



Sveriges lantbruksuniversitet  
**Fakulteten för veterinärmedicin och husdjursvetenskap**

Swedish University of Agricultural Sciences  
**Faculty of Veterinary Medicine and Animal Science**

## **Animal welfare in Ethiopia: Transport to and handling of cattle at markets in Addis Abeba and Ambo**



**Josefine Jerlström**

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# Animal welfare in Ethiopia: Transport to and handling of cattle at markets in Addis Abeba and Ambo

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## **Abstract**

Stressful routines for animal handling can reduce immune function and productivity of animals. If stakeholders are handling animals aversively, animals will show increased expressions of fear for humans and higher stress levels which lead to the compromise of animals' welfare. In Ethiopia, there are no legislations to protect animals from suffering or discomfort. The main objective of this study was therefore to analyse welfare of cattle on animal markets in Ethiopia and map out supply chains of animals to these markets. The study comprised 332 cattle at three different markets; Kera and Shola in Addis Abeba, and Gudar market in Ambo. A total of 38 behavioural observations were performed using a behavioural survey, with an average group size of 8.2 animals, and 106 interviews with stakeholders on the markets were completed using three different surveys. The results indicated that an increased rate of abusive handling by the stakeholders increased animals' expressed levels of aggressive, stress-related and resistance behaviours. It also showed that animals are transported for long distances and durations to the markets. The most common transport system was by foot to Gudar market and by vehicle to Kera and Shola markets. The prevalence of death and injuries during transport was in total 19% and 14% respectively. This study states that animal welfare at markets in Ethiopia is poor and that transport conditions are inadequate. Suggested improvements for the future are education of stakeholders, establishment of animal welfare regulations, and use of appropriate vehicles when transporting animals and lastly to make sure that animals will get feed, water and rest during transportation.

**Key words:** Ethiopia, animal welfare, animal transport, animal handling, market, supply chain, cattle, animal behaviour

## **Sammanfattning**

Djurhanteringsrutiner som ökar djurens stressnivåer försämrar både deras immunförsvar och produktivitet. Till följd av en ovarsam hantering av djuren visar de höjda nivåer av rädsla för människor och högre grad av stress. Det leder till minskad djurvälstånd. I Etiopien finns det inga djurskyddslagar som reglerar hur djuren ska hanteras, varken generellt i landet eller på marknaderna. Syftet med den här studien var därför att analysera djurvälståndet för nötkreatur på djurmarknader i Etiopien samt att kartlägga kedjan av djurtransporten till dessa marknader. Studien omfattar totalt 332 nötkreatur fördelat på tre olika marknader: Kera och Shola i Addis Abeba och Gudar i Ambo. Sammanlagt utfördes beteendebeskrivningar på 38 grupper av nötkreatur, med ett genomsnitt på 8,2 djur i varje grupp. En annan del av datainsamlingen var att utföra intervjuer med de olika aktörerna på djurmarknaderna. Totalt genomfördes 106 intervjuer på de 3 marknaderna baserat på tre olika enkäter. Resultaten visade att en ökad frekvens av ovarsam hantering av djuren ökade deras uttryck av aggressiva, stressrelaterade och motståndsbeteenden visade mot människorna som hanterade dem. Vidare visades även att djuren transporteras långa sträckor och lång tid för att komma till marknaderna. Det leder till ett ineffektivt flöde av djur till marknaderna. Det vanligaste sättet att transportera djuren till marknaden i Gudar var till fots och på lastbil till marknaderna i Kera och Shola. Antalet djur som dog under transporten var totalt 19% medan det totala antalet djur som skadades var 14%. Den här studien indikerar att djurvälståndet på marknaderna i Etiopien är lågt och att förhållandena vid transport är undermåliga. Slutligen rekommenderas flera förbättringsområden inför framtiden: att utbilda de människor som arbetar på marknaderna, att skapa lagar och regler för djurskydd, att använda lämpliga fordon vid transport och att ge djuren tillräckligt med foder, vatten och vila under transporten.

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## 1. Introduction

Ethiopia is a country with high level of diversity in the agriculture (Stock & Gifford-Gonzalez, 2013) and has one of the biggest livestock populations in Africa (Masiga & Munyua, 2005). In fact, the fast development of the economics has been highly dependent on agriculture resources (Mengistu, 2006). Although the country is developing and the economic condition improving, animal welfare is a subject that so far has not gained much attention. At present, there are no legislations that protect animals from cruel actions by humans. However, there are a few organisations that work for animals' situation but they mainly focus on homeless and/or injured animals (Bekele, 2009). This is therefore an important first step to take in order to regulate how animals are managed and handled (Masiga & Munyua, 2005).

Animal handling is an important subject since it affects not only animals' emotional states but also economics due to fact that abusive handling can, or most likely will, result in lowered production (Price, 2008). Furthermore, animals that are considered to be especially hard to handle possess a great risk for handlers, which increases the cost of animals and makes them harder to sell (Grandin, 1993). How animals are behaving during handling is dependent mainly on genetics but also of previous experiences (Grandin, 1998). In Ethiopia, handling of animals is usually aversive (Bulitta et al., 2012) and therefore in conflict with animal welfare. If animals fail to cope with environmental stressors, it is likely that they will express chronic stress. This will result in lowered animal welfare, which leads to the proclamation that welfare of an animal is said to be good when it can manage to cope with stress factors satisfactorily (Blokhuys et al., 1998).

Several market systems exist for trading animals in Ethiopia. Usually they involve various stakeholders, e.g. farmers, traders, merchants and butchers, and animals of different breeds (Solomon et al., 2007). The transport to markets is mostly by foot, due to lack of suitable vehicles, and there has been research performed on how many animals die and get injured during transport (Bulitta et al., 2012). Furthermore, transport conditions and level of vibration has a direct impact on the behaviours an animal expresses and the changes of stress hormones (Bulitta, 2012). The ranges of behaviours that an animal expresses are good indicators of how the animal copes with certain situations. If a behavioural change is observed, i.e. the animal refuses to move or vocalise in a high extent, it may indicate what the problem is and where in the situation improvement is needed (Aradom, 2012).

With this as a background, the main objective of this study was to analyse welfare of cattle on animal markets in Ethiopia. Two markets were examined in Addis Abeba and one market was examined in Ambo. The study also aimed to map out supply chains of animals to all three markets.

## 2. Literature review

According to FAO, there were 53.4 million cattle, 25.5 million sheep and 22.8 million goats in Ethiopia in 2011 (FAOSTAT, 2013). Furthermore, Ethiopia was the country with highest livestock population in Africa at the end of 20<sup>th</sup> century (Salomon & Workalemahu, 2003). According to Mengistu (2006), agriculture has played a central role in economics over the years and contributes to almost 40% of total GDP (around 20% of this comes from livestock and their products). Ethiopia is a country with a high level of diversity in agriculture and with high amount of livestock resources. However, genetic resources have not been evaluated sufficiently yet and more research is needed. The country is divided into regions and zones which are illustrated in Figure 1. The climate in Ethiopia varies a lot between these areas and therefore five climatic zones are defined where distinctive weather features can be explained. In the central highlands, temperature is mild and approximately 16°C during daytime. In east and south, the weather is dry and hot, whilst in western parts of Ethiopia the climate is humid and hot (tropical). The northern parts are typically dry and warm. The rainy season in Ethiopia also varies in different areas, but is usually occurs between April and October. In the central highlands, rain falls between end of June and beginning of October (Briggs, 2012).

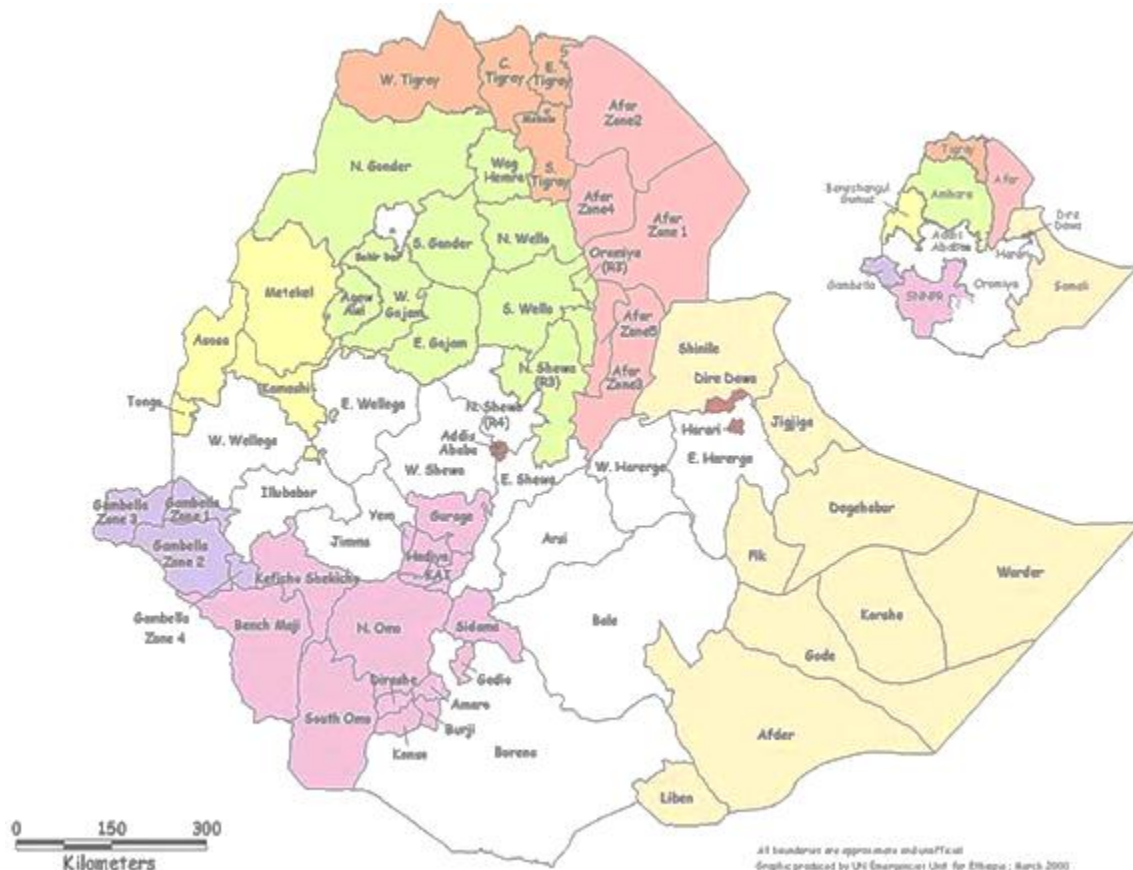


Figure 1: the different administrative regions and zones in Ethiopia (UN, 2000).

The different breeds of cattle in Ethiopia are mainly indigenous and used for dual purposes, i.e. for both milk and meat production. Zebu (*Bos Indicus*) is adapted to hot climates and is the prominent breed in Ethiopia; however breeds like Boran and Fogera are also prevalent (Stock & Gifford-Gonzalez, 2013). Another strain of cattle that is used in livestock production is Sanga (*Bos Taurus Africanus*) which is thought to be a crossbreed between Zebu and Longhorn (or Shorthorn) cattle (Strydom, et al., 2001).



## 2.1. Animal welfare

Animal welfare is a worldwide issue that is under more focus now than ever before. The western countries outline strict animal welfare regulations and organisations are fighting for animals' rights in a society where economics is often deemed the most important factor. In Ethiopia there are no animal welfare regulations or any constitution that protects animals from suffering. However, there are six or seven organisations that work for animals' welfare, and the first was established as early as 1954. Still they have not yet accomplished the main objectives of their work to implement animal welfare, but it is under progress and hopefully ready within near future (Bekele, 2009).

There are a variety of aspects affecting an animal's welfare and therefore a unified definition of the desirable welfare state has not yet been adapted. However, the term animal welfare can be looked at from three different perspectives (Mellor et al., 2009):

1. *The biological state*: describes welfare of an individual as good when the animal is healthy and grows and reproduces well;
2. *The affective state*: stresses potential for animals to suffer or to have positive experiences;
3. *The natural state*: explains differences between captive animals and the wild state where they origin from, and to what extent they are able to express natural behaviours.

From the animals' perspective, the most important aspect is how it manages to cope with environmental stressors. When behavioural and physiological stress responses are thwarted or if it fails to maintain homeostasis, it is likely that the animal will express chronic stress. Symptoms of this can be injurious behaviour to themselves e.g. self-mutilation, or chronic activation of the autonomic nervous system. This will evidently result in lowered animal welfare. Therefore, welfare of an animal is said to be good when stress responses are not chronically activated and when the individual can cope with them successfully (Blokhuys et al., 1998).

The World Organization for Animal Health (OIE) implemented the first international guidelines for animal welfare in 2005. In total, 167 countries accepted these (OIE, 2005). However, there is still a lack of guidelines and regulations for animal welfare in Ethiopia (Bekele, 2009). The five freedoms were outlined in the 1970s in England and have since then been a fundamental basis for animal welfare all over the world (FAWC, 2011):

1. *Freedom from Hunger and Thirst*: by providing constant access to fresh water and a diet to maintain full health and vigour;
2. *Freedom from Discomfort*: by providing an appropriate environment including shelter and a comfortable resting area;
3. *Freedom from Pain, Injury or Disease*: by prevention or rapid diagnosis and treatment;
4. *Freedom to Express Normal Behaviour*: by providing sufficient space, proper facilities and company of the animal's own kind;
5. *Freedom from Fear and Distress*: by ensuring conditions and treatment which avoid mental suffering.

## 2.2. Animal handling

The term animal handling originates from when humans started to domesticate animals and handling of animals to some extent became a daily routine. Since then, many researchers and organisations have stated the importance of correct procedures for this. It has been shown that

handling routines that are stressful for animals can reduce their immune function and most likely result in lowered productivity (e.g. growth rate, meat production, milk production etc.) (Price, 2008). Some cattle are said to be uncontrollable and wild, which presents a safety risk to their handlers, make them cost more to own and harder to sell for profit. Besides, they are more predisposed to stress and their conversion of feed to meat is not as efficient as with calmer cattle. Genetics are another factor that affects animals' behaviour and stress levels during handling (Grandin, 1993). However, genetics and experiences interact and determine temperament of the animal and furthermore how the animal will behave during handling (Grandin, 1998). In contrast, animals that are handled with minimum level of stress and low impact of aversive handling have less risk of injuring themselves, other animals and their human handlers. This will make handling procedures more effective since routines will take less time and demand fewer people, which is favourable from an economic standpoint (Price, 2008).

It has been shown by Hemsworth (2003) that an animals' fear of humans can limit productivity and welfare of farm animals. The expression fear is used when describing an animals' undesirable emotional state of suffering (Jones & Waddington, 1992). Hemsworth also revealed that associations between a positive handling, e.g. tactile contact and verbal effort, were negatively correlated with the use of negative tactile interactions, e.g. pushes, which were positively associated with an animals' fear of humans. Stress can be defined in many different ways, but the widely accepted term was defined by Walter Cannon (1929) as the disturbance of an organism's physiological homeostasis or physiological well-being.

Stakeholders, who have inadequate attitudes towards animals when interacting with them, are believed to affect the behavioural response of animals towards humans. Thus, productivity of animals is affected and likewise, associated with increased fear of humans. This is believed to reduce animal welfare (Figure 2) (Hemsworth, 2003).

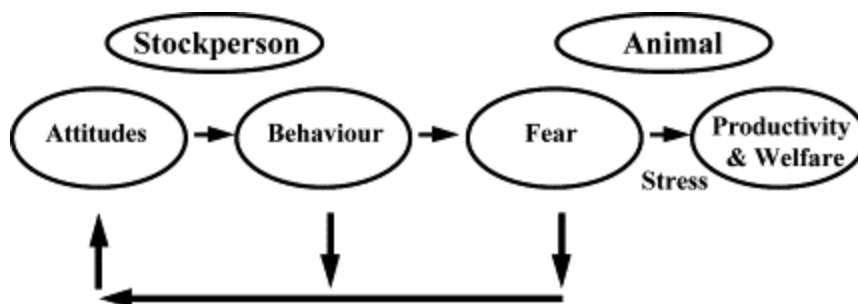


Figure 2: the model of human-animal interactions (Hemsworth, 2003).

In order to establish the level of fear and stress an animal expresses, there are three different types of measurements that are routinely done. The first, most commonly used, is measuring distance that an animal either keeps between a stakeholder, or approaches a stakeholder at. Other factors taken into consideration here can also be latency to make contact or the duration the contact lasts for. The theory is that fearful animals will keep greatest distance from handlers. Another method is to perform handling tests, meaning that animals are observed while being handled and different behaviours associated with fear are recorded. The third method is using of rating scales with base from either descriptions of behaviours or assessment of the animals' overall temperament (de Passillé & Rushen, 2005). These authors stress the importance of how the described factors would affect outcome of behavioural measurements, i.e. animal welfare, feeding and housing environment.

### **2.2.1. Animal handling in Ethiopia**

The handling of animals in developing countries has been a subject for critical discussion for a long time and is in need of further research. A recent study indicated that stakeholders in Ethiopia handle animals in an aversive way, which has been shown to increase prevalence of death and injuries (Bulitta et al., 2012). By measuring behavioural or physiological conditions, animal handling can be explained to a higher extent and a welfare concept implemented (The Scientific Committee on Animal Health and Animal Welfare, 2002). When adult male cattle are mixed in lairage or during transport, they express higher levels of fighting behaviour which can be recorded and measured as a welfare indicator. Another established method for this is to use the fact that farm animals that are handled or transported remember previous situations where they have been exposed to aversive handling by stakeholders. The larger the hesitance animals show, the greater the previous aversion must have been (Broom, 2000).

### **2.3. Animal markets**

According to Gregory (2008) there are four major aspects that need to be considered when selling animals on markets:

1. The difficulties with tracing meat back to original farm;
2. The transmission of disease on markets;
3. The effect on animal hygiene;
4. The compromised welfare of those animals sold on markets compared to welfare of animals transported directly to abattoirs.

The last aspect is supported by evidence that prevalence of bruising is higher in cattle sold at markets, and that fear, distress, dehydration and injuries are believed to affect welfare. Furthermore, cattle sold at markets were more thirsty and tired when they arrived at abattoir than cattle that were sent directly from farm. This will affect cattle's abilities to keep their balance and will lead to injuries exclusively from transport (Weeks et al. 2002).

#### **2.3.1. Animal markets in Ethiopia**

Animal trading is carried out only on special markets in Ethiopia. These markets could be fenced or without fencing, and trading occurs mostly with farm animals. They are usually of local breeds and trading with male animals dominates over females. Farmer generally sells their ox at an age of five years, with main purpose of meat, and selling typically increases during holidays such as Easter. The price is often negotiated between seller and buyer but it is affected by several factors: age, weigh, colour, body condition of animals, value of hides and skins, distance of travel to sell animals and ease of bringing animals back with them (Gebremedhin et al., 2007). Consumers either buy live animals from terminal market, i.e. bigger markets located in cities, slaughter them by themselves or buy meat from markets or butchers, where in both cases meat has been processed at abattoirs. However, these methods of acquiring meat are likely to spread zoonotic diseases and options need to be evaluated (Salomon & Workalemahu, 2003).

Even though Ethiopia is a country with high dependency on livestock and agriculture, various production systems are not market-oriented in extent that is needed. Most farmers sell their animals for income and in order to be able to keep up with costs their farms demand. However, selling of animals is usually not the first option. There are varying reasons behind this; in the highlands cattle are kept as a draft power for crop production whilst in the lowlands cattle are a form of social security and also seen as a prestige.

When trading with animals there are often many different kinds of stakeholders involved, which most commonly include farmers (animal owners), traders (small and big), merchants and butchers (buyers). Their involvement is described in four marketing systems in Ethiopia (Figure 3). At farm gate sales, main participants are local farmers and rural traders who operate at farm level with between one and two animals of varying species (either small or large animals). These small traders travel from various rural locations to bring their livestock to local markets. At local or primary market, traders purchase a few large animals or a sufficient number of small animals for selling on secondary market. On secondary market, large and small traders work together. Also, traders and butchers from terminal markets come to buy animals. Lastly, in terminal markets, big traders and butchers work with a large number of animals mainly for slaughter. The livestock markets are usually controlled by local authorities (Salomon & Workalemahu, 2003).

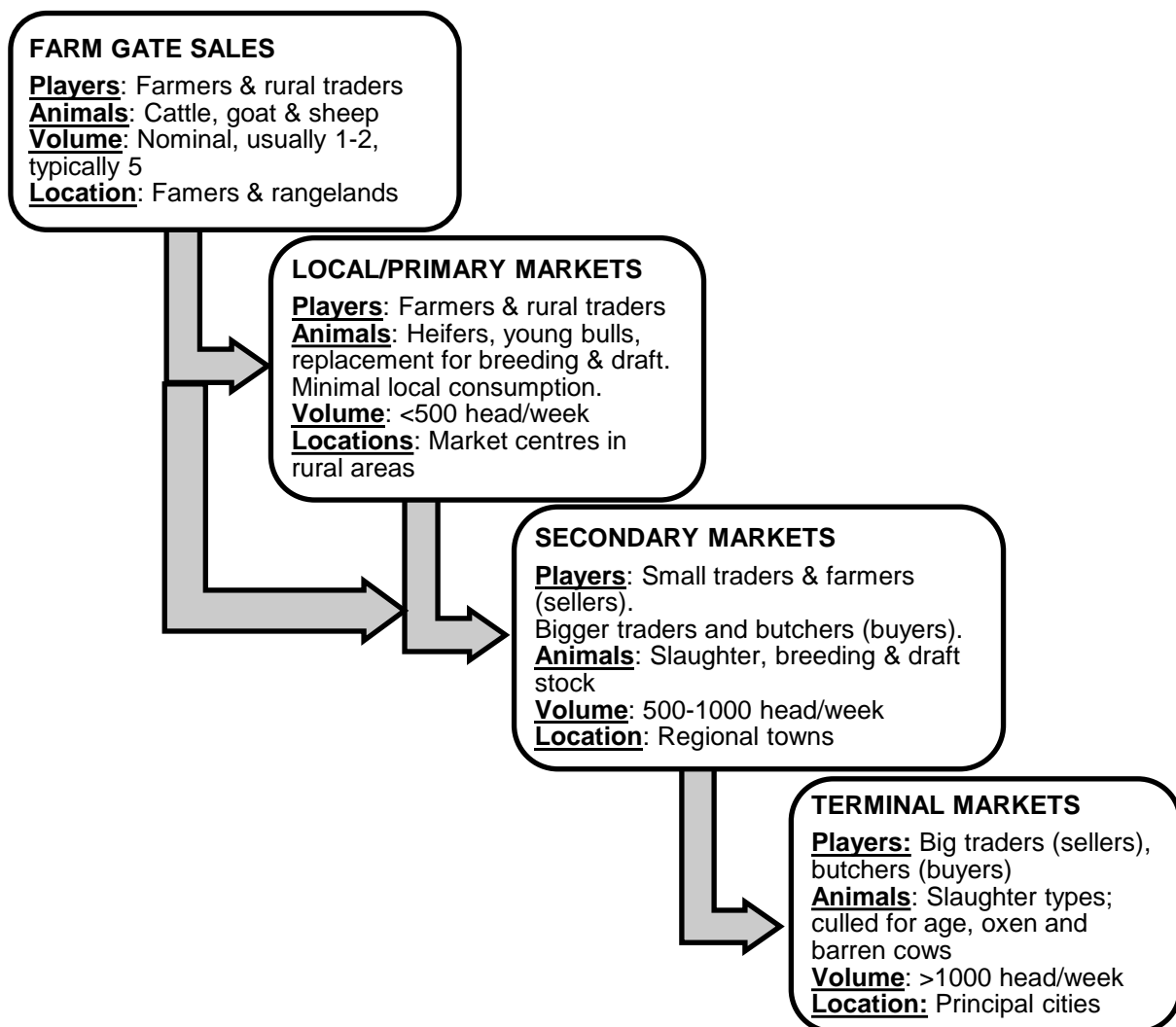


Figure 3: typical Ethiopian livestock structure on markets (Salomon & Workalemahu, 2003).

## 2.4. Animal transport

The mixing of cattle during transport may cause them to fight with each other, which in turn is an important behavioural measure of welfare during transport. Similarly, cattle that were regrouped on a stationary vehicle expressed higher frequencies of exploratory behaviours, sexual behaviour, and were head-butting each other more as compared to resting values (Kenny & Tarrant, 1987). The mortality occurrences during transport can be used to give information about welfare during transport. Broken bones are categorised as extreme injuries and are mostly caused by personnel without sufficient training expertise, who intend to move animals but do it in an unnecessarily cruel way. Although measurements on live animals are good indicators of transport situation, information on dead animals is needed in order to make improvements. Bruising and lesions can be scored in order to downgrade carcasses, and meat quality problems such as dark, firm, dry (DFD) meat can be detected. This can be used for indicating poor welfare and can be used in order to prevent problems associated with transport (EFSA, 2004).

The different behaviours that an animal expresses are good indicators of how the animal is coping with the situation. If behaviours change, i.e. animal refuses to move, or animal freezes or vocalise, it may indicate where in the situation there is a problem. Apart from behavioural measurements, physiological measurements are usually performed. This involves measuring heart rate, body temperature and hormonal changes (e.g. vasopressin, cortisol, creatine kinase, lactate dehydrogenase, etc.) (Aradom, 2012). Furthermore, injuries on animals are shown to increase if vehicle is poorly constructed or simply if they are hit by handler. Some factors that influence animal welfare during handling and transport are (Broom, 2003):

1. *The attitudes of stakeholders* and their driving skills;
2. *Laws and codes of practice*;
3. *Genetic differences* between breeds, and different selection pressure;
4. *The design of vehicle for transport* and design of equipment used for loading;
5. *The stocking density* of animals and mixing of unfamiliar animals;
6. *Payment of persons working with animals*;
7. *The actual physical condition* such as temperature, humidity and risk of disease transmission;
8. *The methods* used during handling, loading and unloading.

The transportation of indigenous *B. Indicus* breeds during the hot-dry season in Nigeria was associated with multiple stress factors. These were shown to affect health, productivity and market value of animals. Additionally, this study emphasised that the different levels of expressing behaviours were a combination of breed, production and management of animals (Minkaa & Ayo, 2007). Lastly, it has been shown that transport conditions, level of vibration on vehicle, behaviours the animal expresses and changes of stress hormones, contradict animal welfare to a great extent (Bulitta, 2012).

### 2.4.1. Animal transport in Ethiopia

The most common way of transporting animals in Africa is by foot since there is a great lack of vehicles with sufficient capacity (Masiga & Munyua, 2005). Walking animals by foot often leads to injured, dead or stolen animals, which were investigated by Bulitta, et al., (2012) who found that 7.6% of animals died, 6-9% got injured and 2.8% were stolen. Furthermore, he found that lameness and injuries such as swelling of legs commonly occur. This has also been proven to be a problem when animals are transported by vehicle (Masiga & Munyua, 2005), and also alludes to the problems which accompany a lack of rest, water and feed.

### **3. Objectives**

With this as a background, the main objective of this study was to analyse welfare of cattle on animal markets in Ethiopia. Two markets were examined in Addis Abeba and one market was examined in Ambo. The study also aimed to map out supply chains of animals to all three markets. The specific objectives were to:

1. Evaluate animal welfare situation at markets;
2. Observe and analyse animal behaviours at markets;
3. Observe and analyse how stakeholders are handling animals at markets;
4. Map out supply chains of animals to markets.

The questions that were outlined to achieve these aims were as follows:

1. Which behaviours are most frequently exhibited by animals at Kera, Shola and Gudar market?
2. Are there any significant correlations between the stakeholders' abusive handling of animals and the behaviours that animals express?
3. Which transport system is most common, by vehicle or by foot, and for how long are animals transported?
4. Where do the animals at markets origin from?

## 4. Materials and Methods

Before the field study started in Ethiopia, a pre-study was carried out in Sweden. It involved composing of a project plan, surveys and an ethogram. In total, this took three weeks. In Ethiopia, two assistants were hired to help with collecting data at markets in Addis Abeba, and two assistants were hired to help with data collection in Ambo. These assistants also functioned as guides and helped with organisation of transport to markets and explained how the trade system worked with stakeholders and animals.

### 4.1. Study areas

The field study was performed during three months between April and June, and weather conditions varied from warm and sunny to cool and rainy. This study comprised two animal markets in Addis Abeba (Kera and Shola, Figure 4) and one animal market in Ambo (Gudar, Figure 6).

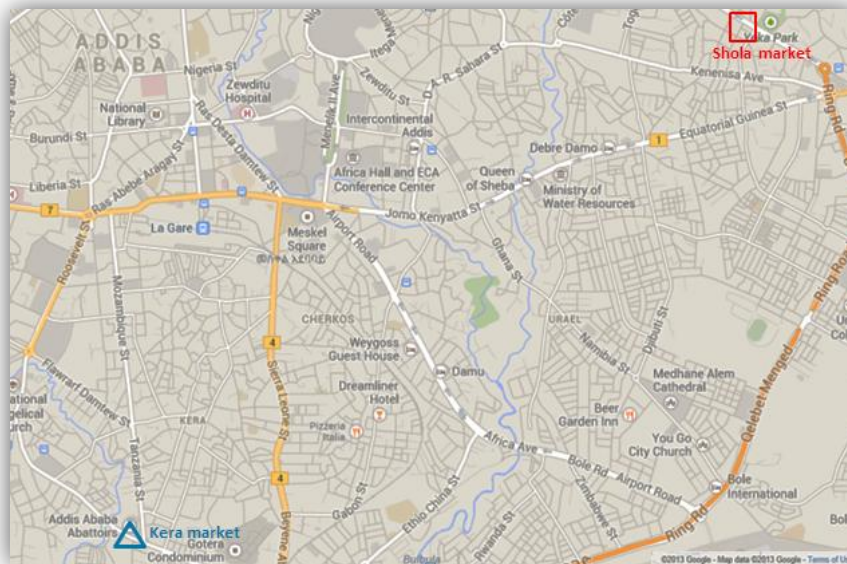


Figure 4: Location of the markets Kera ( $\triangle$ ) and Shola ( $\square$ ) in Addis Abeba.

Kera market is located in Kera district, close to Addis Abeba Kera Abattoir Enterprise, and is the largest market in Addis Abeba that holds cattle. However, some sheep and goats are also held here but that is not taken under consideration in this study. There is a zone in entrance to the market where animals are unloaded and gathered inside a small fence. This area is around 20 m<sup>2</sup> and connected to a bigger fenced zone that is approximately 80 m<sup>2</sup> and further divided into smaller pens. These areas consist of gravel, sand and stones (big and small). There is a water trough in the middle of this big zone where animals are herded to drink. How often they have possibility to do so was not estimated. There are some provision of feed, and then mostly dried grass. On markets, there are no shelters for protection from sun or rain.

Shola market is a regional market located in the region of Kebena/Yeka that holds cattle, sheep and goat. It is open for trade with animals in Mondays and Wednesdays. The area where animals are held is approximately 50 m<sup>2</sup> and consists of gravel, sand and stones, which impacts how animals are grouped and how they move. There are no fences, and therefore stakeholders have to keep track of their group of animals in order to have them separated from

rest of the animals. There are some provision of water and feed (dried grass) but no shelter for provision from sun or rain.



Figure 5: From left, Shola market, Kera market and Gudar market.

Ambo is a smaller town around 100 km west from Addis Abeba with a well-known agricultural university. Gudar market is located approximately 10 km west of Ambo, Figure 6. Here, cattle, sheep, donkeys and horses are held but the focal animals for this study were cattle. The areas where animals are kept are approximately 60 m<sup>2</sup>, and further divided into three fences with cattle, sheep/goats and donkeys separated. The fences consist mostly of stones and gravel. There are no water for animals and no provision of feed during market days. Furthermore, there are no shelters for provision from sun or rain.



Figure 6: Location of Gudar market in Ambo.

## 4.2. Study animals

The behavioural observations were performed on cattle, mostly bulls and steers of crossbreeds between Zebu and Sanga. All animals were used to being handled. The ages of animals varied considerably and therefore were not documented. In total, 312 animals were observed in 38 different groups, which gave an average of 8.2 animals per group. On Gudar market, 94 animals (14 groups) were observed, on Kera market, 188 animals (21 groups) was observed and on Shola market 30 animals (3 groups) was observed.

## 4.3. Behavioural observations

For the ethological measurements, an ethogram was outlined with definitions of 45 behaviours based on literature (Aradom, et al., 2012) and experience (Table 1). The



behaviours were further divided in five categories (Appendix I) based on animal and human behaviour (natural, abusive handling, aggressive, stress-related and resistance behaviours). It was dependent on observers' prior knowledge and experience. It was done in order to separate the behaviours from each other and ease data collection. The behavioural survey was tested in a two day pilot study at Shola and Kera market and then edited, e.g. some behaviour removed and/or added before final version was reached. When performing observations, scan sampling was used, meaning that a group of five to ten animals randomly was chosen and observed by instantaneous recordings for six minutes. Some groups of animals, but not all, were filmed and/or photographed, in order to make registrations repeatable. During these six minutes, all behaviours that the animals were expressing were recorded in a behavioural survey as a frequency, e.g. number of animals in the group performing same behaviour (Appendix II). Also, if the stakeholder who was responsible for the animals expressed abusive behaviours against the animals it was recorded using the same method. The behavioural observations were performed by two persons at Kera, Shola and Gudar markets. On each observation, date, number of animals in the group and condition of animals was recorded.

*Table 1: Definitions of most observed behaviours*

BEHAVIOUR	DEFINITION
Beating of body	The stakeholder beats the animal with an object, e.g. stick, against its body
Beating of head	The stakeholder beats the animal with an object, e.g. stick, against its head
Moving forward 2	The animal moves faster due to stress or panic
Fighting	The animal attacks other animals and fight
Aggressiveness	The animal shows aggressive behaviour, with ears pinned back, eyes wide open and/or snaps in the air
Tail pulling	The stakeholder pulls the animal's tail
Head swinging	The animal swing head from side to side
Idling	The animal stands or lies down and do not want to move
Mounting	The animal mounts another animal
Resisting to being pulled	The animal stands up and resists to being pulled by stakeholders
Watching around	The animal look from side to side and observe the environment
Ear erecting	The animal's ears are erected
Vocalisation 1	The animal communicates with other animals, without being stressed or due to panic
Charging at stakeholders	The animal charges at stakeholders
Vocalisation 2	The animal vocalise with high squeals due to stress or panic
Horn pulling	The stakeholder pulls animal forward by its horns, using rope and/or hands
Eliminations	The animal urinates or defecates

#### **4.4. Transport to markets**

At the same time behavioural observations were performed, the stakeholders who were responsible for animals in the group were interviewed. These interviews were based on three questionnaires: first, to get information about stakeholder; second, to get information about animals' situation at market; and third to get information about animals' situation during transport to markets, (Appendix III). The stakeholders that were of interest in this study were farmers, handlers, traders, merchants and butchers. The main focus was to determine transport duration, transport system, and origin of animals. The assistants in this study helped with the interviews since observers did not speak local language fluently; however there were two persons who carried out interviews in Addis Abeba and two persons that performed interviews in Ambo. In total, 106 interviews with different stakeholders were done; 48 interviews on Gudar market and 29 interviews each from Kera and Shola market. During each interview, date, species, number of animals in group, number of survey and condition of animals was observed.

#### **4.5. Statistical analysis**

The data from behavioural observations were summarised in spread sheets in Excel, one from every market. In each group of animals, a frequency of all expressed behaviours was calculated as percentages. These were then summarised within each of the behaviours and divided by number of animal groups per market in order to get average values. This was named the frequency of expressed behaviour and used to indicate differences. To calculate correlations between human handling and animal behaviours, the behaviours with highest frequencies (abusive, stress-related, aggressive and resistant) were used. The abusive handling was used as fixed factor, i.e. animal behaviours were dependent on how humans were handling them. When data was tested for normal distribution, a linear correlation was not detected. In order to use data, it was manipulated to 0 and 1 values, with 0 defined as if behaviour was not expressed by animal and 1 defined as if behaviour was expressed by animal. To calculate correlations between human handling and animal behaviour, data was imported in SAS 9.3 for calculating Kendall's tau-b correlation coefficient ( $\tau$ ) and level of significance was set to 5% ( $p < 0.05$ ).

In order to calculate most common transport system of animals, the average value was calculated by dividing the number of groups of animals that were transported by vehicle with total number of animal groups that were transported. The same equation was used when calculating proportion of number of groups of animals that was transported by foot. The supply chains of animals to markets were mapped with help from information given by stakeholders about transport and origin of animals.

## 5. Results

### 5.1. Behavioural observations

From behavioural observations, means were calculated as frequencies of behaviours from all three markets (Appendix IV). The highest expressed abusive behaviours were stakeholders beating of body (59%), beating of head (37%) and tail pulling (30%). The least expressed abusive behaviour by stakeholder was pushing animal forward (1%), forcing animals to fall were never observed. The highest expressed animal behaviour was moving forward 2 (31%), fighting (29%) and aggressiveness (27%). The least expressed behaviours by animals were jumping, stretching and balking which never was observed.

The lameness that was recorded at markets was in total 3%; 1% at Gudar, 5% at Kera and 0% at Shola.

#### 5.1.1. Frequencies of behaviours

The result was divided into five categories: natural behaviours, abusive handling by stakeholders, aggressive-, stress-related- and resistance behaviours. In each category, differences between the three markets are shown. The natural behaviours that were highest expressed by animals were watching around, ear erecting, and eliminations (Figure 7). At Gudar market, rumination and ear erecting were more frequently observed and vocalisation 1, turning and moving forward least observed. At Kera market, higher frequencies of vocalisation, lying and moving forward was recorded and lower frequencies of rumination and smelling was recorded compared to the other markets. At Shola market, smelling and rumination was highest expressed behaviours and lying and turning was least expressed. Tail erecting and turning were least expressed behaviours.

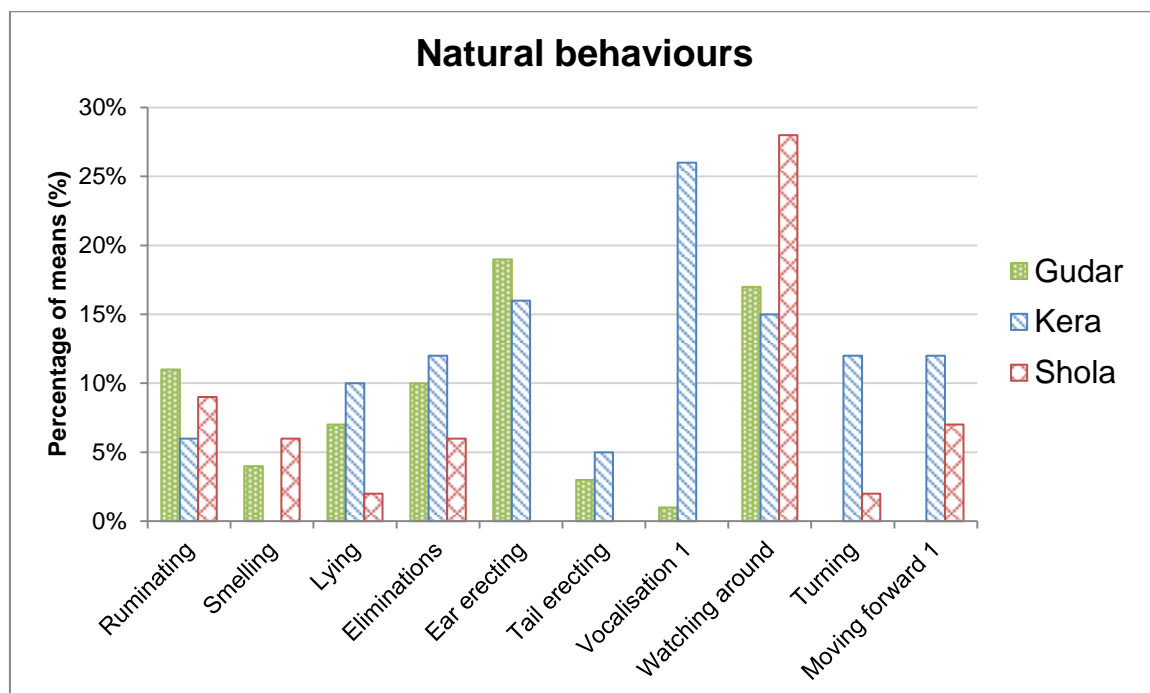


Figure 7: the frequency of natural behaviours that animals were expressing at Gudar, Kera and Shola markets.

The abusive handling by stakeholders differed between the three markets but in general the most abusive handling was beating of animal's head and body (Figure 8). At Gudar, Kera and Shola markets, the most frequently observed abusive behaviour by stakeholder was beating of body and beating of head. At Gudar, horn and tail pulling was also recorded, which is similar to Kera market, but there kicking animal was frequently occurring. This is in contrast to Shola market, where it was more common with stoning animals in order to move them in any directions. The least common abusive handling of animals was pulling horns and pushing animals forward by hands. Forcing animals to fall down was never recorded at any of the three markets.

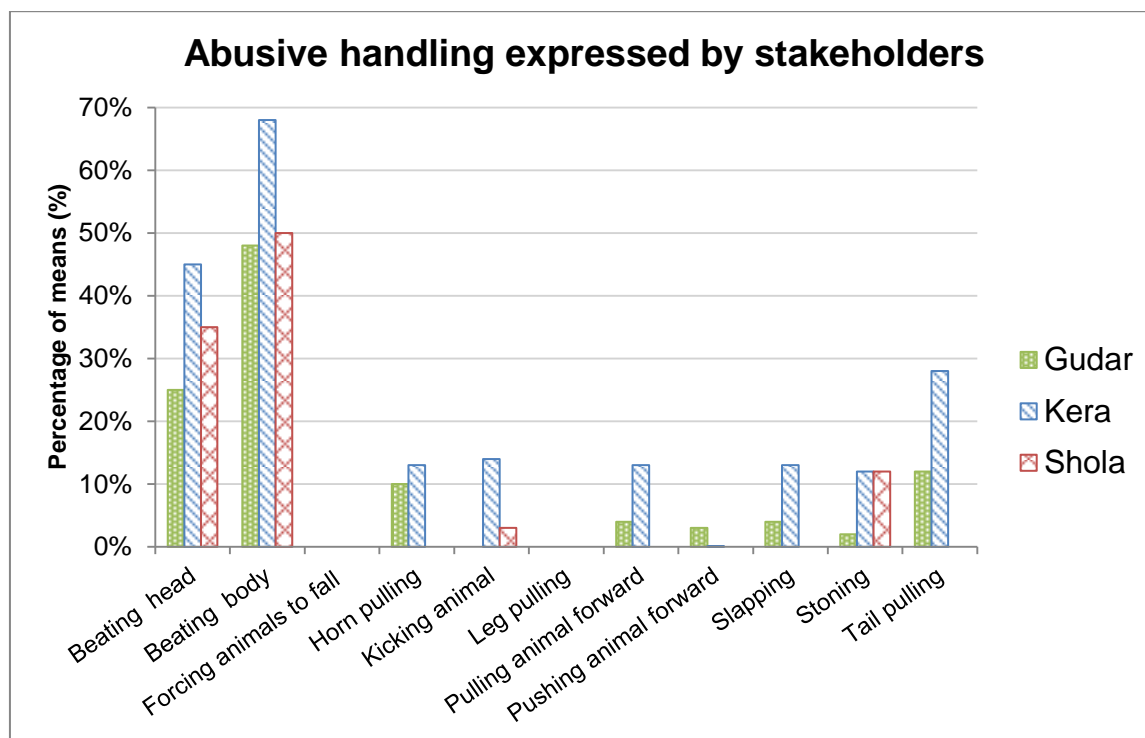


Figure 8: the frequency of stakeholders' abusive handling towards animals at Gudar, Kera and Shola markets.

Aggressiveness was the animal behaviour which was most frequently recorded on all three markets. At Gudar and Kera markets, fighting was also highly performed and at Kera, mounting was observed often. At Gudar market, kicking in handlers' direction was observed often as well as mounting. At Shola market, mounting and running were behaviours that was most expressed. The frequencies of aggressive behaviours that animals expressed are shown in Figure 9. The least expressed behaviours were kicking and running. Jumping was not observed on any of the markets.

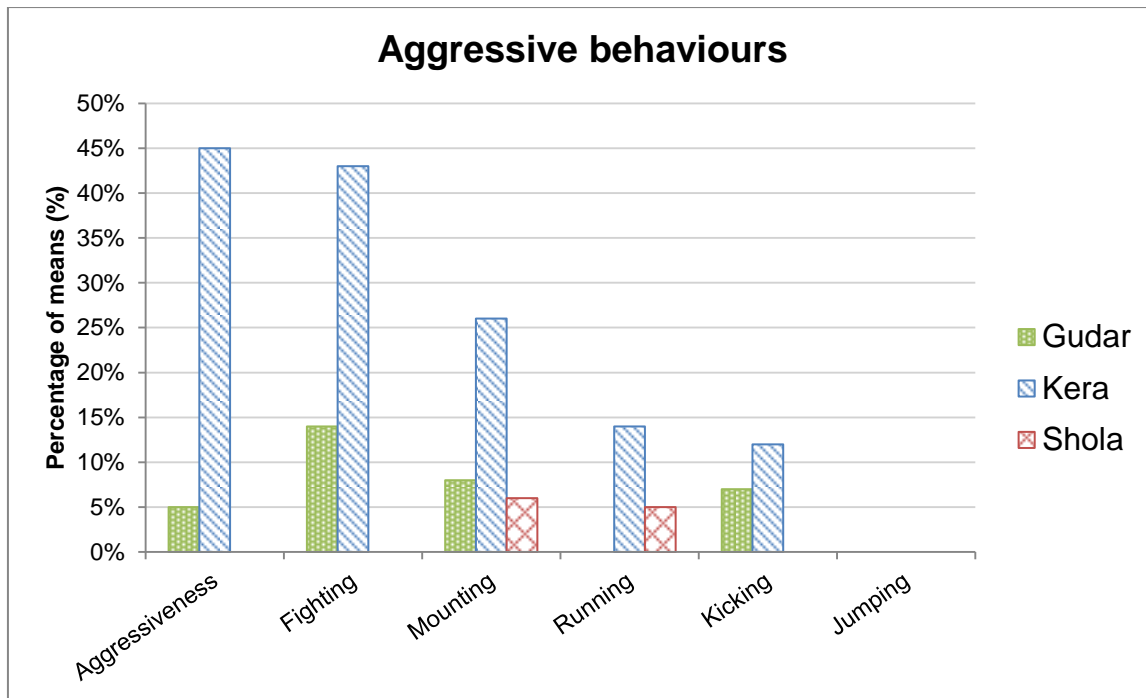


Figure 9: the frequency of aggressive behaviours that animals expressed at Gudar, Kera and Shola markets.

The stress-related behaviours that were observed at the highest extent at markets was moving forward 2, head swings and idling (Figure 10). At Gudar market foaming was more common compared to the other two markets. At Kera market it was more common with vocalisation and paralysed respiration and at Shola market higher frequencies of idling was recorded. The least expressed stress-related behaviours were panting and paralysed respiration. Stamping of feet and stretching were not observed.

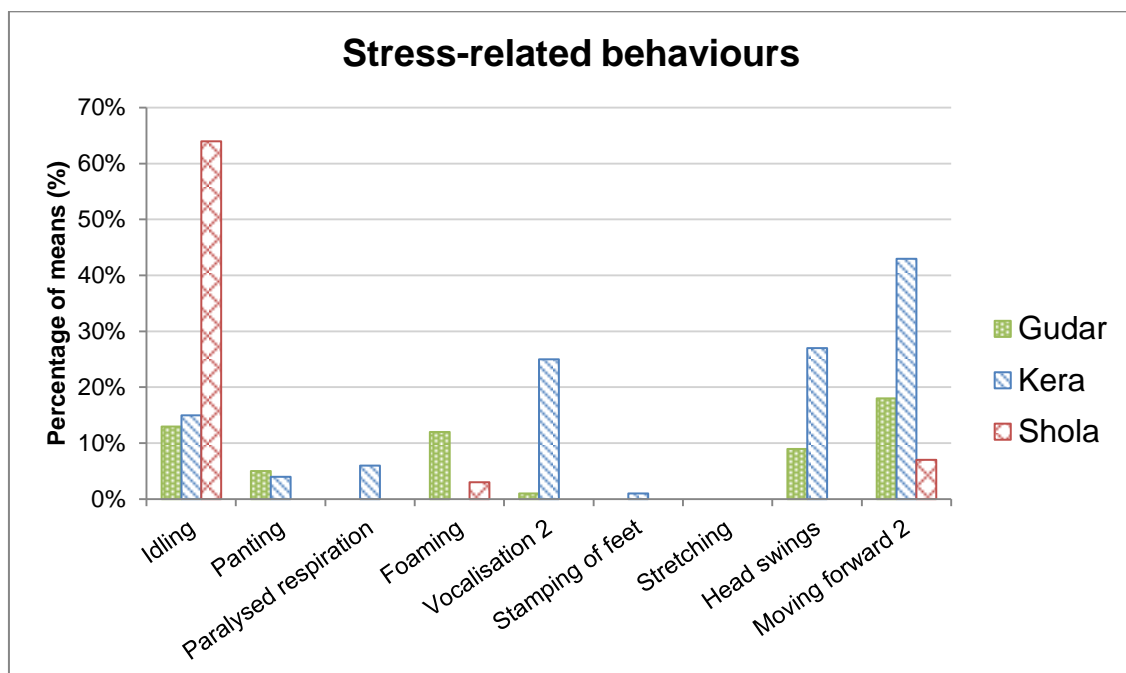


Figure 10: the frequency of stress-related behaviours that animals expressed at Gudar, Kera and Shola markets.

Of the resistance behaviours, occurrences of each behaviour varied greatly between markets but most common were resistance to being pulled and charging at stakeholders (Figure 11). At Gudar market, it was more common with animal showing resistance when being pulled, retreating and charging at stakeholders. At Kera market, the most expressed behaviours were resistance to being pulled, charging at stakeholders and falling down on ground. On Shola market, the only behaviour that was recorded was reversing. The behaviours that the animals showed least were refusing to leave their original place and reversing. Balking, slipping severely and falling were not observed at any of the three markets.

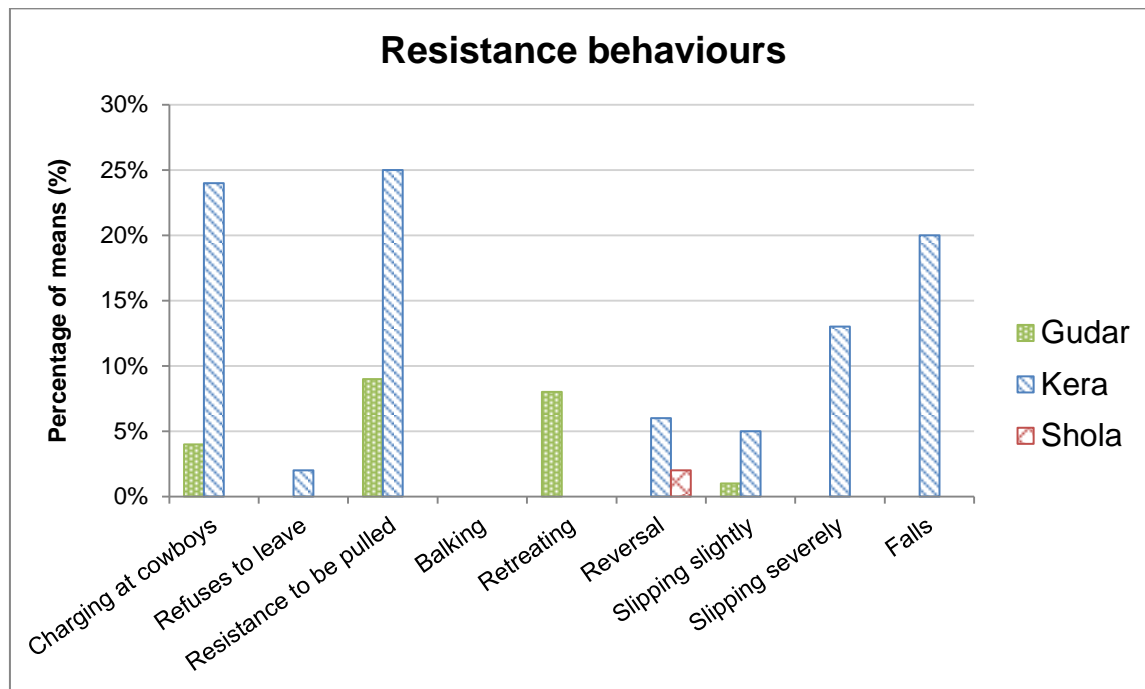


Figure 11: the frequency of resistance behaviours that animals expressed at Gudar, Kera and Shola markets.

### 5.1.2. Correlations between abusive handling and behaviours

The animals' behaviours and stakeholders' abusive handling that were significantly correlated were in total 32 pairs, summarised in Table 2 (Appendix V show all correlations). Beating of animals head were significant positive correlated with fighting, aggressiveness and vocalisation 2. Pulling by rope was significant positive correlated with mounting, fighting, aggressiveness, charging at stakeholders and vocalisation 2. Pushing animal forward was significant negative correlated with mounting and aggressiveness. Slapping animals was significant positive correlated with mounting, fighting, aggressiveness, charging at stakeholders and vocalisation 2. Kicking animal was significantly positively correlated with mounting, fighting, aggressiveness, charging at stakeholders and vocalisation 2. Horn pulling was significant positive correlated with mounting, fighting, aggressiveness, charging at stakeholders and vocalisation 2. Stoning was significantly positively correlated with mounting, charging at stakeholders and vocalisation 2. Tail pulling was significant correlated with mounting, aggressiveness, charging at stakeholders and vocalisation 2.

Table 2: the significant Kendall's tau-b correlations between abusive handling and animal behaviour

Abusive handling	Behaviour	$\tau$	p-value
Beating of animals head	Fighting	0.565	0.001
	Aggressiveness	0.424	0.01
	Vocalisation 2	0.406	0.014
Pulling animal forward	Mounting	0.592	0.0003
	Fighting	0.617	0.0002
	Aggressiveness	0.510	0.002
	Charging at stakeholders	0.672	<0.0001
	Vocalisation 2	0.61	0.0002
Pushing animal forward	Mounting	-0.343	0.037
	Aggressiveness	-0.381	0.020
Slapping animal	Mounting	0.721	<0.0001
	Fighting	0.551	0.0008
	Aggressiveness	0.649	<0.0001
	Charging at stakeholders	0.763	<0.0001
	Vocalisation 2	0.703	<0.0001
Kicking animal	Mounting	0.499	0.002
	Fighting	0.436	0.008
	Aggressiveness	0.537	0.001
	Charging at stakeholders	0.763	<0.0001
	Vocalisation 2	0.703	<0.0001
Horn pulling	Mounting	0.546	0.0009
	Fighting	0.357	0.03
	Aggressiveness	0.468	0.004
	Charging at stakeholders	0.836	<0.0001
	Vocalisation 2	0.655	<0.0001
Stoning	Mounting	0.50	0.002
	Charging at stakeholders	0.763	<0.0001
	Vocalisation 2	0.703	<0.0001
Tail pulling	Mounting	0.579	0.0004
	Aggressiveness	0.371	0.024
	Charging at stakeholders	-0.638	0.0001
	Vocalisation 2	0.566	0.0006

## 5.2. Transport to markets

The transport of animals to markets is organised in tables for each market, with information about origin, distance and transport system. Information about injured and dead animals during transport was gathered from the interviews. It showed that during transport to Gudar market, 17% of animals died and 13% were injured or sick, to Kera market 22% of animals died and 29% was injured or sick, to Shola market 19% of animals died and no animals were injured or sick.

### 5.2.1. Gudar market

From 48 interviews performed with different stakeholders, i.e. traders, merchants, information about origins, distance and transport system of cattle were gained, Table 3. The most common transport system was by foot, and 96% of cattle were transported in that way. The remaining 4% were transported by vehicle.

Table 3: the origins of cattle on Gudar market

No. on map	Origin	Distance (km)	Time by foot (h)	Time by vehicle (h)
1	Arsi	230	-	6
2	Babich	40	24	-
3	Baco	120	72	-
4	Gedo (Chelia zone)	40-60	24-48	11-24
5	Fincha'a (Horo Guduru zone)	200	72	24
6	Gudar (Toke Kutaye zone)	1-15	0.5-3	-
7	Jimarare	130	72	-
8	Kolba	7	1	-
9	Midakegn (Ijeji zone)	90-110	48	-
10	Shenen	30	15-24	-
11	Toke	25	3	-
12	Tikur Inchini	35	5-24	-
13	Wadessa	5-20	2-24	-
14	Wajira	30	3	-

### 5.2.2. Kera market

From 29 interviews performed with different stakeholders, i.e. traders, merchants, information about origins, distance and transport system of cattle were gained, Table 4. The most common transport system was with vehicle, and 79% of cattle were transported in that way. The remaining 21% were transported by foot.

Table 4: the origins of cattle on Kera market

No. on map	Origin	Distance (km)	Time by foot (h)	Time by vehicle (h)
1	Adama	90-300	-	2- 10
2	Arsi	265-405	-	7-12
3	Bekoji	220	-	6
4	Chaffe Dunsä	95	10-36	-
5	Enewari	150	72	-
6	Gondar	500-740	-	8-36



7	Harar	390-560	-	5-24
8	Jimma	160-480	-	5-11
9	Kotu Gebeya	100	-	5
10	Negumit	338	-	16
11	Sendafa	40	8-24	-
12	Sheno	80	24	-
13	Tulu Bolo	80	-	2

### 5.2.3. Shola market

From 29 interviews performed with different stakeholders, i.e. traders, merchants, information about origins, distance and transport system of cattle were gained, Table 5. The most common transport system was with vehicle, and 93% of cattle were transported in that way. The remaining 7% were transported by foot.

Table 5: the origins of cattle on Shola market

No. on map	Origin	Distance (km)	Time by foot (h)	Time by vehicle (h)
1	Chelia	120	-	2
2	Debra-Birhan	130	-	2-5
3	Debra-S	170	-	4
4	Dessie(Wallo zone)	300-470	-	6-36
5	Ginchi	130	-	4
6	Jimma	350-380	-	4-12
7	Kotu Gebeya	100	-	5
8	Megui/Mesui	45	-	1
9	Menzo	140-380	168	6-36
10	Sheno	75	-	1.5-2
11	Tulu Bolo	80	-	1

\*Number 8 (Megui/Mesui) could not be found and is therefore not on map.

For the two markets in Addis Abeba, the most common way of transporting animals was by vehicle. In Ambo, it was more common to transport animals by foot to markets, Figure 12.

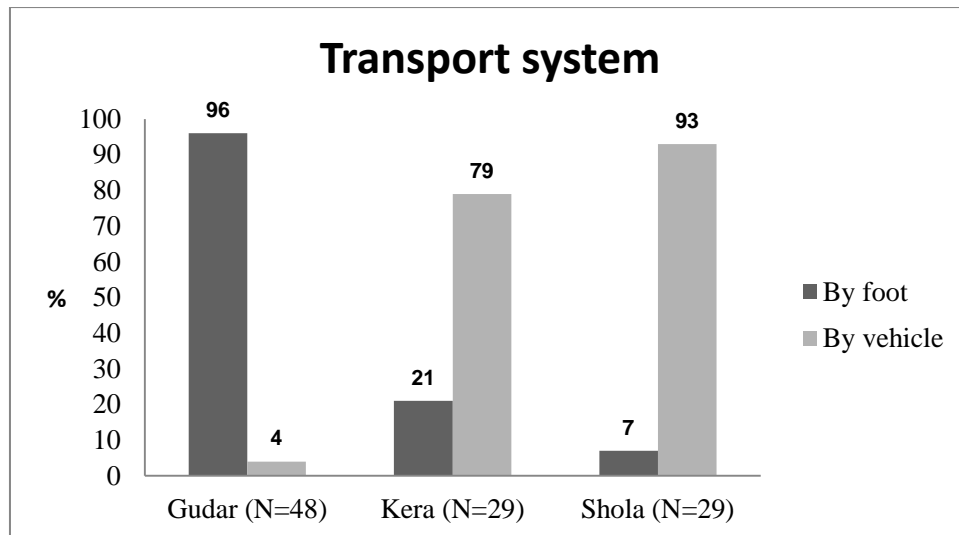


Figure 12: different transport system to the markets.

#### 5.2.4 Animal supply chains

The animal supply chains to markets are illustrated by three different maps, one from each market.

##### 5.2.4.1. Gudar market

The analysis of 48 interviews performed on Gudar market showed that the animals were transported from 14 different places in Ethiopia, Figure 13. The animals transported longest distance came from Arsi (not on map, see Figure 9) southeast of Addis Abeba by vehicle, and animals transported shortest distance came from Gudar, Toke Kutaye zone, by foot. To analyse supply chains of animals, information about transport duration and origin was used.

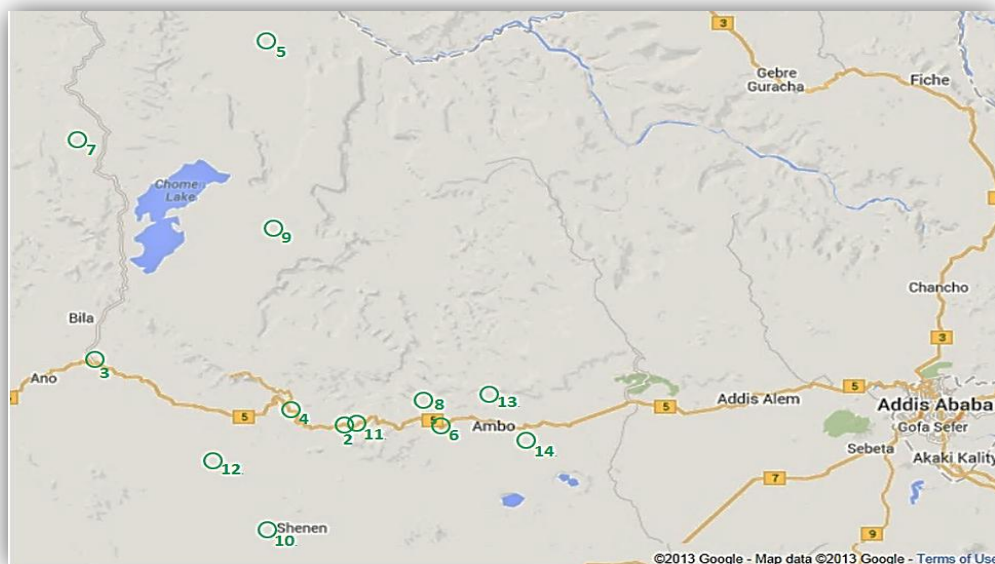


Figure 13: the supply chain of animals to Gudar market (no. 1 is not on the map, but can be seen on as no. 2 on Figure 14).

#### 5.2.4.2. Kera market

When analysing 29 interviews from Kera market, it was revealed that animals were transported from 13 different places, Figure 14. The animals transported the longest distance by vehicle came from Gondar (6), in north of Ethiopia, and animals transported the shortest distance came from Sendafa, southeast from Addis Abeba.

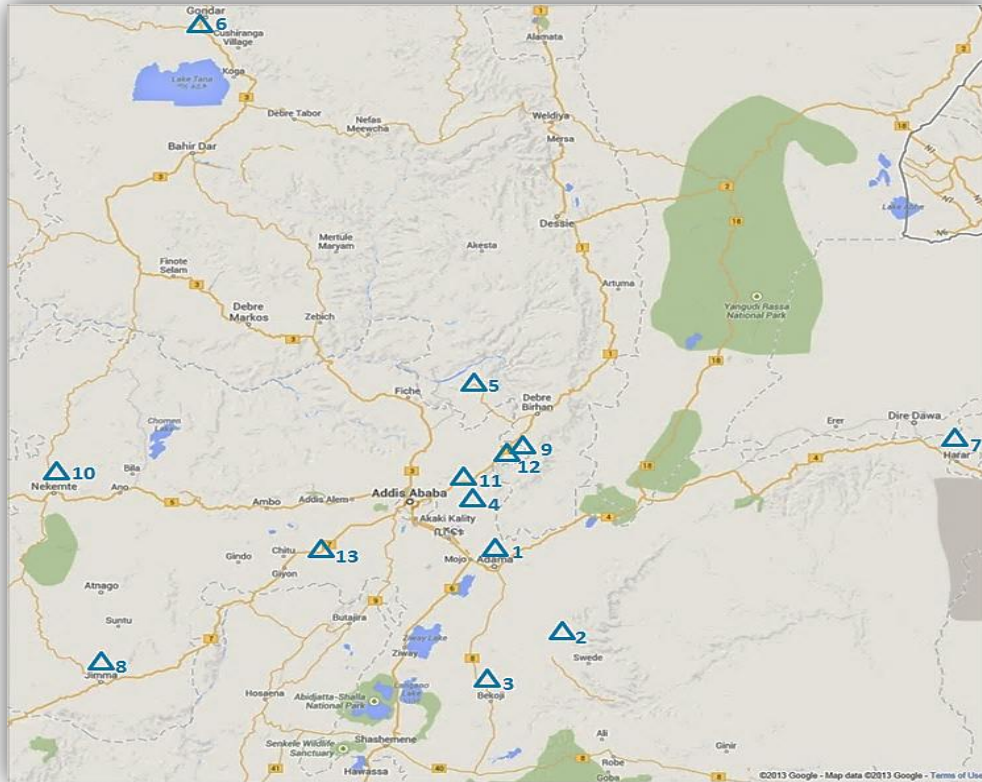


Figure 14: the supply chain of animals to Kera market.

#### 5.2.4.3. Shola market

From the analysis of 29 interviews performed on Shola market, it was shown that animals were transported from 11 different places, Figure 15. The animals transported the longest distance came from Dessie (4) in north of Ethiopia and Jimma (6) in southwest of Ethiopia. The animals transported the shortest distance came from Megui/Mesui (not on the map), also by vehicle.

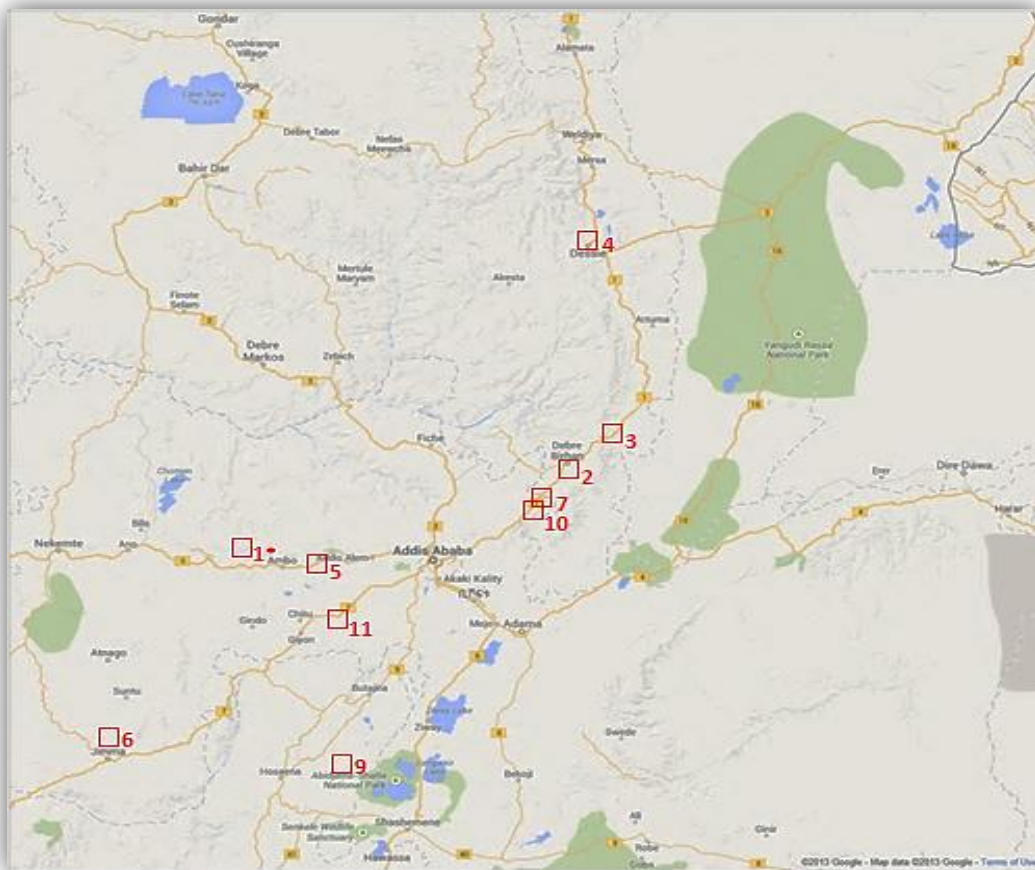


Figure 15: the supply chain of animals to Shola market (no. 8 is not on the map).

## **6. Discussion**

The main findings in this study are that the level of animal welfare is low for cattle held at markets and that behavioural correlations indicate that abusive handling by stakeholders increases animals' expression of stress-related and aggressive behaviour. Furthermore, poor animal welfare during transport is supported by high prevalence of death and injuries during transport to the markets. This is the first study that aims to evaluate animal welfare issues during handling by stakeholders at markets in Ethiopia.

This discussion is based on the four questions this study aimed to analyse:

1. Which behaviours are most frequently exhibited by animals at Kera, Shola and Gudar market?
2. Are there any significant correlations between stakeholders' abusive handling of animals and behaviours that animals express?
3. Which transport system is most common, by vehicle or by foot, and for how long are animals transported?
4. Where do the animals at markets origin from?

### **6.1. Behavioural observations**

From the beginning, this study was comprised of behavioural observations on cattle, sheep and goats. Due to amount of data and time restraint of the study, records from sheep and goats had to be eliminated from the analysis. However, interviews with stakeholders that owned sheep and goats were included when mapping supply chains of animals.

It was found that weather conditions influenced both how animals and stakeholders at markets behaved. This affected animal flow; when temperature was high the animals were observed to move less compared to when temperature was low. During some observational sessions, animals moved around a lot, which made it hard to observe and record behaviours. It also made it hard to distinguish the groups of animals from each other. When it was sunny, the ground on the markets was dry but when it was raining ground and stones got wet and slippery. This was observed to affect animals' movements and also had a great impact on which behaviours that were expressed. Furthermore, weather conditions also impacted on observers' working situation. During behavioural observations when animals were more active, it was a safety risk for observers to be in the areas together with animals. Therefore, these observations were either performed when moving away from animals or from distance above ground, behind fences, which then make out possible error sources. The behavioural observations were performed on unequal groups, i.e. different numbers of animals in each group, since number of animals at market varied depending on the weekday. The different group sizes were observed to affect animals' expression of behaviours; smaller and larger groups of animals showed either wide or narrow ranges of behaviours dependent on composition of individuals. If a small or big group of animals was composed of stressed animals which showed aggressive behaviour, the group became unstable. Furthermore, it was observed that abusive behaviours increased when the animals' stress-related behaviours increased. This consequently led to a negative handling experience for animals.

The behavioural observations were performed on groups; however, for further studies in the area it would be preferable to use continuous recording and focal sampling. If choosing one focal animal instead of a group of animals, data will be easier to manipulate and analyse. Moreover, if the amount of data were to increase and also to observe equal numbers of animal

groups on each market; it is likely that a normal distribution will be seen. That would further ease data analysis. Also, to evaluate reasons behind including behaviours in ethogram would be beneficial to ensure that only most relevant behaviours are included and that categories of behaviours are better defined. Whether or not the stakeholders changed their behaviour towards animals and the handling of them when I was filming and performing behavioural observations is not taken under consideration in this study.

#### **6.1.1. Frequencies of behaviours**

In order to calculate frequencies of behaviours, total number of expressed behaviours was divided with number of animals in the group. These frequencies were used in order to explain to what extent different behaviours were performed. Here, total frequencies of behaviours from the three markets are discussed.

Of the natural behaviours, the most frequently expressed animal behaviour was watching around, holding ears erect, vocalising and rumination. The explanation of this was that these behaviours are categorised as exploratory behaviours and are shown when environment is changing and when something happens in the animals' surroundings. Vocalisation is a natural behaviour that animals use when communicating with each other. Rumination is also a behaviour that animals do naturally. The highest incidence of abusive handling by stakeholders was beating of animal's body and head, and tail and horn pulling. This could have two different explanations; first that stakeholder wants to control animals at markets; second that stakeholder wants to move animal and when beating them, they move in opposite direction of the beating. The aggressive behaviours expressed by animals were fighting, aggressiveness and mounting. A reason for this can be that when animals are aggressive, they are fighting and mounting each other at a higher extent. Of the stress-related behaviours moving forward, head swings, idling, and vocalisation was the most expressed animal behaviours. These are believed to occur mostly due to that when animals express stress, they move around and vocalise more. Also, when an animal cannot cope with its environment, stress will be so high that it can lead to chronic stress, e.g. idling (Hemsworth, 2003). This is a state defined as when animal does not want to move and expresses restlessness. Moreover, swinging head from side to side can be a way of avoiding the source causing stress, which is usually stakeholder showing abusive behaviours. Of the resistance behaviours, resistance of being pulled and charging at stakeholders were the highest expressed animal behaviours. This is thought to be due to environmental factors; if animal is introduced to a new environment it usually takes some time before it gets used to it. However, expression of resistance behaviours can be due to stress caused by something else than a change in environment. The assumption of this is that different markets possess different environments, e.g. different numbers of animals, stakeholders and variable size of markets, and stakeholders who work on markets handle the animals in different ways. The animals' earlier experience of handling and animals' genetics are also influencing how they cope with these situations (Grandin, 1998).

Lastly, the findings in this study are in accordance to the finding by Bulitta, et al., 2012 who showed that animal handling in Ethiopia is mainly aversive. This study supports those findings, but also shows which behaviours that are expressed by animals handled in an abusive way.

#### **6.1.2. Correlations of behaviours**

When correlating behaviour, significant associations between stakeholders' abusive behaviour towards animals and behaviours expressed by animals were detected. These were used in

order to explain how animal welfare situation was at markets with respect to animal handling.

In general, abusive handling by stakeholders was significantly correlated with one or more animal behaviours from the categories aggressive, stress-related and resistant behaviours (Table 2). The abusive handling observed was beating animals' head, kicking and slapping animal, and pulling animal by rope and by horns. This resulted in higher expression of mounting, fighting, aggressiveness, charging at stakeholders and vocalisation due to stress or panic. This depends on the fact that the stakeholders' attitude and behaviour towards animals will affect how it behaves. If stakeholder behaves in an aversive way with a poor attitude and shows abusive behaviours, animal will behave in direct response to this and show more fear. This can also be measured by the distance animal keep from human when it resists against their behaviour and moves away from it (Hemsworth, 2003). An explanation for occurrences of aggressive behaviour is that when animals are mixed at markets, it is likely that they express higher frequencies of fighting behaviour (Broom, 2000). In the present study, mounting was observed to increase when animal was handled in an abusive way. However, this was not observed in referred study but it is likely that it is dependent on same reason as when mixing cattle at markets. Mixing unfamiliar animals with different experiences with early handling and varying genetic composition will lead to consequences in range of expressed behaviours and level of stress that animal shows (Grandin, 1998). However, negative correlations were found between pushing animal forward, mounting and aggressiveness. This means that animal behaviours are decreasingly dependent on abusive handling and a similar explanation like one above can be identified; if animals are being pushed forward, fighting will decrease since the animal is moving. Therefore, the aggressiveness that the animal shows will decrease. If behavioural changes are observed, it may indicate where in the situation there is a problem. If animal fails to maintain homeostasis during longer periods, it is more likely to express chronic stress (Blokhuys, et al., 1998), and this could sometimes be observed at markets when a high prevalence of stress-relating behaviours occurs.

The incidence of lameness was in total 3% at the markets. The reasons behind this could be if animal was moving away from abusive handling and fell, if stakeholder was beating the animal so it showed lameness, or if animal was injured during transport to market. It was sometimes hard to detect and distinguish lameness due to the crowded animal mass at markets. Also, some animals could have been sick and therefore showed lameness. In some cases, animals' claws were long which explained why animal could not walk properly.

The welfare situation for animals at markets was not in accordance with the Five Freedoms (FAWC, 2011). The markets in Ethiopia do not allow animals to have freedom from discomfort, or pain, injuries or diseases, or fear and distress.

## **6.2. Transport to markets**

When my colleague and I were gaining access to markets, permission was needed from Kera market. This was not expected and it therefore took several weeks before I could enter and start performing interviews and behavioural observations. However, at Shola and Gudar market, permission was not needed to get access. Some animal owners did not want to participate in the study and that sometimes limited number of available people to interview. Also, information from the interviews with stakeholders may not always be trustworthy. It happened that the real situation was exaggerated, e.g. about number of animals that died during transport or number of animals that were loaded on the vehicle. This is expected to

depend on various reasons: misunderstandings of questions and stakeholders giving information that they thought I wanted to have. When stakeholders described where the animals came from and when the assistant wrote it down, there could have been some misunderstandings due to the language barrier which possibly lead to misspellings of origins.

The transport to Gudar market was usually by foot (96%), while transport to Kera and Shola was with vehicle (79% and 93% respectively). To Gudar market, most of animals were transported from local villages and towns, which made walking the easiest way to move them. However, conditions of roads are also believed to be reasons for this type of transport. The transport to Kera and Shola market was usually farther, which explains why transport by vehicle was more common. Although, a few exceptions from this were identified and depend on the reasons described. This is in accordance with Masiga & Munyua (2005) that states that the most common transport system is by foot dependent on the low level of appropriate vehicles in Ethiopia. The economic aspect also affect choice of transport system since it is cheaper to transport animals by foot compared to by vehicles (Gebremedhin, et al., 2007). In some circumstances it is better to transport animal by foot, in case of shorter distances or when it is only a few animals, but this means that the price at local market might not be as good as the price on terminal market. On the other hand, animal's body condition can be compromised when walking long distances, especially without water, feed or sufficient rest. Taking this into consideration, transporting animals by vehicle may be a better option. However, incidence of bruising and lameness of animals is higher during transport on poor vehicles (Broom, 2003). The weather conditions differ from day to day and impact animals' expression of behaviours. It is also associated with multiple stress factors, which was in accordance to a study performed by Minkaa & Ayo (2007).

The high numbers of dead animals during transport to markets indicate that transport conditions are poor. Similarly, prevalence of injuries or sickness from transport indicates the same. This is stated to lower welfare during transport considerably, which is in accordance to a report by EFSA (2004) where mortality occurrences and injuries on animals are used as indicators of welfare level. The conclusion from this is that welfare during transports in Ethiopia is poor and needs to be improved. Some suggestions from this study are to design appropriate vehicles for use of transporting animals, to educate drivers and require a licence of driving vehicles which transport animals, to adjust transport to weather conditions and to make sure that stocking density is not exceeded. In order to evaluate animal welfare during transport, it would be of interest to follow a group of animals from farm to market and see how body conditions change. Then, prevalence of injuries and occurrence of dead animals could be identified and also reasons for this. Altogether, the results would be more reliable if performing these tests. If the stakeholders who work with transport of animals are educated, the situation would improve further.

### **6.2.1. Supply chains of animals**

The origin of animals transported to markets varied largely between and at markets; they could be transported for days or hours either by foot or vehicle. The duration that stakeholder was telling is thought to differ some due to that number of stops during the transport not was included in the study. It could also differ since some stakeholders were going to more than one market with their animals, expecting to get higher payment at larger markets. Therefore, it could be discussed whether the number of larger (terminal) markets should be increased in Ethiopia so animals and stakeholders do not need to be travel for so long in order to get god payment. For example, to Shola market animal's origin from 11 different areas and five of



these are close to each other. A possible solution could therefore be to have a terminal market located somewhere in the middle of this area. The same is observed for animals transported to Kera market.

In this study, supply chains of animals are insufficient since animals are transported long distances and for long time periods. This is both an issue for animals and for humans. A better animal flow will result in less time and money spent on transporting animals, and lead to improved animal welfare.

In order to improve animal welfare situation in Ethiopia, a first step is to outline guidelines for how animals are supposed to be housed, managed and taken care of with respect to their welfare status. This could be done either by developing policy frameworks in order to better address animal welfare issues, by monitoring for and reduce incidence of animal abuse, by increasing societal awareness of importance of animal welfare (education in school), by promoting training in animal welfare for veterinarians, farmers, people in agriculture and wildlife or lastly, by promoting and facilitate society's involvement in and education about animal welfare issues. As stated, Ethiopia has one of the biggest livestock populations in Africa and there are many challenges for the agricultural sector in order to achieve sustainable production (Masiga & Munyua, 2005).

## **7. Conclusions**

The main conclusions from this study are that stakeholders at markets are handling animals abusively. This type of handling is correlated with higher frequencies of aggressive, stress-related and resistance behaviours that animal express. The behaviours that the animals most frequently expressed were moving forward, fighting and aggressiveness. The most common transport system was by foot to Gudar market and vehicle to Kera and Shola markets. A high prevalence of dead and injured animals during transport was found, which is supposed to depend on type of transport and distance. The time of transport varied considerably dependent on origin and distance to the markets. Furthermore, supply chains of animals were shown to be deficient due to the many different origins and distances to those, which easily could be improved if it was taken into consideration when transporting animals.

The animal welfare at markets in Ethiopia is poor and animal transport conditions inadequate and this affects how animals behave towards stakeholders who are handling them. Further studies need to be carried out in order to analyse animal welfare situation at additional market. Also, the stakeholders who work on markets and with transport of animals are in need of education, and animal welfare legislation in Ethiopia needs to be established. This study can provide guidelines and results that can be used for such research.

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*Amasegenalu!*

*Love,*

***Bezunish***

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## Appendix I

The ethogram, with definitions, that was used for behavioural observations (Aradom, et al., 2012).

CATEGORY	BEHAVIOUR	DEFINITION
<b>Natural behaviour</b>	Rumination	The animal again chews what has been chewed and swallowed before
	Smelling	The animal breaths deep, fast and sniff air with the muzzle close to the ground
	Lying	At least two legs and stomach touches ground
	Eliminations	The animal urinates or defecates
	Ear erecting	The animal's ears are erected
	Tail erecting	The tail is not in its usual position, i.e. stands up or bent to the left or right side
	Vocalisation 1	The animal communicates with other animals, without being stressed or due to panic
	Watching around	The animal look from side to side and observe the environment
	Turning	The animal rotate from its original place
	Moving forward 1	The animal walk forward
<b>Abusive handling by stakeholder</b>	Beating of head	The stakeholder beats the animal with an object, e.g. stick, against its head
	Beating of body	The stakeholder beats the animal with an object, e.g. stick, against its body
	Forcing animals to fall	Stakeholder's force the animal to fall down on the ground, using rope and/or hands
	Horn pulling	The stakeholder pulls animal forward by its horns, using rope and/or hands
	Kicking animal	The stakeholder kicks the animal to make it move
	Pulling animals forward	The stakeholder moves the animal forward, by using rope
	Pushing animals forward	The stakeholder pushes the animal forward or to the side, by using hands
	Slapping	The stakeholder slaps the animal using hands
	Stoning	The stakeholder throws stones on the animal
	Tail pulling	The stakeholder pulls the animal's tail

<b>Aggressive behaviour</b>	Aggressiveness	The animal shows aggressive behaviour, with ears pinned back, eyes wide open and/or snaps in the air
	Fighting	The animal attacks other animals and fight
	Mounting	The animal mounts another animal
	Running	The animal moves faster than walking
	Kicking	The animal kicks against the stakeholder
	Jumping	The animal jumps with less than two feet touching ground
<b>Stress-related behaviour</b>	Idling	The animal stands or lies down and do not want to move
	Panting	The animal breaths rapid and gasps for air
	Paralysed respiration	The animal breaths slow due to stress
	Foaming	The animal produces saliva in large amount
	Vocalisation 2	The animal vocalise with high squeals due to stress or panic
	Stamping of feet	The animal stamps with one or more feet on the ground
	Stretching	The animal extends the body due to stress
	Head swinging	The animal swing head from side to side
	Moving forward 2	The animal moves faster due to stress or panic
<b>Resistance behaviour</b>	Charging at stakeholders	The animal charges at stakeholders
	Refusing to leave their original place	The animal stands still and refuses to move
	Resistance to being pulled	The animal stands up and resists to being pulled by stakeholders
	Balking	The animal lies down and resists to being moved by stakeholders
	Retreating	The animal moves backward
	Reversing	The animal changes direction and moves against animal flow
<b>Injuries</b>	Lameness	The animal is lame on one or more legs
	Falls	The animal falls down with any part of the body touching ground
	Slipping slightly	The animal loses its balance temporarily but remain straight
	Slipping severely	The animal loses its balance and almost fall down

## Appendix II

The survey of behavioural observations performed on markets.

**Date:**

**Survey number (date-groupnr-breed)**

**Market:**

CATEGORY	BEHAVIOUR	NUMBER OF ANIMALS	SUMMATION
<b>Natural behaviour</b>	Rumination		
	Smelling		
	Lying		
	Eliminations		
	Ear erecting		
	Tail erecting		
	Vocalisation 1		
	Watching around		
	Turning		
	Moving forward 1		
<b>Abusive handling by stakeholder</b>	Beating of head		
	Beating of body		
	Forcing animals to fall		
	Horn pulling		
	Kicking the animal		
	Pulling animals forward		
	Pushing animals forward		
	Slapping		
	Stoning		
	Tail pulling		
<b>Aggressive behaviour</b>	Aggressiveness		
	Fighting		
	Mounting		
	Running		
	Kicking		
	Jumping		
<b>Stress-related behaviour</b>	Idling		
	Panting		
	Paralysed respiration		
	Foaming		
	Vocalisation 2		
	Stamping of feet		
	Stretching		
	Head swinging		
<b>Resistance behaviour</b>	Moving forward 2		
	Charging at stakeholders		
	Refusing to leave its original place		
	Resistance to being pulled		
	Balking		
	Retreating		
<b>Injuries</b>	Reversal		
	Lameness		
	Falls		
	Slipping slightly		
	Slipping severely		

## Appendix III

The three questionnaires (Information about stakeholder, Transport to market, At market) that were used for interviewing stakeholders on markets.

### 1. INFORMATION ABOUT STAKEHOLDER

Date:

Surveynr:

**Stakeholder:**

Owner \_\_\_\_\_

Trader \_\_\_\_\_

Merchant \_\_\_\_\_

Butcher \_\_\_\_\_

Slaughter man \_\_\_\_\_

buying animals and sell them at market

buying animals for restaurants etc.

buying animals for meat store

**Level of Education:**

Yes \_\_\_\_\_ in what? \_\_\_\_\_

No \_\_\_\_\_

**Age:** \_\_\_\_\_ years

**Earlier experience:**

S. no	Earlier experience in animal	Yes	No
1	Owner		
2	Handling		
3	Transporting		
4	Marketing		
5	Slaughtering		

### 2. TRANSPORT TO MARKET

Date:

Surveynr:

**Breed & number of animals can be transported to market**

S. no	Breed/species	Number of animals	
1	Cattle		
2	Sheep		
3	Goat		



**Transport system:**

1. By walk \_\_\_\_\_
2. By vehicle \_\_\_\_\_

**Transport duration**

\_\_\_\_\_ km  
 \_\_\_\_\_ hours  
 \_\_\_\_\_ days

**Initial place/origin:** \_\_\_\_\_

**How did you get them?**

1. From original farm \_\_\_\_\_
2. From other markets \_\_\_\_\_

**Is there provision of following managerial activities during transport?**

S. no	Provision of ----during transport	Yes	No
1	Rest		
2	Shelter		
3	Water		
4	Feed		

**How many animals died during transport? \_\_\_\_\_, Why?**

1. Traffic accident \_\_\_\_\_
2. Bad condition \_\_\_\_\_
3. Other \_\_\_\_\_

What? \_\_\_\_\_

**How many of them got injured/ sick? \_\_\_\_\_****During transporting animals to market what do you consider as the main problem?**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

### 3. AT MARKET

Date:

Surveynr:

Name of Market: \_\_\_\_\_

Breed & number of animals can be marketed

S. no	Breed/species	Number of animals	
1	Cattle		
2	Sheep		
3	Goat		

#### Animal condition:

- |           |       |   |
|-----------|-------|---|
| 1. Thin   | _____ | can see ribs clear, obviously spinal column |
| 2. Normal | _____ | can see ribs and spinal column, not clear   |
| 3. Fat    | _____ | cannot see ribs or spinal column            |

#### Injury

- |                         |       |       |
|-------------------------|-------|-------|
| 1. Dead                 | _____ |       |
| 2. Lameness             | _____ |       |
| 3. Opened, bleeding cut | _____ |       |
| 4. Other injury         | _____ | What? |

\_\_\_\_\_

#### Are injured/sick animals treated?

- |        |       |
|--------|-------|
| 1. Yes | _____ |
| 2. No  | _____ |

#### Is there provision of following management activities at market?

S. no	Provision of the following at market	Yes	No
1	Rest		
2	Shelter		
3	Water		
4	Feed		

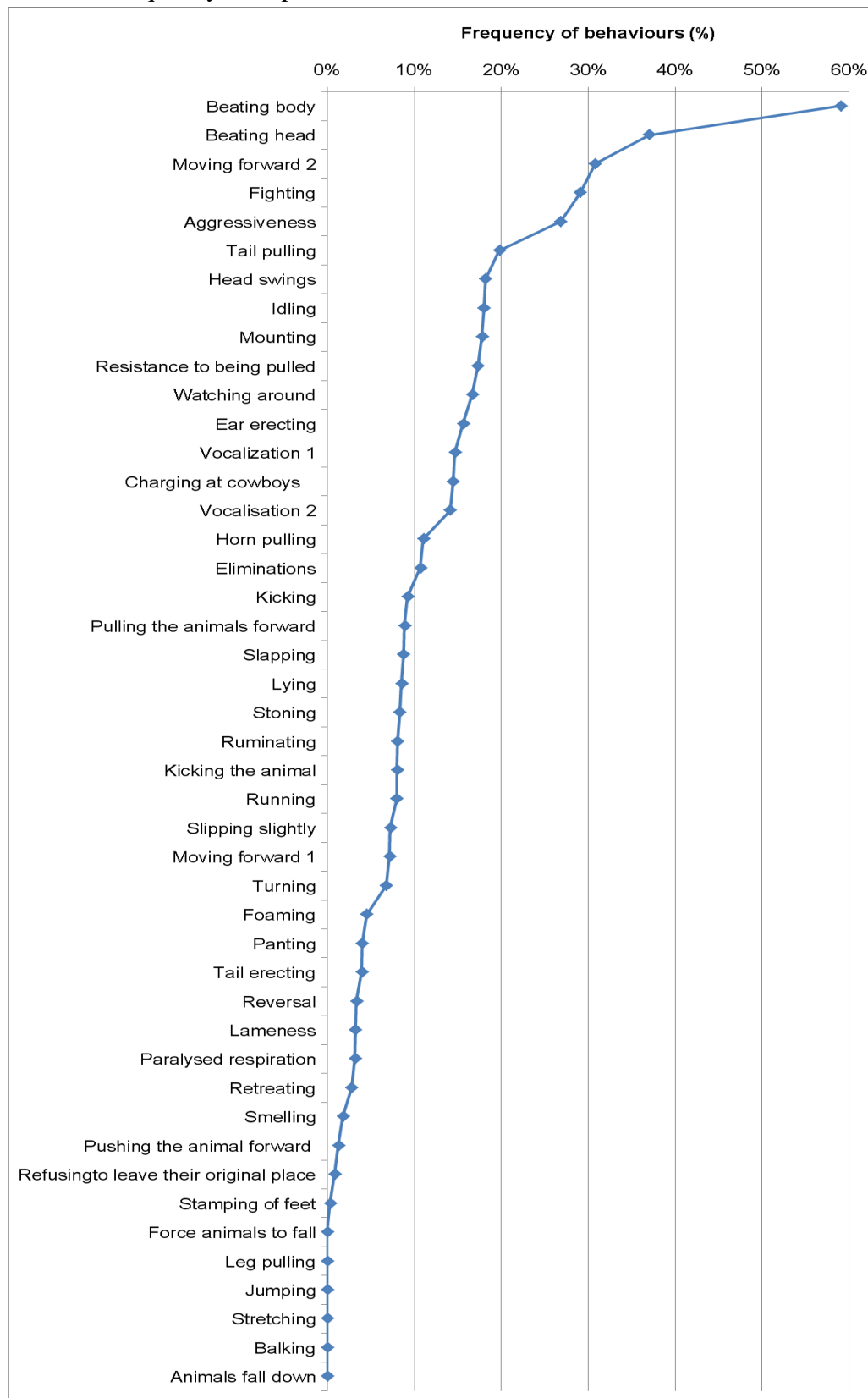
#### At market what do you consider as the main problem?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

## Appendix IV

### Results

The total frequency of expressed behaviours, calculated as a total value for all three markets



## Appendix V

### Results

The Kendall's tau-b Correlation Coefficient calculated between stakeholders' abusive handling against animals and behaviours that animals express.

Kendall's tau-b Correlation Coefficients N = 38; p-value <0,05											
	BEATING HEAD	BEATING BODY	PULLING BY ROPE	PUSHING BY HANDS	SLAPPING	KICKING THE ANIMAL	FORCE ANIMALS TO FALL	HORN PULLING	LEG PULLING	STONING	TAIL PULLING
MOUNTING	$\tau$	0.239	-0.097	0.592	-0.343	0.721	0.499	0	0.546	0	0.579
	p-value	0.146	0.553	0.0003	0.037	<0.0001	0.002	0	0.0009	0	0.0004
FIGHTING	$\tau$	0.565	0.181	0.617	-0.094	0.551	0.436	0	0.357	0	0.218
	p-value	0.001	0.271	0.0002	0.569	0.0008	0.008	0	0.03	0	0.184
AGGRESSIVENESS	$\tau$	0.424	0.129	0.510	-0.381	0.649	0.537	0	0.468	0	0.371
	p-value	0.01	0.432	0.002	0.020	<0.0001	0.001	0	0.004	0	0.024
CHARGING AT COWBOYS	$\tau$	0.250	0.187	0.672	-0.219	0.763	0.763	0	0.836	0	-0.638
	p-value	0.129	0.256	<0.0001	0.183	<0.0001	<0.0001	0	<0.0001	0	0.0001
PANTING	$\tau$	-0.298	-0.175	0.004	-0.134	-0.281	-0.281	0	-0.136	0	-0.078
	p-value	0.07	0.288	0.978	0.417	0.088	0.088		0.409	0	0.636
VOCALIZATION 2	$\tau$	0.406	-0.011	0.61	-0.233	0.703	0.703	0	0.655	0	0.566
	p-value	0.014	0.947	0.0002	0.157	<0.0001	<0.0001	0	<0.0001	0	0.0006

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