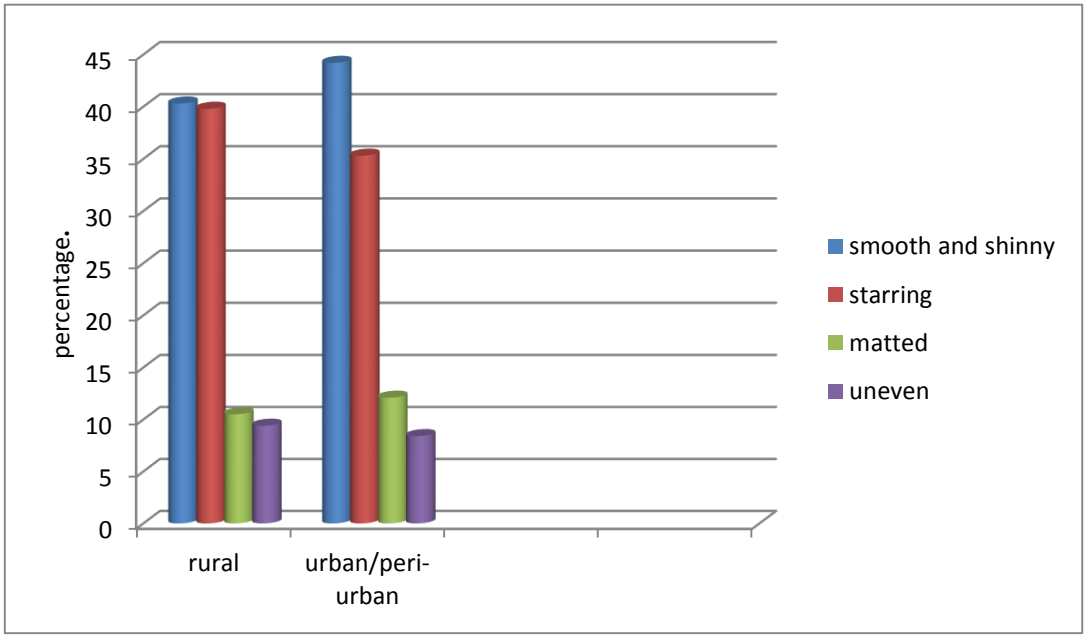

Figure 14: Hair coat appearance

4.5.3 Prevalence of wounds and scars

The number of wounds and scars on the animal were assessed according to the numbers categorized as 1-3,4-7, 8-11,12-15 and 16 and above. The body parts affected with wounds and scars were also evaluated. The presence of wounds prevalence was at 18.2% with a majority being in the urban / peri urban setting. Many of the donkeys had between 1-3 wounds at16.7 % with a large proportion at the urban peri-urban table 35 and plate 7.

The part of the donkey's body most affected by wounds was the sides followed by limbs and the back (see figure 16). Tether wounds caused by ropes on the limbs were found to be in 16.7% of the donkeys sampled. Out of these 11.6% of the donkeys had tether wounds on 2 limbs with a large proportion being in the urban / peri-urban centers at 12.1% (see plate 8 and table 36).

The study established that 52% of the animals sampled had scars on their body. Many of these at 27% were in the rural set-up. Majority of these had 1-3 scars at 85% with majority of these again being in the rural set-up. The body part with most scars was the sides of the animals, followed by the limbs and then the back (table 34 and figure 15).

Plate 7: A donkey with a septic wound on the back

Table 35: Scars on the animals

Scars on animal		Study site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
	+ve	108(59.7)	97(45.1)	205(51.8)
Number of scars	1-3	93(51.4)	81(37.7)	174(44)
	4-7	12(6.6)	15(7)	27(6.8)
	8-11	3(1.7)	1(0.5)	4(1)
	16and above	0	1(0.5)	1(0.3)

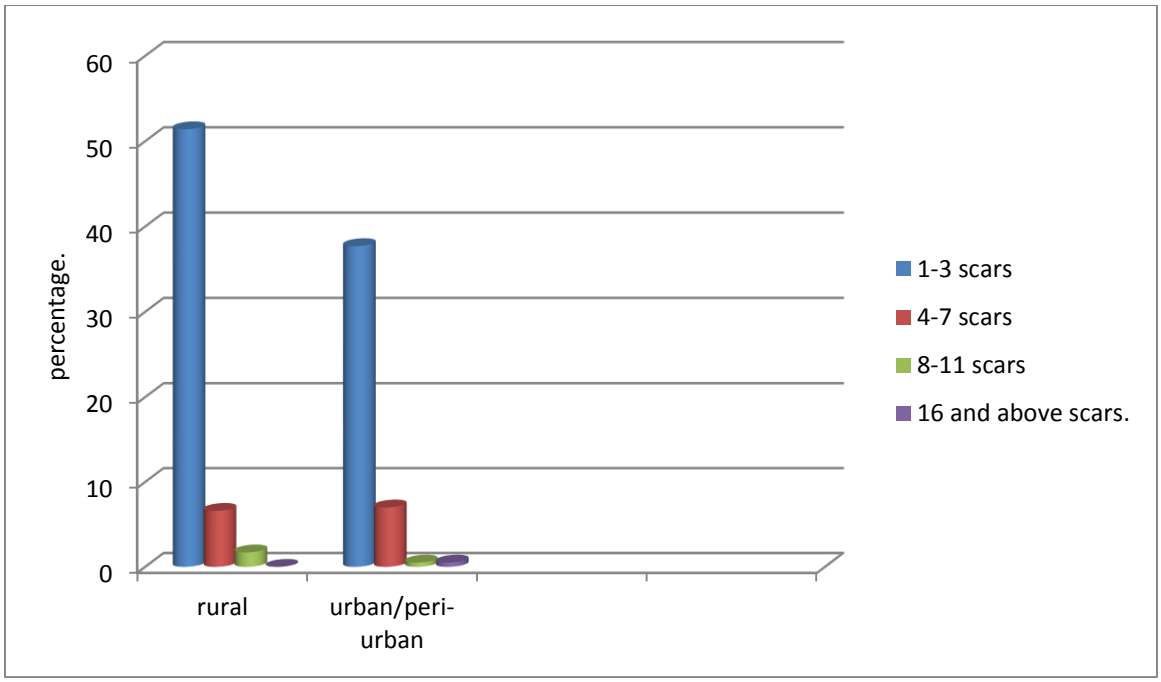

Figure 15: Scars count on the donkeys

Table 36: Presence of wounds, number of wounds and part affected

body wounds		Study site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
	+ve	33(18.2)	39(18.1)	72(18.2)*
number of wounds	1-3	28(15.5)	38(17.7)	66(16.7)
	4-7	4(2.2)	0	4(1)
	8-11	1(0.6)	1(0.5)	2(0.5)
body part affected with wounds	Back	7(3.9)	8(3.7)	15(3.8)
	Sides	13(7.2)	10(4.7)	23(5.8)
	Limbs	9(5)	10(4.7)	19(4.8)
	Neck	2(1.1)	6(2.8)	8(2)
	Loins	0	3(1.4)	3(0.8)
	Withers	1(0.6)	2(0.9)	3(0.8)

*Statistically significant at $p<0.05$

Source: field results 2016: Figures in brackets are percentage

On statistical analysis, prevalence of wounds and scars were found to be have a statistically significant difference at $p<0.05$ level. There was difference in wound prevalence between rural (18.2%) and urban/peri-urban donkeys (18.1%) where $p=0.012$. the prevalence of scars on the body was 59.7% in rural donkeys and 45.1% and was statistically different at $p=0.00$

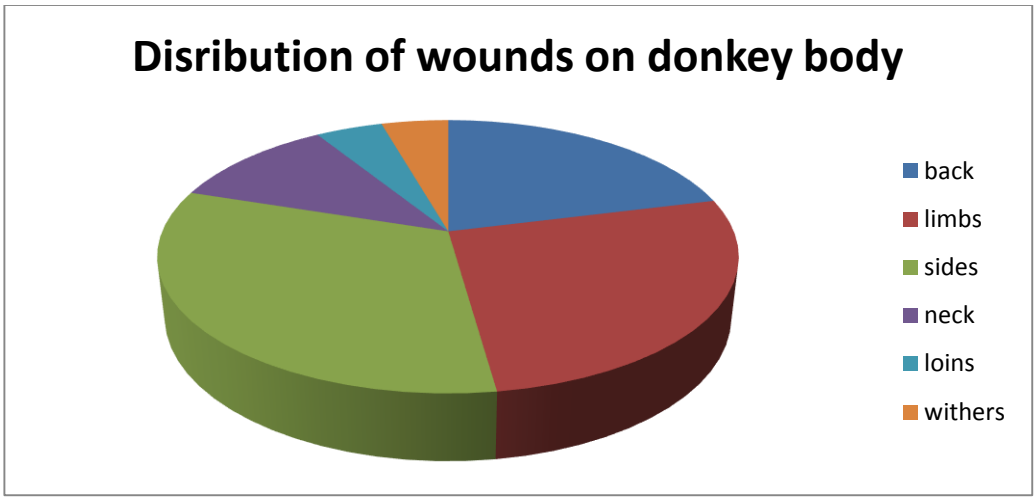

Figure 16: Body wounds

Plate 8: A tether wound on the foreleg of a donkey

Table 37: Tether wounds

		Study site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
tether wounds	Yes	32(17.7)	34(15.8)	66(16.7)
limbs affected by tether wounds	One	13(17.2)	12(5.6)	25(6.3)
	Two	20(11)	26(12.1)	46(11.6)

Figures in brackets are percentages.

Source: *researcher 2016*

4.5.5 Prevalence of external parasites

The animals were examined for the presence of external parasites. The parasites were categorized as ticks, fleas and lice. The ticks were further classified as either hard or soft ticks. The body part most infested with the ticks was also indicated.

The study established that 48.2% of the animals had external parasites, mainly ticks (46.7%), fleas were also recorded as well as lice but at very low rates. Hard ticks were highly recorded in occurrence at 34.3% of donkeys (see table 37). The body parts most affected by ticks were the ears followed by the perineum (see table 38).

Table 38: External parasites and type of parasite

		study site		Total
prevalence of external parasites		Rural (n=181)	Urban/Peri-urban (n=215)	N=396
	Yes	92(50.8)	99(46)	191(48.2)
parasite type on animal	ticks	88(48.6)	97(45.1)	185(46.7)
	fleas	5(2.8)	0	5(1.3)
	Lice	0	2(0.9)	2(0.5)

Figures in brackets are in percentages.

Table 39: Type of tick and body part infested

		study site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
Type of tick	Hard	65(35.9)	71(33)	136(34.3)
	Soft	24(13.3)	26(12.1)	50(12.6)
part of body most infested with ticks	Ears	64(35.4)	54(25.1)	118(29.8)
	Withers	11(6)	9(4.2)	20(5)
	Tail	3(1.7)	7(3.3)	10(2.5)
	Perineum	11(6)	22(10.2)	33(8.3)
	Limbs	1(0.6)	2(0.9)	3(0.8)
	Any other part	0	3(1.4)	3(0.8)

Figures in brackets are percentages.

Source: field results 2016

4.5.6 Eye Conditions

Among all the animals sampled 19% of the donkeys were found to have eye problem. Among these animals with eye conditions 12.9% had one eye affected. The animals had eye discharges and 2% of the animals had corneal opacity as shown in table 39 and plate 9. Prevalence of eye discharges was statistically different between urban/peri-urban and rural donkeys at p=0.042 where rural donkeys had 20.4% and urban/peri-urban prevalence was 18.1%. .Corneal opacity was also significant at p=0.016 with 2.2% prevalence in rural and 1.9% in urban/peri-urban donkeys.

Plate 9: A donkey with an eye condition(teary discharge)

Table 40: Respondents reporting on eye conditions in the donkeys

		study site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
Prevalence of eye problems	Yes	42(23.2)	35(16.3)	77(19.4)
Number of eyes affected	One	26(14.4)	25(11.6)	51(12.9)
	Two	17(9.4)	13(6)	30(7.6)
Eye discharge	Yes	37(20.4)	39(18.1)	76(19.2)*
corneal opacity	Yes	4(2.2)	4(1.9)	8(2)*

*Statistically significant at p< 0.05

Figures in brackets are percentages.

Source: field results 2016

4.6 Physiological Donkey Welfare parameters

4.6.1. Heart rate, capillary refill time and color of mucus membranes

The donkey's physiological parameters notably the heart rate, capillary refill time and the color of the mucus membranes were examined and recorded by the researcher. The heart rate was recorded per minute and was categorized as normal, above normal, and below normal. The capillary refill time was recorded in seconds and the appearance of the mucus membranes was recorded depending on color observed.

A high proportion of donkeys (87%) had normal heart rate while approximately 10% had their heart rate above normal those with below normal were recorded at 2.5% as shown in Table 41.

On skin pinch test, 62.1% of the animals had their skins return to normal at between 1-2 seconds, with 36.6% having their skin retract to normal at 3-4 seconds.(see table 42)

Among the sampled animals78.5% had a capillary refill time of 1-2 seconds while 20% had a CRT of 3-4 seconds (table 43 and figure 17)

The animal's oral mucus membranes were examined. A majority at 84% had pink and moist membranes, while those with congested mucus membranes were recorded at 4.3%. Animals, with pale mucus membranes formed a proportion of 11.4 %.(table 44 and figure 18).

All the physiological welfare indicators used were subjected to a t-test to determine the ones that showed significant differences. The only variables found to have significant differences between the rural and urban/peri-urban was the one on the color of the mucus membrane at p=0.010*.88.8% of the urban peri-urban donkeys with pink and moist mucus membranes compared with 79% for the rural working donkeys.

Table 41: Heart rate

Heart rate	Study Site		Total
	Rural n=181	Urban/Peri-urban n=215	N=396
Normal	161(89)	184(85.6)	345(87)
Above normal	15(8.3)	26(12.1)	41(10.4)
Below normal	5(2.8)	5(2.3)	10(2.5)

Figures in brackets are percentages

Source: field results 2016

Table 42: Skin pinch test

Skin pinch test	Study Site		Total
	Rural n=181	Urban/Peri-urban n=215	N=396
1-2 sec.	117(64.6)	129(60)	246(62.1)
3-4 sec.	64(35.3)	81(37.7)	145(36.6)
5 sec. and above	0	5(2.3)	5(1.3)

Figures in brackets are percentages

Table 43: Capillary refill time

prevalence of external parasites		Study Site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
prevalence of external	1-2 sec.	140(77.3)	171(79.5)	311(78.5)
	2-4 sec.	39(21.5)	41(19.1)	80(20.2)
	5 sec. and above	2(1.1)	3(1.39)	5(1.26)

Figures in brackets are percentages.

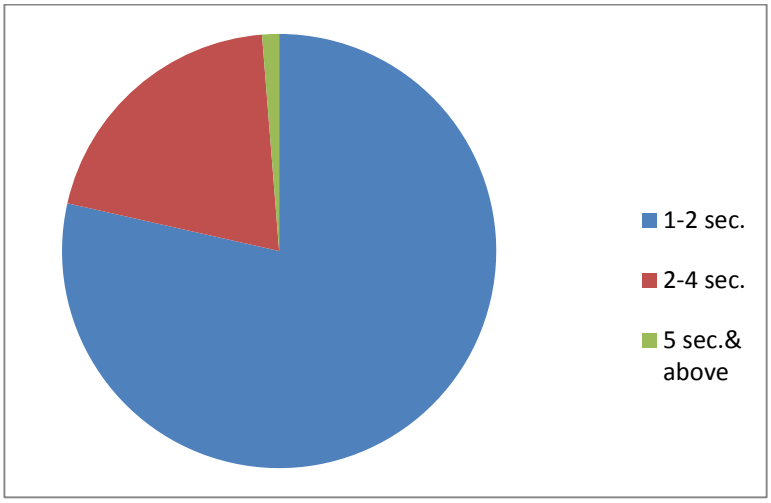

Figure 17: Capillary refill time

Table 44: Color of mucus membrane

Color of mucus membrane		Study Site		Total
		Rural n=181	Urban/Peri-urban n=215	N=396
	pink and moist	143(79)	191(88.8)	334(84.3)
	congested	10(5.5)	7(3.3)	17(4.3)
	Pale	28(15.5)	17(7.9)	45(11.4)

Figures in brackets are percentages.

*statistically significant at p< 0.05

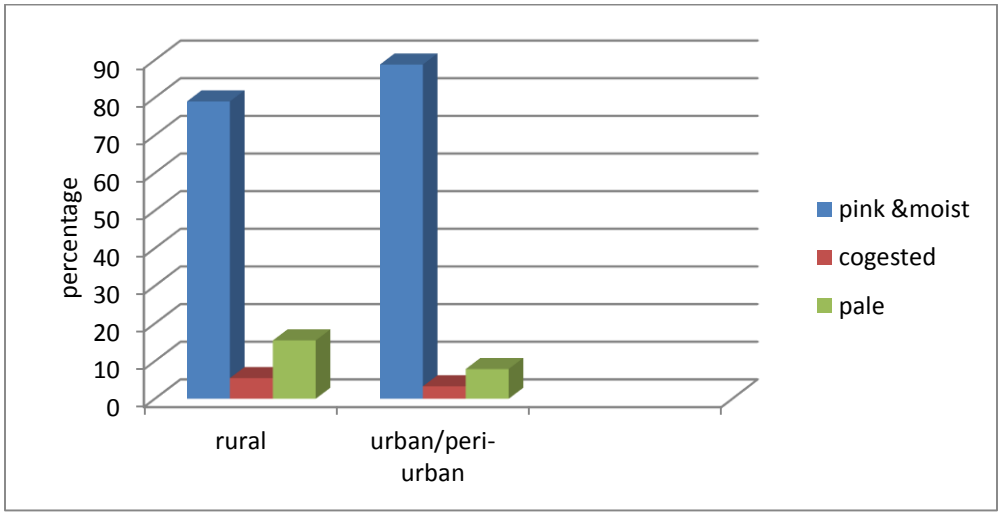

Figure 18: **Color of mucus membrane**

4.7 Cortisol Hormone Assays

4.7.1 Stress assessment by use of extracted free fecal cortisol

Table 45 represents the concentration of free cortisol found in fecal samples collected from donkeys working in the urban/peri-urban area of Mwingi town.

The samples were run in duplicates hence the mean cortisol levels per week and the grand mean cortisol levels for each of the donkey in the study.

The mean cortisol concentration levels for donkeys of Mwingi central ward in Mwingi town (urban/peri-urban) was found to be 54.662ng/ml. The concentrations ranged between 47.028 ng/ml (being the lowest) and 69.597ng/ml (being the highest). Comparatively in terms of stress level of donkeys, it was presumed the higher the cortisol concentration the higher the stress levels and vice-versa. As shown in table 47, the donkey coded as mwi.3 has the highest fecal cortisol level in the group. This particular animal seems to have had stressful events on week two and week three. A stressful event could be overworking, sickness or lack of feeding or watering. On the other hand, donkey coded mwi.7 with the lowest mean cortisol concentration appears to have begun in non-stressful condition on week one and continued on a stabilized conditions and therefore ended up with a low mean. This could be an indication of an animal whose welfare is good, with good nutrition, free from disease and not overworked.

Table 45: Fecal cortisol concentration of Mwingi central ward donkeys (urban/peri-urban)

Donkey code.	Week 1 Mean cortisol conc.	Week 2 Mean cortisol conc.	Week 3 Mean Cortisol conc.	Week 4 Mean cortisol conc.	Average Grand mean cortisol conc.
MWI 1	44.870	50.069	65.05	66.402	56.598
MWI 2	51.290	61.564	38.805	46.243	49.476
MWI 3	52.579	69.585	109.970	46.555	69.597
MWI 4	56.122	40.881	53.094	58.556	52.163
MWI 5	61.329	37.392	41.690	47.701	47.028
MWI 6	64.156	74.764	67.974	42.366	62.315
MWI 7	45.117	41.198	52.162	52.511	47.747
MWI 8	49.761	49.378	42.646	67.699	52.371

Source: field results 2016

The table below (46) represents the concentrations of free cortisol found in fecal samples collected in the urban /peri-urban area of Nguni ward in Mwingi central sub County. For this group of donkeys their mean cortisol concentration was 56.423ng/ml. The donkey with the highest cortisol concentration was coded Ng.1 (67.779 ng/ml) while the lowest had 48.108ng/ml.

Table 46: Fecal cortisol concentration of Nguni donkeys (urban/peri-urban)

Donkey code	Week 1 Mean cortisol conc.	Week 2 Mean cortisol conc.	Week 3 Mean cortisol conc.	Week 4 Mean cortisol conc.	Grand mean cortisol conc.
Ng1	56.791	72.034	81.664	60.625	67.779
Ng 2	41.310	42.557	58.249	50.314	48.108
Ng 3	54.378	74.396	59.509	49.868	59.538
Ng4	54.841	74.906	37.324	52.124	54.799
Ng 5	41.890	40.669	84.449	44.153	52.790
Ng 6	60.173	53.596	71.103	47.563	58.109
Ng 7	71.031	47.650	56.645	40.013	53.835

The table (47) below represents the concentrations of free cortisol found in fecal samples collected in the urban /peri-urban area of Nuu ward in Mwingi central sub County. From this ward the urban /peri-urban donkeys had a mean cortisol concentration of 52.160ng/ml. the animal with the highest cortisol concentration was Nuu4 (57.962 ng/ml) while donkey coded Nuu7 (47.539ng/ml) had the lowest cortisol concentration.

Table 47: Fecal cortisol concentrations of Nuu ward donkeys. (Urban/peri-urban).

Donkey code	Week 1 Mean cortisol conc.	Week 2 Mean cortisol conc.	Week 3 Mean cortisol conc.	Week 4 Mean cortisol conc.	Grand mean cortisol conc.
Nuu 1	53.286	46.450	60.483	52.372	53.148
Nuu 2	51.066	51.530	49.735	38.557	47.722
Nuu 3	38.405	53.139	83.908	47.726	55.795
Nuu 4	50.176	45.776	61.257	74.640	57.962
Nuu 5	66.446	54.482	49.520	45.053	53.875
Nuu 6	42.244	58.983	47.817	47.260	49.076
Nuu 7	43.717	53.881	58.230	70.185	47.539

Table 48 below represents the concentrations of free cortisol found in fecal samples collected in the rural area of Kanzui area of Mwingi central ward in Mwingi central sub County. Six animals were sampled and the donkey with the highest cortisol concentration was Kan 2 which had 80.626ng/ml, while the lowest was 45.574ng/ml from donkey coded Kan 1. The mean for this particular group was 63.664ng/ml. The donkey coded Kan 2 appears to have had stressful events on week one and week two when the cortisol levels increased progressively. It was established that donkeys Kan 2 and Kan 3 were being used to fetch water and ferry other building material for the construction of a classroom in a local primary school. Donkey Kan 5 was noted to have been suffering from a skin condition and Helminthiosis and was under treatment during the study period.

Table 48: Fecal cortisol Assay results of Kanzui area donkeys (rural)

Donkey code	Week 1 Mean cortisol conc.	Week 2 Mean cortisol conc.	Week 3 Mean cortisol conc.	Week 4 Mean cortisol conc.	Grand mean cortisol conc.
Kan 1	43.717	53.881	58.230	70.185	45.574
Kan 2	99.747	114.342	55.856	52.557	80.626
Kan 3	50.574	54.592	77.513	91.386	68.516
Kan 4	59.973	48.075	45.888	59.008	53.236
Kan 5	73.867	94.086	87.854	53.913	77.430
Kan 6	43.631	43.897	67.524	71.359	56.603

4.7.5 Donkeys with elevated cortisol levels (Kanzui rural area)

The data set obtained from this group of animals with elevated cortisol levels, namely kan. 2(80.626ng/ml) and kan. 5(77.430 ng/ml) was noted and the explanation was as explained.

Table 49 below represents the concentrations of free cortisol found in fecal samples collected in the rural area of Ikusya area of Waita ward in Mwingi central sub County.

For waita ward, the rural donkeys were sampled from Ikusya village in a rural setting. Here the donkey with the highest cortisol concentration had 74.403ng/ml while the lowest had 35.196ng/ml. the mean cortisol concentration for this group of animals was 51.466ng/ml. the donkey code named Iku. 2 was being used for the ferrying of construction material mainly sand and water at the household level for the construction of a house at the

homestead. This could explain the high fecal cortisol levels in its results. Fecal sample for week 4 for donkey code named Iku 5 was not obtained as the owner had reportedly sold the donkey.

Table 49: Fecal cortisol Assay results of Ikusya area donkeys of Waita ward (rural)

Donkey code	Week 1 Mean cortisol conc.	Week 2 Mean cortisol conc.	Week 3 Mean cortisol conc.	Week 4 Mean cortisol conc.	Grand mean cortisol conc.
IKU 1	45.810	43.284	37.890	47.344	43.582
IKU 2	67.525	88.890	73.458	67.740	74.403
IKU 3	53.927	45.715	59.088	63.195	55.481
IKU 4	61.644	43.129	71.068	95.849	43.960
IKU 5	33.138	31.513	40.936	-	35.196
IKU 6	61.507	66.251	51.152	45.789	56.175

Table 50 below represents the concentrations of free cortisol found in fecal samples collected in the rural area of Ngungi area of Mui ward in Mwingi Central sub County.

These animals had a mean concentration level of 48.225ng/ml where the highest had 53.759ng/ml and the lowest was 44.485ng/ml. This group had the most stable cortisol concentrations with no particular donkey out of the ordinary.

Table 50: Fecal cortisol Assay results of Ngungi area donkeys of Mui ward (rural)

Donkey code	Week 1 Mean cortisol conc.	Week 2 Mean cortisol conc.	Week 3 Mean cortisol conc.	Week 4 Mean cortisol conc.	Grand mean cortisol conc.
Ngi 1	29.335	47.653	55.854	51.795	45.909
Ngi 2	45.305	42.333	50.221	40.081	44.485
Ngi 3	41.674	40.669	44.278	88.415	53.759
Ngi 4	59.162	40.783	42.794	62.648	51.347
Ngi 5	50.141	38.023	59.452	-	49.205
Ngi 6	32.526	56.765	-	-	44.646

Source: field results 2016

For donkey ngi. 6, samples for week 3 and 4 were not collected and donkey ngi. 5 samples for week 4 were also not collected as the donkeys were unavailable.

Table 51: Descriptive Statistics on standard error of mean.

Description	N	Maximum	Minimum	Mean		Std. deviation
				Statistic.	Standard Error.	
Urban/peri-urban donkeys and Rural working donkeys.	40	80.626	35.196	54.43758	1.525787	9.649927

Based on the statistics above where the mean cortisol concentration is 54.437 ng/ml and the standard error of mean is +/_ 1.525 then the basal cortisol levels for these donkeys in the study ranges between 52.926 and 55.976 ng/ml.

Table 52: Mean cortisol concentration for all the study animals

(22 urban/peri-urban and 18 rural donkeys.)

*Donkey with elevated cortisol levels

Sample number.	**Grand mean cortisol concentration in fecal samples for urban/peri-urban donkeys. ng/ml**SEM+/- 1.525	**Grand mean cortisol concentration in fecal samples for Rural donkeys. ng/ml** SEM+/-1.525
1	56.598	45.574
2	49.476	80.626*
3	69.597	68.516
4	52.163	53.236
5	47.028	77.430*
6	62.315	56.603
7	47.747	43.582
8	52.371	74.403*
9	67.779	55.481
10	48.108	43.960
11	59.538	35.196

12	54.799	56.175
13	52.790	45.909
14	58.109	44.485
15	53.835	53.759
16	53.148	51.347
17	47.722	49.205
18	55.795	44.646
19	57.962	-
20	53.875	-
21	49.076	-
22	47.539	-
Grand total cumulative mean concentration.	**54.425**	**54.451**

Source: field results 2016

From the table above the mean cumulative cortisol concentrations for the urban/peri-urban and rural donkeys are nearly equal. However the results need to be interpreted with caution since in the category of rural working donkeys 3 animals namely Kan2, Kan 5and Iku. 2 were found to have elevated cortisol concentration levels above the rest in their category. The reasons for their elevated cortisol concentration were due to increased workload for Kan 2and Iku2 while Kan 5 was noted to have been suffering from a skin condition and Helminthiosis.

A statistical analysis of the cortisol concentration levels of the 40 animals without the 3 rural donkeys with elevated cortisol concentration levels reveals that the urban/peri-urban donkeys have a higher cortisol concentration levels compared to their rural counterparts.

Table 53: Mean cortisol concentration excluding rural donkeys with elevated cortisol levels

Description	N	Maximum	Minimum	Mean		Std. deviation
				Statistic.	Standard Error.	
Urban/peri-urban donkeys	22	69.597	47.028	54.43758	1.339	6.281
Rural working donkeys.	15	68.516	35.196	49.84493	2.0395	7.899

The mean for rural donkeys was 49.844 and 54.425ng/ml for urban/peri-urban donkeys excluding the 3 rural donkeys with elevated cortisol concentrations. This result would suggest that rural working donkeys have lower cortisol concentrations compared to their urban/peri-urban counterparts.

A graphical comparison of free fecal cortisol concentration between urban/per-urban and rural working donkeys.

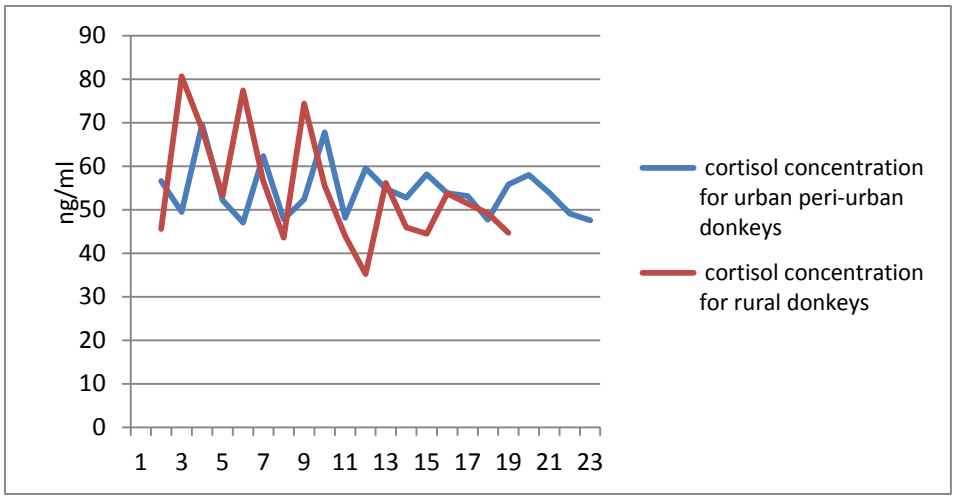

Figure 19: cortisol levels of urban/peri-urban and rural donkeys including those (3) rural donkeys with elevated cortisol levels.

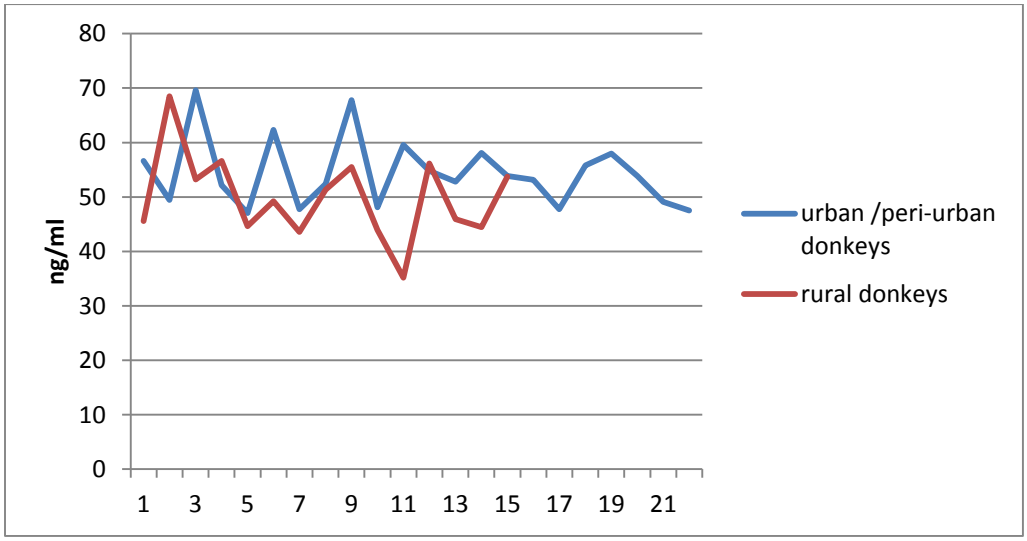

Figure 20: cortisol levels of urban/peri-urban and rural donkeys excluding those (3) with elevated cortisol levels.

CHAPTER FIVE

DISCUSSION

5.1 Demographic Characteristics of the Respondents

According to the Kenya Integrated Household Budget survey report (KIHBS) 2005/6, at the national level for every 10 households, seven are headed by males while three are headed by females. Female headed households are higher in the rural areas at 32.6 percent compared to 32.1 percent in the urban/peri-urban areas.

The house hold head is responsible for the economic well-being of the household. The investigation of house- holds according to the sex of the HH head is motivated by the understanding on the role of the HH on gender differences in access to resources (Budlender, 2003). A donkey in a household is a livestock resource. Research has shown that gender of the Household head affects the manner in which household resources are utilized and disbursed within the household. (Lloyd and Gage, 1993).

Women who are Household heads are more autonomous and have more control over resources by virtue of their position, than women who are not Household heads (Budlender, 2003). In a study carried out by IFPRI (Russel *et al.,* 2015), in regard to Household headship, in all countries in the project, men had higher levels of household headship than female headship.

The gender differences in ownership and access to use donkeys vary per different social arrangements prevailing in different cultures (Braimah, 2014).

Though the ownership of donkeys by women is not uncommon, in many societies they are owned and controlled by men. Among the Maasai for instance, though women have access to the use of donkeys, a woman cannot sell a donkey without a man's permission (Mutharia, 1995).

In this study most of the sampled HH were headed by men who are expected to dominate Household headship in a patriarchal African society.

Formal education is described as schooling in primary, secondary and tertiary institutions (KIHBS 2005/6). In this study 80% of the respondents had attained formal education.

Those in the primary education formed the majority at 48% with the huge proportion of these being in the urban / peri-urban setting.

External factors that affect people's concern for animal welfare include affluence, education, cultural heritage and religious believes (Bousefield 2010)

According to (Braimah 2014), education has influence on perception and involvement, particularly in decision making and monitoring of activities regarding resource use. There is a correlation between the educational attainments of an individual and how such individuals imbibe different dissenting opinions.

Majority of the respondents were farmers followed by those who engage in *juakali* work (informal employment activities, such as construction work, fetching and selling water and firewood). These types of work usually require the use of the donkey in carrying the loads from one place to another. Farmers are also more likely to use the donkey in their farm work such as carrying farm production inputs such as fertilizer. Seeds, and later during harvesting time, in the ferrying of the farm produce from the farms to the homes and later to the markets for sale.

In another study carried out in northern Tanzania by Swai and Bwanga in 2008, the major sources of regular income for the respondents were agriculture and livestock rearing.

The use of donkeys by women is significant as women often find donkeys easier to use than oxen (Fernando, 2000). For many women headed households donkeys are also usually more affordable. The gender issues in use and management of donkeys are dependent on the roles and responsibilities that women and men have in different communities where donkeys are used. These roles and responsibilities are dynamic and change with time.

(Fernando, 2000). Household roles categorized and related to maintenance of household such as cooking, fetching water and collecting firewood are allocated to women. The gender differences in the use of donkeys and the benefits accruing from this use stem from the fact that in most societies women and men carry out different tasks. A woman's transport burdens derive primarily from her reproductive or domestic responsibilities whereas a man's transport burdens are related to his productive role. In the predominantly cattle rearing area of western Zambia, women farmers and female household heads have embraced the use of donkeys. In this area, most donkeys are owned by women who use them to work in the fields and to carry out household chores (Bwalya, 1997).

5.2 Donkey dynamics and characteristics

Both males (intact males are called jacks and castrated males are geldings) and females (Jennies) can be used for work According to (Oudman, 2004), donkeys reach maturity around four years of age with maximum age being reached at about six years of age. When they are well taken care of donkeys can have a working life of 12-15 years and can even live longer. Animals that are young and still growing and females that are pregnant or nursing need extra energy especially extra protein and important minerals such as calcium and phosphorous (Oudman, 2004). The question of if there is an ideal sex for working donkey, and if so is it females, intact males or castrated males is pertinent (Jones, 1997). However it has been shown that animal sex has little apparent direct effect on the work output of donkeys. If males are stronger than females, this could be more of function of their sometimes larger size, and freedom from the energetic demands of pregnancy (Jones, 1997).

It is during this resting period that donkeys get to feed so as to get energy for sustenance and work purposes. Feeding is an important aspect in the management of farm animals. According to (Aganga *et al.,* 2000), it requires knowledge of feeding behavior and nutrient requirement of animals for specific production functions such as work. In arid and semi-arid areas, donkeys eat a variety of feeds. They should be allowed to graze for six to seven hours a day on free range (Aganga *et al*., 2000). Donkeys are nutritionally adaptable to life

in arid lands, capable of tolerating up to 30% dehydration and are good selective grazers. The advantage of having a narrow muzzle and mobile lip promote greater selectivity in feeding which allows them to maximize feeding quality rather than quantity (Aganga *et al.*, 2000). Donkeys spend less energy while foraging for food. This lowered energy costs results in lowered dry matter intake, thereby enabling donkeys to have lower maintenance costs than any other livestock species (Smith and Pearson, 2005)

A donkey is a monogastric herbivore thus it eats roughages and utilizes roughages and hemicelluloses efficiently. Dry matter intake of the donkey is high compared to with other large herbivores, being 3.1%of live weight (Maloiy, 1973).

A general rule of the thumb is that donkeys should be provided daily with straw or hay equal to 5%of its body weight, even though it may only eat half of this (Jones, 1997).When the animals are expected to produce extra work or when the grazing range has been depleted, supplementary feeding may be required (Aganga *et al.,* 2000).

5.3 Donkey Health and Welfare

Donkeys harbor myriad infections and parasitic agents, not all which have been thoroughly investigated in this animal. Identification is often taken from knowledge of the diseases in horses (Pearson *et, al* 1999).however horses may be more susceptible to some diseases as compared to donkeys which may be more tolerant to some diseases such as tse-tse transmitted trypanosomes. Nevertheless *trypanosome brucei* causes acute disease in donkeys. Studies have shown that donkeys are a host to a wide diversity and high prevalence of helminth parasites which can lead to disease when the animals are under fed or overworked (Pearson *et, al* 1999). The clinical effects of helminth disease on donkeys are less well known than in horses.

In a study carried out in Ethiopia by (Niraj, 2014) on donkey welfare assessment, 31.6%of the diseased donkeys were taken to the nearby veterinary clinics, 10.5% were treated traditionally, and 57.9% did not get any help from their owners and were forced to work regardless of the disease. Another study carried out in northern Ethiopia by Getnetet, al

(2014), on causes of welfare problems in donkeys, treatment interventions by owners was done with traditional medications before being taken to the veterinary clinics.

In another study by Amante *et al.,* (2014) 10.6% of the respondents treat their animals traditionally by use of plant juice by drenching, pouring on animals which is mainly derived from leaf bark of tree and seeds. Similarly 88.2% of respondents used veterinary clinics to treat their animals while only 0.5%left untreated due to misconception that donkeys do not need treatment.

In this study government veterinary officers were identified to be the main veterinary service providers. This is because they are evenly distributed in the study area compared to the private veterinary service providers who are usually found around the major urban trading centers. Quacks are also known to take advantage of the unavailability of qualified veterinary personnel to provide substandard services to the unsuspecting donkey owners.

5.4 Herbal and plant therapies

Herbal medicine has been used from ancient times. It involves the medicinal use of plants to treat diseases and enhance general health and wellbeing. In this study a small proportion of the donkey owners were found to be using herbal medication. Majority of these were in the rural areas, which could be explained by scarcity of convectional veterinary medication outlets compared to urban peri-urban areas where Agro-veterinary shops and majority of veterinary service providers are easily found and located. As per Scantlebury *et al.,* (2013), according to circumstances and depending on their relative efficacy, bioactive plants offer an alternative that may overcome problems of drug resistance, availability of modern medicines and excessive cost of the modern drugs.

A number of studies from Ethiopia and elsewhere have reported plants that are believed to have efficacy against internal parasites in ruminants, chicken and people. (Scantlebury *et al*., 2013).

5.5 Community awareness on Animal welfare

The study established that large number of respondents (65.9%) were aware of donkey welfare issues. The urban/peri-urban donkey owners had a higher percentage of donkey welfare knowledge at 74%.this can be attributed to the work and advocacy of animal welfare organizations which are found based in the urban centers as opposed to the rural areas which are in the interior and no animal welfare organizations are based there. The respondents obtained information regarding animal welfare issues mainly from NGO officers, mass media (radio), animal health personnel, and others such as teachers, relatives and other donkey owners. This indicates to a large extend the effectiveness of non-governmental organizations involved in animal welfare promotion in the area. Some of these are; the donkey sanctuary (Kenya), the KSPCA, and the Brooke through Caritas Kitui. The approach of involving animal health care providers in welfare issues by these organizations seem to be bearing good results since 15.4% of the respondents obtain their animal welfare information from them.

In this study only 4% of the donkey owners provide them with housing or shelter, this is in contrast to a study by Amante *et al.,* (2014) on health and welfare assessment of working equine in and around Nekemete Town, east Wollega zone, Ethiopia where 76.6% of the respondents provide shelter at night to protect them from predators and other factors.

5.6 Physical and Pathological Welfare Indicators

In this study only 13% of the donkeys were lame and this contrasts with the findings of Pritchard *et al.,* (2005), which found that 99% of animals surveyed in a welfare assessment of 4,903 working equids had gait abnormalities.

Body condition score was categorized as thin, medium, and fat. The researcher scored the appropriate body condition of the donkey as assessed. This also applied for hair coat appearance which was categorized as smooth and shiny, starring, matted and uneven.

Donkeys are exposed to wound infections mostly during hot, dry, and rainy seasons (Asha *et,al* 2006).wound can serve as entry points of infectious pathogens such as the tetanus causing bacteria which is quite common in donkeys. In this study the donkey's body most affected by wounds was the sides (5.8%) then the limbs (4.8%) and then the back at 3.8%. This could be explained by the work performed by donkeys where they mainly carry loads over the back and also due to poor back padding and harnessing.

In a similar study by Niraj *et al.*, (2014),on the welfare assessment of working donkeys in Mekelle city in Ethiopia, the greater distribution of wounds was found at the wither and back region at 14.3% and 7.7% at the tail region. These findings though not completely similar to the current study have relevant findings for comparison purposes.

The most prevalent external parasite found on the donkeys in this study was the ticks. Ticks are even more common in the wet season (data for this study was collected in the months of April and May immediately after the long rains in the study area).The predilection sites were classical generally in the protected areas such as the ears and perineum. Ticks are vectors for protozoa diseases and may cause anemia in heavy infestations. Other external parasites reported in the study but at very low rates were fleas at 1.3 % and lice at 0.5 %. External parasites also cause irritation and affect the welfare of the animals

5.7 Physiological Donkey Welfare parameters

Knowing the vital signs of equids is important when diagnosing various conditions from bacterial infections, disease and colic. A stressed animal or one infected with bacteria will exhibit an elevated heart rate and increased respiratory rate (Mclean, 2014)

Mucus membrane color indicates the level of tissue oxygenation and perfusion of the capillary bed. Severe disturbances will induce color change, even when the hemogram is normal. Pale and pink is usually the normal, while pale white may indicate pain, anemia due to gastro intestinal parasitism, shock, hemorrhage or chronic disease (the Brooke. 2013). In cases where the mucus membrane color is dark red/purple the possible indications

are endotoxaemia and severe pathology. Yellow or icteric color denotes anorexia, liver disease, piroplasmosis e.g. babesiosis and bilirubinaemia.

Capillary refill time (CRT) measures the degree of peripheral perfusion, this indicating the strength of blood flow to the extremities (Brooke, 2013). Normal CRT is 1-2 seconds and prolonged CRT indicates decreased peripheral perfusion e.g. shock.

Normal values of resting donkey's heart rates are higher than for a normal horse, and heart rate is a very good indicator of stress or pain, even when it is not noticed physically in donkeys (Ayo, 2013).

5.8 Cortisol as a marker of stress

Studies have shown a good correlation between fecal and plasma glucocorticoids for the assessment of stress (Sheriff *et al*, 2010). For this reason this study used an ELISA kit designed for urinary steroids but modified and validated for use with fecal cortisol hormone. The purpose was to asses stress by use of cortisol as a marker of stress. There are many measurable parameters of stress and cortisol hormone is considered as a key indicator. This is because it is released in response to stress and it is responsible for many stress related physiological changes in the body (Kataria and Kataria, 2010).

In this study, the urban/peri-urban donkeys had a higher levels of free fecal cortisol concentration compared to their rural counterparts. Therefore the urban/peri-urban donkeys are presumed to have had higher stress levels compared to the rural donkeys. This is correlated by other welfare indicators such as long working hours they have to endure since they are considered as a means of income generation in the urban/peri-urban setup. Nearly half of the urban/peri-urban work for 7 days per week which means they have less time for rest. They work for more days on average than those working in the rural areas. They also have more cases of lameness and which affect more limbs, as well as a larger proportion of them have poor body condition. Urban/peri-urban donkeys have more body wounds compared to their rural counterparts. On physiological indicators, urban/peri-urban donkeys have a larger proportion of them with a higher heart rate (above normal). This

study also established that they are more dehydrated on average compared to the rural working donkeys.

In a study carried out by Andre *et al.,* (2010), on elephant lameness caused by foot lesions (ulcerative pododermatitis), it was documented that that stress caused by the temporary injuries was associated with elevated fecal glucocorticoid metabolites, which amounted to a fourfold increase in one of the animals under study. According to Laws *et al*., (2007), translocation of elephants in another study proved to be a stressful event which resulted in a 4-5 fold increase in fecal glucocorticoid concentrations.

A study by Turner *et al.,* (2002) to remotely asses stress in white and black rhinoceros documented that fecal cortisol and corticosterone measurement were accurate and reproducible and that serum and fecal levels in the white rhinoceros were well correlated for both hormones. This was an indication that fecal hormone levels were a fair measure of adrenocortical activity. The overall results of the study suggested that measurement of either hormone alone may be satisfactory for quantification of rhinoceros stress. This study on the rhinoceros demonstrates that remotely collected feces can be a reliable resource for monitoring stress related glucocorticoids in animals. This similarly means that fecal glucocorticoids have potential as a non-invasive tool for stress monitoring in both domestic and wild animals.

In another study carried out by Bashaw *et al.,* (2016) to measure stress in giraffes by use of non-invasive assessment, it was demonstrated that fecal glucocorticoid metabolite changes due to physiological stimulation (ACTH) and an environmental event (transportation) could be monitored and measured in daily fecal samples from the giraffes.

Stress is defined as any physical or psychological stimulus that disrupts the homeostasis of an organism (Asterita, 1985). Stress can cause immunosuppression, disruption of metabolism and gastro-intestinal dysfunction (Beerda, 1996). Adrenal glucocorticoid levels in biological sources, such as saliva, cerebrospinal fluid, blood and feces have been used to asses stress (Brown, 1995). Of these only urine and feces can be reasonably be

expected to be accessed in animals without using invasive techniques. According to (Turner, 2002) in many species of animals, feces and urine contain free cortisol and corticosterone and their hydrolyzed metabolites with the majority in hydrolyzed form.

Stress can be measured and monitored in terms of behavioral and physiological alterations that might be pointers of the individual animal's state of wellbeing (Von Borell 2001 and Kashinakunti *et al.*, 2010). Stress can be caused by psychological factors e.g. inability to exhibit natural behavior patterns and fear, physiological factors, physical abnormalities, poor nutrition, pain, pregnancy, overcrowding, rough handling, thermal extremes and poor facility design such as housing (Ake *et al.*, 2013).

When animals have difficulty in coping with stress, adverse effects of stress are manifested. These manifestations include low productivity, reduced immunity against infections, aggressive behaviors and reduced growth rate in young animals (Von Borell, 2001). There are various conditions that would cause stress to donkeys. In this study work stress was a major consideration since all donkeys were working animals.

Work is produced when animals by physical exertion use energy to pull an implement through the soil or to carry a load over a distance (Pearson and Vall, 1998). Work output is not just a function of the speed of the animal itself but is also influenced by the environment and soil conditions. (Pearson and Vall, 1998).

5.9 Stress adaptation

Stress induces animals to adapt to a given situation; it is an environmental situation that provokes the adaptive response. Stress can be chronic (long term) or acute (very short term). Adaptation is the morphological, anatomical, physiological and biochemical characteristics of an animal which promote welfare and favors survival in a specific environment (Niyas, 2015). Environmental stressors have the potential to activate the hypothalamo-pituitary adrenal cortex axis (HPA). The activation of HPA during stress leads to increased concentration of cortisol (Niyas, 2015). Individuals that suffer from poor welfare presumably experience stress and may consequently exhibit stress responses. According to (Bonne, 2014), adaptations to stress are in themselves indicative of reduced welfare.

In this study, three donkeys described as having elevated cortisol concentration were found in the rural areas (Kan 2, 80.626ng/ml, Kan 5, 77.430ng/ml, and Iku2, 74.403ng/ml). They had unusually high free fecal cortisol concentration which is explained by the prevailing environmental conditions which acted as unusual stressors. It is presumed that the animals adapt to their various environmental routines and daily life in the rural areas. However when "new' or unusual stressors do appear, the donkey is sufficiently stimulated to produce more cortisol and hence the higher concentrations.

In a study carried out by Kataria and Kataria, (2010), on the assessment of stress due to hot ambience in donkeys from arid tracts in India , serum cortisol levels in moderate ambience was recorded at 24.63nmol/L +/- 2.09 and at 103.97nmol/L +/-5.43.

CHAPTER SIX

CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH AREAS

6.1 Conclusions

- On demographics it's concluded that two thirds of households were headed by males.
- Women form the majority of people who work with donkeys.
- Majority of donkey owners have attained formal education.
- Majority of donkey owners acquire their donkeys from the market by buying.
- Gastro intestinal ailments are prevalent in donkeys compared to other ailments.
- Donkeys in the study area were not provided with housing and mineral supplementation.
- Half of the donkeys are affected by external parasites mainly ticks.
- Urban/peri-urban donkeys suffered more stressful lifestyle conditions compared to their rural counterparts.
- Upon validation and pre-testing a human urinary Elisa kit can be used to assay free fecal cortisol from donkey feces.
- Fecal glucocorticoid measurement has potential as a non-invasive tool for stress monitoring in donkeys
- Urban/peri-urban donkeys suffer from poor welfare conditions compared to their rural counterparts.

6.2 Recommendations

Animal welfare advocates should enhance their advocacy for donkey welfare especially amongst women who work with them.

Farmers/donkey owners need sensitization for donkey housing and mineral supplementation in order to improve welfare of their animals.

A fecal cortisol Elisa kit needs to be developed for use in animals. Such a kit would be used to carry out similar studies in future and compare the results with the results of this study.

Proper donkey harnessing techniques need to be passed on to donkey owners and handlers to improve safety of the donkey and the handlers.

6.3 Future research areas

More research needs to be conducted on chemical composition, efficacy, dosage and side effects of herbal plants used by donkey owners for treatment of various donkey ailments in the study area.

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APPENDIX 1

INTRODUCTION LETTER AND QUESTIONNAIRE

JOSEPH K. KAMONZO

P.O.BOX 241, 90400,

MWINGI

Date……

Dear Sir/Madam

RE: REQUEST TO FILL QUESTIONNAIRE FOR ACADEMIC PURPOSES

I am a postgraduate student at South Eastern Kenya University (SEKU) Department of Range and Wildlife Sciences, School of Agriculture and Veterinary Sciences. I am carrying out a research on donkey welfare in urban and rural areas of Mwingi Central Sub- County.

The information gathered will be treated as confidential and will be for the sole purpose of this study. Kindly respond to the items in the attached questionnaires to the best of your knowledge.

Kind regards,

Dr. Joseph K. Kamonzo

APPENDIX 2

QUESTIONNAIRE ON ASSESSMENT OF WELFARE INDICATORS FOR DONKEYS WORKING IN RURAL AND URBAN/PERI-URBAN AREAS OF MWINGI CENTRAL SUB-COUNTY

SECTION A

i) General information.

Questionnaire number ……..

Date ……..

Name of household head …….

Sub -Location ……

Ward……....

Sex of house head. Male [ ] female [ ]

Age 18-35 youth [ ] 36 -55 [ ] 56-75 [ ] 76 and above [ ]

Education level of house head: No formal education [ ]

Primary level [ ]

Secondary level [ ]

Tertiary level and above [ ]

Occupation of household head…….

Name of person working with the donkey…….

Sex of the person working with the donkey: male [] female [ ]

Education level of the person working with the donkey:

No formal education [ ]

Primary level [ ]

Secondary level [ ]

Tertiary level and above [ ]

Apart from the donkey what other animals do you have? Cattle [ ] goats [ ] sheep [ ] poultry [ ]

Poultry [ ] Others? Specify……

Number of donkey in the house hold…….

How did you get your donkey(s)? Bought in the market [ ] born at the household [ ] as dowry [ ]

As a gift [ ]

Area of work. Rural [ ] urban/peri-urban [ ]

Age of owner 18yrs-25 [ ] 26-35 [ ] 36-45 [ ] 46-55 [ ] 56-65 [ ] 66-75 [ ] 76 and over [ ]

Name of donkey…….

I.D of donkey …….

Sex. Male [ ] female [ ]

Age of donkey: 1-3yrs [ ] 4-7yrs [ ] 8-11yrs [ ] 12-15yrs [ ] 16yrs and over [ ]

Work purpose associated with the donkey: fetching water [ ] ploughing [ ] pulling cart [ ] carrying construction material [ ] multipurpose [ ]

Number of days worked in a week……

Number of hours worked per day……

Number of hours rested……

Number of hours allowed for feeding …….

Provision of water: yes [ ] No [ ]

How many times in a day: once [ ] twice [ ] thrice or more [ ]

ii) Animal health and welfare perspective.

Does the donkey get sick: Yes [ ] No [ ] sometimes [ ]

How often does it get sick: every week [ ] every month [ ] every 3 months [ ] every 6 months [ ]

Do you provide veterinary medical care when the donkey needs it: Yes [ ] No [ ]

Where do you access veterinary care from: private service providers [ ] Government officers [ ] NGO service providers [ ]

Do you use herbal medicines to treat your donkey? Yes [ ] No [ ]

If yes, above in what form is the herb used? Powder [ ] boiled liquid [ ] crushed [ ]

What types of plants are commonly used? Trees [ ] shrubs [ ] runners [ ] climbers [ ] weeds [ ]

Which part of the plant is commonly used? Leaves [ ] bark [ ] roots [ ]

flowers [ ] fruits [ ]

What parts of the plants are used for the listed category of ailments?

Category/part affected	Part of plant used				
	flower	leaves	fruits	roots	bark
Eyes					
Skin					
Respiratory					
Gastro-intestinal					
Wounds					
Abortions					
Hooves					

Are you aware of the importance of animal welfare: Yes [ ] No [ ]

Where do you get information regarding animal welfare? Animal health personnel [ ] chief [ ] NGO staff [ ] from mass media (radio) [ ] Police [ ]

What conditions commonly affect your donkey? Skin conditions [ ] respiratory conditions [ ] gastro- intestinal conditions [ ] musculo-skeletal conditions [ ] eye conditions [ ]

Do you deworm your donkey? Yes [ ] No [ ]

If yes above, how often Every 3 months [ ] every 6 months [ ] every 9 months[ ] once every year [ ]

What is your preferred deworming formulation? Bolus [ ] drench/suspension [ ] injectable [ ]

What is your preferred route of deworming: oral [ ] injectable, sub cutaneous [ ]

Do you provide housing to your donkey? Yes [ ] No [ ]

If yes how often? Always [ ] during rainy season [ ] sometimes [ ]

Do you give mineral supplementation to your donkey? Yes [ ] No [ ]

If yes which form of mineral supplementation do you prefer? Block form [ ] powder form [ ]

Do you use a harness when working the donkey? Yes [ ] No [ ]

Do you use a back padding when working the donkey/? Yes [ ] No [ ]

Material of padding used: Cloth material [ ] sisal sack [ ] nylon sack [ ]

B) Physical welfare indicators (to be completed by the researcher)

Lameness

Yes [ ]

No [ ]

If yes how many limbs affected

1 [ ]

2 [ ]

3 [ ]

4 [ ]

Evenness of the Hooves:

Even [ ]

Uneven [ ]

Condition of the hooves

Cracked [ ]

Not cracked [ ]

Presence of over-grown hooves? Yes [ ] No [ ]

If yes how many hooves affected? 1 [ ] 2 [ ] 3 [ ] 4 [ ]

Body condition score

Thin [ ]

Medium [ ]

Fat [ ]

Hair coat appearance: smooth and shiny [ ] starring [ ] matted [ ] uneven [ ]

C) Pathological conditions and external parasite infestation

Presence of wounds on the animal

Yes [ ] No [ ]

If yes how many: 1-3 [ ] 4-7 [ ] 8-11 [ ] 12- 15 [ ] 16 and above [ ]

Part of the body affected. Back [ ] sides [ ] limbs [ ] neck region [ ] loin [ ]

Presence of tether wounds? Yes [ ] No [ ]

If yes how many limbs affected? 1[ ] 2 [ ] 3 [ ] 4 [ ]

Presence of scars on the animal:

Yes [ ] No [ ]

If yes how many: 1-3 [ ] 4-7 [ ] 8-11 [ ] 12- 15 [ ] 16 and above [ ]

Part of body affected: Back [ ] sides [ ] limbs [ ] neck region [ ] loin [ ] withers [ ]

Presence of external parasites on the animal's skin?

Yes [ ] No [ ]

If yes; which parasite

Ticks [ ] fleas [ ] lice [ ]

For ticks; what kind of ticks are found on the donkey.

Hard [ ] soft [ ]

Part of body most infested with ticks:

Ears [ ] withers [ ] tail [ ] perineum [ ] limbs [ ] any other part [ ]

Does the animal have eye problem

Yes [ ] No [ ]

If yes: one eye [ ] both eyes [ ]

Presence of discharges from the eye; Yes [ ] No [ ]

Corneal opacity? Yes [ ] No [ ]

Condition of body coat: smooth [ ] smooth and shiny [ ] rough [ ] has alopecia patches [ ]

D) Physiological animal welfare indicators (TO BE COMPLETED BY RESEARCHER)

Heart rate;……./min

Normal [ ] above normal [ ] below normal [ ]

Time in seconds Skin returns to normal position after pinch and release……. Seconds

Capillary refill time (CRT) 1-2 sec.[ ] 3-4 sec [ ] more than 5sec [ ]

Appearance of the mucous membranes: pink [ ] congested [ ] icteric [ ] pale [ ]

APPENDIX 3

MEAN CORTISOL CONCENTRATION FOR THE STUDY ANIMALS EXCLUDING 3 RURAL DONKEYS WITH ELEVATED CORTISOL LEVELS

(22 urban/peri-urban and 15 rural donkeys)

Sample number.	**Grand mean cortisol concentration in fecal samples for urban/peri-urban donkeys. ng/ml**SEM+/- 1.525	**Grand mean cortisol concentration in fecal samples for Rural donkeys. ng/ml** SEM+/-1.525
1	56.598	45.574
2	49.476	-
3	69.597	68.516
4	52.163	53.236
5	47.028	-
6	62.315	56.603
7	47.747	43.582
8	52.371	-
9	67.779	55.481
10	48.108	43.960
11	59.538	35.196
12	54.799	56.175
13	52.790	45.909
14	58.109	44.485
15	53.835	53.759
16	53.148	51.347
17	47.722	49.205
18	55.795	44.646
19	57.962	-

20	53.875	-
21	49.076	-
22	47.539	-
Grand total cumulative mean concentration.	**54.425**	**49.844**