THE EFFECTS OF SWEDISH MASSAGE ON PERFORMANCE HORSES IN THE BLOEMFONTEIN AREA

By

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DECLARATION OF INDEPENDENT WORK

I, Jolandé Badenhorst, do hereby declare that this research study submitted for the degree MAGISTER TECHNOLOGIEA: SOMATOLOGY in the DEPARTMENT OF HEALTH SCIENCES at the CENTRAL UNIVERSITY OF TECHNOLOGY, FREE STATE, is my own independent work that has not been submitted before, to any institution by me or anyone else as part of my qualification.

_____ _____

Signature of student Date

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I thank the heavenly Father for blessing me with the knowledge and perseverance to complete my degree.

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ABSTRACT

Somatologists in South Africa are currently searching for new and innovative ways to broaden their specializing field and not just be recognised as a beauty therapist. A somatologist receives skilled training in different alternative therapies as well as the well-being of the whole body in order to be a cut above the rest. Performing alternative therapies, like massages on horses can broaden the horse loving somatologist's specializing field. In the past the horse's well-being was not catered for and was not treated with respect. Nowadays the horse's well-being is more respected due to anti-animal cruelty societies. A somatologist, who has a love for horses, might improve the horse's well-being through massage, in similar ways a human's well-being is improved. Furthermore, the horse's performance ability might improve when its well-being is improved. In order to accomplish the above mentioned it will be necessary to investigate the effects of Swedish massage on the performance ability of competitive horses. The objective of the study was firstly, to obtain information regarding the age, environmental stressors, breed, specific diets, disciplinary of the horse and horse's performance ability by means of the completion of a questionnaire by the owner. Secondly, to measure the heart rate and observe the behaviour of the horses before and after a Swedish massage in order to determine whether any physical and/or behavioural changes have occurred. Thirdly, to evaluate possible improvement in the horse's performance ability, by using a post treatment questionnaire. Lastly, to compare the different disciplines regarding the specific influence Swedish massage may have on the horse's performance. Data was collected by means of qualitative research which was conducted through the practical performance of Swedish massage on the horse and recording the different responses to the massage on a record card. Quantitative data was collected from the horse's owner/trainer/rider through pre- and post- intervention questionnaires. The results obtained indicated that a horse benefits from a Swedish massage in similar ways a human does. The horses became more relaxed due to a decrease in heart rate after the massage as well as the horse's overall flexibility improved. The horse's muscle condition however did not improve due to the Swedish massages. A

somatologist, whom has a passion for horses, can effectively perform Swedish massages on a horse to improve flexibility of muscles and overall relaxation to enhance the performance ability of the competitive horse.

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ABBREVIATIONS

AST	Aspartate aminotransferase
CK	Creatine kinase
cm	Centimetres
CUT	Central University of Technology, Free State
DOMS	Delayed onset muscle soreness
ERASA	Endurance ride association of South Africa
FEI	Federation Equestre Internationale
hh	hands for horse measurement
IFREMT	International Federation of Registered Equine Massage Therapists
iu/l	International units per litre
km/h	Kilometres per hour
RSA	Republic of South Africa
^{o}C	Degrees Celcius

CHAPTER 1: GENERAL INTRODUCTION

1.1 INTRODUCTION

The word ‘massage’ stems from the word ‘mass’; the Arabic term denoting ‘to press’. Swedish massage is a massage expressing certain scientific manipulations that are performed by the hands of the massage therapist upon the body of the patient/client (Hollis, 2009). Swedish massage is an ancient art, and modern clinical research has provided increasing scientific evidence for its therapeutic use on the human body. For centuries the effects of ‘laying on hands’ or touch may have been beneficial to the human body and mind. Touch stimulates the somatosensory system which is the part of the sensory system concerned with the conscious perception of touch, pressure, pain, temperature, position, movement and vibration, which arise from the muscles, joints, skin and fascia (Gleveckas-Martens, 2013). The effects of massage can be classified as a means of creating energy, where such has become exhausted, from whatsoever the cause, and is a natural method of restoring the muscle part; either locally or generally injured; to its normal condition (Hollis, 2009).

A massage routine is part of physiotherapy that has long been accepted as a rehabilitation method, and is used on human athletes in high performance sports. The performance horse can also be classified as an equine athlete and might benefit from a Swedish massage in the similar way that a human athlete does. The advantages of massage, in animal medicine, is currently rediscovered and valued. By massaging a horse, the owner learns to contribute to the health and comfort of the horse, therefore contributing to the horse’s everyday needs. Anyone can learn to massage a horse by gaining knowledge of its superficial muscle anatomy and of basic massage techniques. No detailed medical knowledge is necessary, unless the equine massager wants to do therapy for injured horses (Ettl, 2002).

In Chapter one, background information on Swedish massage and the effects thereof will be discussed and how it can be adapted to suit a horse’s body.

1.2 BACKGROUND INFORMATION

Massage has been defined as “a mechanical manipulation of body tissues with rhythmical pressure and stroking for the purpose of promoting health and well-being” (Weerapong, Hume and Kolt, 2005). Currently numerous forms of massage therapies exist - Swedish massage being only one of these. The massage manipulations of Per Henrik Ling, often referred to as the father of Swedish massage, have been taught and performed for over two centuries. Swedish massage has been and is still being used by massage therapists, other manual therapists and health care workers around the world. Massage manipulations are skilfully performed in different ways, either by the therapist’s hands or by mechanical means. A therapist using massage manipulations as a form of treatment can be described as having the ability to treat with their hands and touch in a skilful manner (Casanelia and Stelfox, 2010). These hand-applied manipulations are performed with different techniques or strokes including effleurage, petrissage, tapotement, friction and vibrations. Each technique plays a specific role in the Swedish massage sequence. These different techniques will be discussed in detail in Chapter 2.

Massage has been used for rehabilitation and relaxation for thousands of years around the world. Physiotherapy massage is generally used for preparation of athletes for competitions, between competitions and it assists in the recovery from competitions, rather than treating specific problems. Therapeutic massage such as Swedish massage has been used to support the general effects of physiotherapy massage. The application of massage for athletes is mostly applied as a result of the belief; through observation and experience; that massage can provide several benefits to the body such as increased blood flow, reduced muscle tension and an increased sense of well-being. Limited scientific evidence exists to support the evidence of using Swedish massage for enhancing performance, enhancing recovery from injury or for preventing muscular injury on humans (Weerapong, Hume and Kolt, 2005). However, literature claims that Swedish massage can have physiological and psychological effects. Physiological effects include increase in blood flow which provides the area massaged with nutrients and oxygen and speeds

up the removal of waste products, consequently enhancing the function of the muscle. Another physical effect is to alleviate symptoms of delayed onset of muscle soreness (DOMS). Psychological effects that can be achieved through massage are enhanced emotional well-being, calmness, improved mood, relaxation and reduced anxiety. During an athletic performance, the athlete may experience muscle tension, DOMS and anxiety that can result in poor performance. When an athlete receives regular massages, it might be beneficial to reduce muscle tension, DOMS symptoms and promote relaxation, thus enhancing the ability to perform (Hemmings, 2001). Through personal experience as a non-athlete, it is difficult to function normally and optimally with muscle tension that leads to discomfort and pain. An athlete who uses his/her muscles more than a non-athlete will not be able to perform optimally with muscle tension. Tensed muscles cannot stretch and relax as normal, thus limiting the full range of motion of the limb. A limb not being able to function in its full range of motion hinders the athlete to perform specific actions, consequently reducing its performance ability.

The performance horse is an equine athlete used for competitions such as dressage, endurance, polo, show-jumping, etc. Attaining optimal individual performance within the equestrian discipline, the performance horse must be in peak condition and possess the correct psychological state (Booth, 2009). As an athlete, the performance horse might experience muscle soreness, pain and fatigue. Horses are unable to verbalise pain or fatigue which could influence the performance ability of the horse. The equine athlete also uses muscles to perform specific movements related to the discipline of competing. The equine athlete might benefit from a massage similar to a human athlete (Hall, 2014).

Massage for horses is currently known as equine massage. Equine massage is the therapeutic application of massage techniques to a horse through the manipulation of the soft tissues (Hall, 2014). Comparing the definition for massage with equine massage, it is exactly the same - the only difference is that it is performed on horses. Many massage techniques performed during an equine massage have

been derived from the normal human Swedish massage. Known effects of massaging a horse are improvement of the horse's performance by treating and preventing muscle tension which can lead to a muscle injury; and relaxing the horse, which can lead to better concentration during training sessions as the horse concentrates on the manoeuvre rather than on discomfort or pain. Massage is recognised as an important element in keeping horses healthy and comfortable as well as improving their movement. A horse free from muscle tension will be able to perform specific manoeuvres aligned with the discipline. The resale value of better performing horses increase, as the horse is able to perform in higher levels of competition, thus earning higher grades (Hall, 2014).

A somatologist is defined as an individual concerned with the treatment and prevention of disorders involving the skin and body, and is interested in the overall health and well-being of people. The somatologist has the knowledge to perform a variety of specialised massages on human clients, including reflexology, aromatherapy, manual lymph drainage and Swedish massage (Vosloo, 2009). Swedish massages performed on horses can broaden the somatologists' specialising field by catering for the horse's well-being, which can be aligned with the somatologists current interest of catering for the human's well-being. A somatologist's working experience may be broadened working in collaboration with a veterinarian or horse trainer to perform Swedish massages on horses.

Even though a somatologist is able to perform an effective Swedish massage on humans, sufficient knowledge regarding the horse's superficial muscle anatomy is imperative in order to perform a proper horse Swedish massage (Ettl, 2002). It is important to know the insertion and origin of the superficial muscles in order to perform the different Swedish massage techniques in the correct manner. Furthermore, it is important for the somatologist to have knowledge in handling horses and interpreting their behaviour, as the horse is a prey animal and can respond negatively by kicking or biting when it feels threatened. Not having knowledge in handling of horses may lead to severe injury to the somatologist

performing the massage. The similarity would be that the Swedish massage techniques used on humans would be exactly the same for horses (Hollis, 2009).

1.3 PROBLEM STATEMENT

In the past the horse's well-being and needs were not a priority and the horse was not treated with respect. Nowadays the awareness of the horse's well-being is becoming more acceptable due to the awareness created by anti-animal cruelty societies to respect the horse's health and welfare. By trying to understand and respect the nature and needs of a performance horse, injury and discomfort may be prevented, as the horse's health is promoted when its needs are catered for. By acknowledging a horse's needs, the horse's health and welfare will be improved. A horse is unable to verbalise any pain or discomfort experienced, therefore preventative treatment for muscle tension must be found before any pain or discomfort appears.

Furthermore, competitive horsemen/women want to have a fit and healthy horse in order to perform optimally, hence increasing the resale value of the horse as mentioned earlier. Horses in training may experience muscle tension but are unable to verbalise it to their owner, and therefore they rather respond with unexplainable behavioural changes. The owner/rider may interpret these sudden behavioural changes as the horse being stubborn, but these changes might be the horse's only way to inform its owner of discomfort and pain. Effective communication between horse and rider may lead to increased ability to perform manoeuvres, and by doing so, improving the horse's performance ability.

Human athletes visit a physiotherapist or a somatologist when needed for therapeutic massage therapies in order to relieve muscle tension, consequently improving their performance abilities in athletics. An equine athlete may also benefit in a similar way a human athlete does from Swedish massage performed by a somatologist, as a therapeutic massage therapy. The research question that arises is whether the Swedish massage may have an effect on the performance ability of competitive horses.

1.4 AIM

The aim of this research study was to investigate the effects of Swedish massage on the performance horse and the possible influence it may have on the performance ability of the horse.

1.5 OBJECTIVES

The objectives of this research study were:

- Firstly, to obtain information regarding the age, environmental stressors, breed, specific diets, discipline of the horse and the horse's performance ability by means of the completion of a questionnaire by the owner.

- Secondly, to measure the heart rate and observe the behaviour of the horses before and after a Swedish massage in order to determine whether any physical and/or behavioural changes have occurred.

- Thirdly, to evaluate possible improvement in the horse's performance ability by means of a post-treatment questionnaire.

- Lastly, to compare the different disciplines regarding the specific influence Swedish massage may have on the horse's performance.

1.6 RATIONALE

Extensive research has been conducted on the effect of Swedish massage on the human body, however a lack in research for using touch, massage and stretching in horses exist. Swedish massage might relax the horse and prevent muscle tension, hence preventing miscommunication between horse and rider.

Further research is necessary in order to determine the effects of Swedish massage on the performance horse. The results of this research study might be valuable for the performance horse industry due to the fact that a horse might return more promptly from or prevent a muscle injury after completion of a massage treatment. Furthermore, somatologists can benefit from this study by broadening their specialising field.

1.7 STRUCTURE OF THE THESIS

- Chapter 1 provides background information about Swedish massage and emphasizes the benefits of Swedish massage for the equine athlete.
- Chapter 2 comprises a literature study that covers the horse's evolution, body and the muscles affected during riding as well as the adaptations for a somatologist to perform a horse Swedish massage.
- Chapter 3 explains the methodology used to obtain the data in order to establish the effect of Swedish massage on the performance horse.
- Chapter 4 presents the results obtained from the pre-intervention questionnaire, flexibility measurements, blood sampling, relaxation signs and the post-intervention questionnaire. Furthermore, Chapter 4 contains a detailed discussion of the results obtained.
- Chapter 5 provides the conclusion of the study as well as recommendations for further research.

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CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Thousands of people rely on horses as their primary source of income, whilst equestrian sports and events provide entertainment to millions of spectators. Horses routinely assist in different human occupations, for instance working with law enforcement (police horses), searching for lost individuals and as a therapeutic riding horse. These working conditions could place physical stress on a horse as well as competing in different disciplines (Hartshorn, 2008).

In the wild, the horse performs a type of self-massage by scratching and rubbing against a tree. Horses also massage each other by nibbling the other on the withers. The Greek physician Hippocrates, advocated rubbing as a treatment for stiffness (Moyer, Rounds and Hannum, 2004). The performance horse lives in a stable and do not have the option of performing a self-massage due to being confined to a stable with walls. Massage therapy on the horse might be a beneficial alternative treatment for pre-competition preparation, relieve of muscle soreness and fatigue. Human athletes utilise massage therapy to relieve muscle soreness and tension in order to return promptly from a muscle injury (Hartshorn, 2008).

2.2 HISTORY

Throughout history the horse has played a significant role in society and continues to do so today. The evolution of the horse is one of the best documented of all mammals due to having a complete fossil record which has appeared in the different stages of the horse's development. Fifty million years ago, the prototype of the horse was the size of a fox called Eohippus, which had toes instead of hooves and was the first recorded fossil in the evolution of the horse (Raven and Johnson, 2001). Millions of years later Eohippus changed to Mesohippus due to vegetation and climate. Mesohippus still had toes instead of hooves but was classified to be a sheep-sized animal. Between 25 and 10 million years ago, Merychippus appeared

which was a pony-sized animal and was a three-toned foot grazing animal (Molén, 2009). Pliohippus appeared about 2.5 to seven million years ago and had more 'horse-like' features such as a single toe (hoof) and with more strength and speed. The final stage in the development of the horse was Equus Caballus and appeared less than two million years ago. Equus Caballus was the forerunner of the present horse, but during the beginning of the Equus stage, horses were not yet domesticated, in other words they were still wild animals (Faurie, 2000).

The first domesticated horse was recorded during the Neolithic era by the tribes who inhabited the steppes around the Black and Caspian seas, and most likely used as draught animals, pulling crude wagons. After the Neolitic era, humans realised the advantage of riding a horse and started breeding and maintaining horses for own use. The origins of tack and equipment can be traced back to 1500BC and was first used by the Chinese in pre-Christian times (Warren, 2007).

Over the past decades, humans have domesticated horses and created more than 200 breeds, from the powerful Clydesdale to the graceful Arabian. The human has bred different horses to ensure their needs on the battlefields, farms and elsewhere are met. Millions of people rely on horses as adored companions as well as other various important purposes (Mills and McDonell, 2005).

2.3 THE DOMESTIC HORSE AND ITS WELFARE

A domestic animal refers to an animal of a species of vertebrates (fish, amphibians, reptiles, birds and mammals) which has been domesticated by humans in order to live and breed in a tame condition and depend on human kind for survival. Domestic animals include any equine or bovine animal, goat, sheep, swine, dog, cat, poultry, or other domesticated beast or bird (RSA, 1962). According to the Animals Protection Act No. 71 of 1962, a domestic animal is defined as a pet; dogs, cats, birds or other tame animals that serve a purpose for its owner (RSA, 1962). A horse is therefore considered a domesticated animal.

Keeping horses within a stabled environment, and using them for riding and driving purposes do require taking into consideration the effect these environments and

activities have on the normal behavioural requirements and motivational drive in horses. One has to pertinently consider the conditions in which horses are kept and the activities for which horses are being used, as these two factors may affect the horse's physical as well as psychological welfare (Henderson, 2007).

Physical welfare of horses may be hindered through two practices; firstly through management practices and secondly through riding practices. Captivity (stabling) is a management practice which may influence the horse and cause behavioural changes (Casey, 2007). Domestic horses in captivity are housed in conditions which differ remarkably from those in which the horse evolved (Cooper and Albentosa, 2005). The horse's behavioural responses evolved in response to challenges faced during its evolutionary herd-forming, grazing herbivore stage, which usually avoid predation by flight, meaning running away from the stressor. However, in captivity many of these challenges have been removed. The stabled horse is protected from predation, provided with sufficient food and sheltered from climatic extremes. The stabled horse's natural instincts cause the horse to still experience the psychological need to respond to environmental stressors, even though there is not any. This may lead to the horse reacting negatively towards a positive stimulus (Cooper and Albentosa, 2005).

Furthermore, horses are social animals which evolved to live in social groups. Performance horses are normally stabled by their owners to prevent injury as a result of aggressive encounters with other horses. Such an injury may reduce the horse's performance ability and appearance. (Fureix, Bourjade, Henry, Sankey and Hausberger, 2012). However, stabling limits the horse's ability to socialise. The stabled horse might be stressed due to the fact that it has been removed from its natural habitat.

Riding practices may physically influence the horse and cause pain-related behaviour and head shaking. The features of a happy Equine athlete is a horse which is calm, supple, loose, flexible, confident and also attentive and keen to understanding the rider's communication aids correctly. Pain during riding may be

shown as lethargy, and some riders may wrongly interpret it as laziness in the horse (Hall, Huws, White, Taylor, Owen and Mcgreevy, 2013). Behavioural signs in the ridden horse may not relate specifically to the source of the pain. Tooth grinding or contact issues, although suggestive of dental pain, may be the result of pain arising elsewhere (such as the lumber region or hind-legs) (Hall *et al.,* 2013).

According to Hall *et al.,* (2013), aggressive behaviour towards humans has been shown by horses with severe vertebral problems and who are in pain. Back pain will be exacerbated by ridden work and is often the cause of poor performance, stiffness and/or abnormality of the hind limb gait in performance horses.

The welfare of the horse participating in equestrian sport has become a contentious issue. Awareness has been created by horse governing bodies to ensure that competitive performance is not achieved at the expense of the horse's welfare (Hall *et al.,* 2013). Each performance discipline has different requirements in order to perform the actions which may influence universal welfare requirements. However, there are basic requirements that underpin all equestrian performances which protect the welfare of the ridden horse. In South Africa, each horse governing body for the different equestrian disciplines have a rule book which stipulates how the welfare of the horse should be maintained (RSA, 2014). In the rule books, clear requirements are stipulated in order to protect the ridden horse from unnecessary pain, suffering, injury and disease.

The above-mentioned domestication factors may influence the horse's welfare and cause the horse to experience stress due to its need to adapt to a man-made environment (Budzyńska, 2014).

2.4 THE HORSE'S BODILY SYSTEMS

A horse is defined as a solid-hoofed plant-eating domesticated animal with a flowing main and long tail, used for riding, racing, or to carry or pull loads. The horse's lifespan is 25 to 30 years, and its gestation period is 340 days. A horse can reach a speed of 40 to 48 kilometres per hour (km/h) on a gallop, 19 to 24km/h on a canter,

6,4km/h on a standard walk and 13 to 19km/h on a trot. A horse's height is between 14.2 hands and higher (144.3cm) and it weighs an average of 450kg (Ettl, 2002).

The horse's skeleton system bears the weight of the whole body, protects the internal organs and nervous system and the muscles provide the horse with its shape. The skeleton of the horse is divided into two parts, namely the axial skeleton (the skull, vertebrae, ribs and breastbone) and the appendicular skeleton (the limbs; including the shoulders and pelvis). Muscles, tendons and ligaments which join the bones together provide stability to the horse's skeleton (Pavord and Pavord, 2004).

The muscular system is the apparatus of movement of the horse's body, consequently providing an important and diligent function. Three types of muscle tissue exist, namely the smooth, striated and heart tissue. The smooth muscles are controlled by the autonomic nervous system, meaning the action is involuntary. This includes the digestive, respiratory and circulatory systems. The striated muscles are the muscles that move the bones and therefore the skeleton. The striated muscles are divided into white (less oxygen) and red (more oxygen) muscle fibre (Ettl, 2002). The difference in muscle fibre is due to the amount of myoglobin available in the muscle fibres. Weight-bearing muscles have a large amount of myoglobin, and this is more present during endurance activities. Muscles with more white muscle fibre will be more responsible for movement and are more present during aerobic conditions. Cold-blooded-horses, for instance endurance horses, have more red muscle fibre and can exert a lot of power over an extended period of time. On the other hand, Thoroughbreds and Quarter horses were bred with more white muscle fibre which enables the horse to be a sprinter - therefore having a lot of power but only for short periods of time (Norton, 2013).

The Cardiovascular system of the horse consists of the heart, arteries, veins and capillary beds (exchange areas). The horse's heart must supply oxygenated-rich blood to all the muscles and organs, not only at rest and routine activities, but also during periods of extreme physical stress encountered through strenuous training (Thomas, 2006).

As in all mammals, the horse's heart consists of four chambers, two atria which are situated above two ventricles separated by four valves. Blood returning from the body enters the side of the heart and the de-oxygenated blood fills the right atrium. Blood pass through the tricuspid valve into the right ventricle. The right ventricle contracts and forces the blood through the pulmonary valve into the pulmonary artery, through the lungs. Oxygenated blood returns to the heart by entering at the left atrium and move through the mitral valve into the left ventricle. The strong contraction of the left ventricle pumps blood through the aortic valve into the aorta and enters the entire body (Norton, 2013).

The horse is a remarkable mammal because of wide limits of heart rate. The resting heart rate of a horse is between 28 to 44 beats per minute, which means the total blood pumped in one minute, the horse's cardiac output, is 28 to 44 litres per minute. This is in contrast to the human cardiac output; which has an average output of five litres per minute, indicating the horse's extraordinary athletic ability. The horse's resting heart rate increases steadily during the level of exercise (Norton, 2013). The average heart beat at a walk is 80 beats per minute, at a trot it is 130 beats per minute, at a canter it is 180 beats per minute and up to 240 beats per minute while galloping. The horse's heart rate recovery time after exercise decreases more rapidly as the fitness level of the horse increases (Pavord and Pavord, 2004).

The horse's heart rate can also be increased by anxiety, pain, dehydration, anaemia, infections and fever (Norton, 2013). The heart rate at any point in time (healthy horses) is determined by interaction between sympathetic (increases heart rate) and parasympathetic (decreases heart rate) regulation. The horse's heart rate can be influenced by the autonomic nervous system's function, so a change in heart rate can influence the balance of the autonomic nervous system and the horse may be more stressed. During a stressful event the heart rate of the horse increases, the sympathetic nervous system is activated and the horse shows signs of nervousness.

According to the equine horse institute no research has been done to determine the autonomic nervous system function of the horse (Hall *et al.,* 2013). Currently, the

only method used to determine the horse's autonomic nervous system function occurs via the heart rate variations (Kuwahara, Hashimoto, Ishii, Yagi, Hada, Hiraga, Kai, Kubo, Oki, Tsubone and Sugano, 1996). Heart rate variability provides a measure of short-term fluctuations in beat-to-beat interval and reflects the balance between sympathetic and parasympathetic control.

Physical stress and negative emotions are characterised by increased sympathetic tone and a decrease in parasympathetic tone, resulting in increased heart rate and decreased heart rate variability (Hall *et al.,* 2013). Aspects that may influence the parasympathetic nerve action are relaxation techniques, massage and a steady environment. The above-mentioned aspects may relax the horse and result in a decrease in the horse's heart rate (Norton, 2013).

The horse has an autonomic nervous system which consists of a parasympathetic- and sympathetic nervous system. The parasympathetic nervous system is responsible for rest and repair of the body whereas the sympathetic nervous system is responsible for excitory actions such as the fight or flight reaction (Hollis, 2009). Under normal function situations, the autonomic nervous system is balanced.

During stressful situations the balance of the autonomic nervous system may be disrupted, in other words the sympathetic nervous system may be over stimulated and cause the horse to experience fight or flight reactions. Stressful events for a horse may be recognised as changes in the environment, performing at shows, poor handling and extreme training techniques. Several studies have shown that stressful conditions, depending on the nature, can result in low levels of parasympathetic nerve activity. Changes in the autonomic system function have been related to changes in the heart rate and heart rate variability (Visser, Van Reenen, Van Der Werf, Schilder, Knaap, Barneveld and Blokhuis, 2002).

Good health of a horse can be classified by means of several signs. Firstly, a healthy horse will possess a good appetite. The first sign of illness may be that the horse turns away from food or has a lack of appetite. Secondly, a bright and alert attitude is indicative of a horse's health status enabling the horse to react quickly

towards a sudden stimulus. Thirdly, the condition of the horse should not be too thin or to fat, thus no ribs should be visible on a well-conditioned horse. The horse should not show any muscle twitching when pressure is applied, as this may indicate an occurrence of muscle injury (Pavord and Pavord, 2004).

The coat of the horse should be shiny, flat and smooth without any skin irritations. The horse's eyes should be clear and open with a salmon-pink mucous membrane. Gut sounds should be heard when placing an ear on the horse's rib cage and the droppings of the horse may vary from the usual moist, oval balls, to soft green cowpats when the horse is eating spring grass or round, hard bullets when horses are stabled. A healthy horse should have a resting heart rate of 28-44 beats per minute (depending on the horse's fitness level) and a body temperature of 37ºC (Pavord and Pavord, 2004).

The height of a horse is usually measured at the highest point of the withers, where the neck meets the back. This point is classified as the stable point of anatomy - unlike the head and neck which can move up and down in relation to the body of the horse. The horse's height is stated in units of hands (one hand equals to 101.6mm). The height is expressed as the number of full hands, followed by a full stop, then the number of additional centimetres (cm) and ending the abbreviation with "h" or "hh" (for hands high). A horse described as 15.2 h is 15 hands plus 2 inches (5.08 cm), for a total of 157.5 cm (Brown, Pilliner and Davies, 2003).

The blood chemistry measurements may be used to assess the status of the horse's body. Through observation of a horse's blood chemistry, the veterinarian can identify the effectiveness of the production and utilising of the different substrates, whether by-products are being effectively eliminated and whether the different bodily systems are operating correctly at the right time and the correct rate. Blood chemistry observation may also indicate the occurrence of an infection or inflammation, possible dehydration, whether the muscles or kidneys experience difficulty in keeping up with the workload, or any liver damage (Garlinghouse and Fleming, 2000).

Muscle enzymes, aspartate aminotransferase (AST) and creatine kinase (CK), help to indicate the presence of muscle injury or disease and the severity and progression thereof. Observing the blood chemistry of these enzymes together with the observation of other clinical signs such as lameness, pain or dark urine, help the veterinarian to identify the severity of possible muscle damage that might have occurred. Important considerations for the examination of these blood chemistry enzymes are taking blood samples before, during or after exercise, and determining whether any other stressful events (an unplanned gallop, recent vaccinations, a long outride) may have contributed to the blood chemistry results. Very high enzyme blood chemistry results after a long outride are not necessarily an indication to predict muscle damage; the horse's muscles might have been over trained as a result of poor fitness (Garlinghouse and Fleming, 2000).

Creatine kinase is a muscle enzyme produced during exercise. Prolonged endurance exercise has shown an increase in CK levels without any clinical signs of muscle damage. Normal CK levels are between 0-175iu/l and muscle exhaustion may cause higher levels which peak two to three hours after insult. Increased CK levels may return to normal after three days (Pavord and Pavord, 2004).

Aspartate aminotransferase is an enzyme released by both skeletal and cardiac muscles, as well as the liver as the result of protein metabolism. Normal AST levels are between 0-300iu/l. Muscle exhaustion causes high levels of AST which may peak 24 to 36 hours after insult. Increased AST levels persist in serum for two to three weeks (Pavord and Pavord, 2004). As with CK, AST levels may also rise after prolonged exercise without any indication of muscle damage. AST levels rise slower than CK levels and remain in the blood for a longer period. Elevated AST levels in a horse with normal CK levels may indicate that the horse was exposed to intense muscular stress sometime during the previous week (Garlinghouse and Fleming, 2000).

Exertional rhabdomyolysis, also known as tying up, refers to a range of muscle disorders in horses, associated with build-up of lactic acid in overworked muscles, which leads to cramping and tension. Tying up can be associated with high AST

and CK levels. In the past, most veterinarians would have treated a horse suffering from tying up with potent drugs to relieve the symptoms. Nowadays veterinarians prefer treating tying up with alternative methods by prescribing a controlled diet, massage, acupuncture, ultra sound and light walking exercises. Utilising alternative treatments may also prevent the reoccurrence of tying up (Gladstein, 2004).

2.5 NERVOUS HORSE VERSUS RELAXED HORSE

The horse is a wild animal that runs freely in open grazing fields. Domestication of the horse is a reality nowadays which can have strenuous consequences on the horse's body. According to Murphy and Arkins, (2007), the changes from a normal evolved environment to an unknown environment can cause a horse to experience stress and abnormal behaviour.

2.5.1 Nervous horse

Stress can be described as the combination of psychological and biological responses of an animal to threatening circumstances (Malinowski, 1993). Stressors are identified as chemical or biological agents, environmental conditions, external stimuli or an event that causes stress to an organism. In this case, a horse's stressors can be divided into two types, namely physical and psychological stressors.

Physical stressors are classified as an injury, change in environment and exertion. Psychological stressors typically include situations that make the animal anxious or fearful which may be caused by uncertainty and fear. Stressors perceived and evaluated by a cognitive and/or emotional system may induce a variety of changes in an animal's behaviour and metabolism (Budzyńska, 2014). Different hormones are released when a situation is perceived as stressful.

The stress response starts by activating the sympathetic nervous system through the release of catecholamines epinephrine and norepinephrine hormones. Catecholamines intercedes the fight-or-flight reaction, resulting in an increased heart rate, blood pressure and respiration rate. The second response will be activated

during a chronic stressful stimulus. The sympathetic activation of the hypothalamus causes the release of corticotropic releasing factor which stimulates the production of glucocorticoids from the adrenal gland, namely cortisol (Malinowski, 1993). Frequent release of the cortisol hormone can affect the horse's digestive, reproductive, immune and cardio vascular systems, leading to diarrhoea, gastric ulcers and colic. Furthermore, too much cortisol may lead to sudden behavioural changes in the horse (Anonymous, 2013). Continual stress causes regular release of cortisol, which causes decreased movement of glucose from the bloodstream into muscle cells for brain activity and energy. This results in a reduction in the available blood glucose to be used by working muscles which can lead to poor athletic performance.

Signs of a stressed horse include one or more of the following:

- Frequent whinnying or squealing
- Shying
- Restlessness
- Tense muscles
- Wild tail tossing
- Flared nostrils and snorting
- Shaking or trembling
- Pinned ears and white of eyes is showing
- Head is in the air (Anonymous, 2013).

A negative mental state may be visible through commonly cited behaviour such as muscle tension, vocalisations (snorting, whinnying, groaning), unusually low head and neck (up and down, side to side, shaking, tilting, head turning), tail position and movements (swishes, lateral and vertical movements), bucking, rearing, shying, and unassignable backwards moving at speeds and directions not asked for by the rider (Hall *et al.,* 2013).

The placement of a saddle on the horse's back and putting a bridle with a bit into a horse's mouth can contribute to higher stress levels in the horse due to not resembling the horse's normal evolved environment as a wild, free running horse. These stressful situations might cause muscle tension (Ettl, 2002).

Transporting a rider is another aspect that might put enough strain on the horse's muscles to cause muscle tension. Saddles not fitted professionally may lead to compensating muscles, thus leading to muscle tension and poor performance ability of the horse (Ettl, 2002). Compensating muscles is a result of the counterbalancing of any defect. Poorly fitted saddles cause a defect in a muscle by applying only pressure on one side of the back, and not the other side's muscles therefore only the one side's muscles counterbalance to support defective saddle pressure (McKinley, 2010).

2.5.1.1 Behavioural changes which may occur during pain and stressful situations

The horse is unable to communicate verbally and inform its owner where muscle tension or pain is experienced. Hence, the horse's behaviour needs to be determined to identify any discomfort.

The horse should be monitored for any change in behaviour during handling and riding. Horses might pin their ears and swish their tail after the saddle has been placed on their back, indicating back ache (Haussler, 2009). A complete assessment of a horse with potential back problems must consist of the following three aspects: an evaluation of the horse's response after placing the saddle on his/her back, during tightening the girth and during riding exercises. Other signs the horse may show that might indicate back problems or muscle tension are rapid elevation of the head, extension of the back or withers after the application of pressure in the area.

2.5.2 Relaxed horse

Relaxation can be described as a state of being free from tension and anxiety without any threatening situations. In order to achieve a state of relaxation, the parasympathetic nervous system needs to be activated. In a relaxed state, endorphins are released; the horse's blood circulation increases, which in turn increases the immune system function and promotes healing (Haussler, 2009).

A relaxed horse will show signs of a lowered head below the withers, hind leg cocked, resting the body weight on the toe. The tail may swish relaxed occasionally; the horst may lick its lips and chew; soft blowing through the nose; ears relaxed turned sideways back; eyes soft; loose lower lip; yawning; sigh of relieve; passing gas and gut sounds. Furthermore, a relaxed horse will have a low resting heart rate (Anton, 2012).

2.6 FACTORS LEADING TO POOR PERFORMANCE

Peak performance requires all bodily systems to function at or close to its maximal capacity. Poor performance is described as horses which previously performed optimally but are having a series of poor performances without any obvious disease. When one or more body systems functionally break down and the horse is no longer able to perform up to its potential, testing is focused on the reason or reasons for diminished performance ability. In some horses, the cause for poor performance is obvious: a horse with musculoskeletal injuries will be lame, where other horses may show signs of gradual decrease in performance over a period of time without any signs of lameness (Davidson, 2009).

During a stressful situation, the horse's fight-or-flight reactions are activated through the sympathetic nervous system, resulting in miss communication between horse and rider. The horse may try to run away from the stressful situation rather than concentrating on the rider's training aids. Relaxation is the first step in optimal performance. Horse and rider must be relaxed in order to work together in harmony (Paulekas and Haussler, 2009). Massage can be used to create a bond between

horse and rider before a competitive show, which will enhance relaxation and create a harmonious environment.

Competitive situations might also increase the horse's heart rate and stress levels, therefore enhancing muscle tension and a decrease in the performance ability of the horse. During training for competitions, the horse's body is forced beyond the normal body movements of the horse and hyper tonicity of the muscles might form. This place even more strain on the performance horse's muscles (Booth, 2009).

Poor flexibility may also lead to poor performance. The performance horse needs proper flexibility to perform specific movements related to the discipline. Back ache and muscle tension might be a major cause of poor performance in equine athletes, due to limited options for preventing muscular problems in equine sports. Massage may improve flexibility and strength of the muscle and should hence be included in a training programme for a horse to maximise the potential strength and flexibility (Scott and Swenson, 2009).

2.7 THE DISCIPLINES AND THE MUSCLES AFFECTED DURING RIDING

Equestrianism, more commonly known as horse riding, refers to the skill of riding, driving, competing/performing or vaulting with horses. Horses can be trained for practical working purposes, transportation, recreational activities, cultural exercises and competitive sports. A horse actively ridden and trained for a competition is classified as a performance horse (Davidson, 2009).

Within the competitive sport category, a variety of disciplines exist. Dressage horses are trained to perform elegant executions. In order to accomplish this, the Dressage horse must demonstrate control, accuracy and flexibility, and be extremely sensitive to the rider's training aids (Hourdebaigt, 2007). A Dressage horse should be well disciplined and balanced in order to perform at its best ability (Sly, 2001). Great demands are placed on the entire body of a Dressage horse. Due to the great demands stress may occur in the back, hips, hocks and especially the hindquarters. Lateral work performed during Dressage contributes to stress build-up in the chest,

shoulders and back. Collection work during Dressage riding can cause the horse to tense up in the jaw and develop stress points in the neck (Hourdebaigt, 2007).

Endurance riding tests the endurance and stamina of both horse and rider. Endurance competitions take place in an established time frame over distances ranging from 40 kilometres to 160 kilometres and over trails with varied terrain, including steep hills and natural obstacles. Tension normally develops in the entire body; however the chest, back and hindquarters are mostly affected (Sly, 2001).

Saddlebred horses, whether under saddle or in harness, have an animated way of moving. Saddlebred horses are popular show horses, and they can be classified by smooth riding, being sure-footed, and they can be either three- or five-gaited horses. The Saddlebred horse can perform a highly elevated walk, trot and canter as well as two artificial four-beat gaits, namely high-stepping gait and extremely fast rack gait. The artificial gaits are produced by leaving the feet very long, shoeing the horse with heavy shoes and inducing specific training techniques (Faurie, 2002). Performing these gaits may develop stress points in the neck, shoulder, forelegs, chest, abdomen and back.

2.7.1 The head and neck

The horse uses its head and neck to keep the rest of the body in balance during motion. The flexibility of both the head and neck is vital for good performance (Hourdebaigt, 2007). A good neck is one of the most important features of a horse. A long neck provides the horse with a mechanical advantage in balancing itself by making a wide range of adjustments during athletic movements.

The major neck muscle affected by riding is the Brachiocephalic muscle. This muscle originates in the Clavicular intersection (first vertebrae) and inserts into the Humerus bone (bone between shoulder and elbow). The muscle is used to contract the horse's head and shoulder, enhancing a lengthened stride. When the muscle is damaged, causing pain or tightness, the horse will find it difficult to move forward with the forelegs, will refuse backward movement and have a shorter, choppier stride in front (Palmer, 2012). Furthermore, when the Brachiocephalic muscles are

tight, the horse will show discomfort by stretching or bending the neck (Hourdebaigt, 2007).

2.7.2 The shoulder

Powerful, flexible, pain-free shoulders are essential for peak athletic performance. The major shoulder muscle affected by riding is the Trapezius muscle. The Trapezius muscle has two portions, a cervical portion (neck) and a thoracic portion (chest). The neck portion originates from the neck Nuchal ligament (broad elastic band of tissue connecting the neck bones to the withers). The chest portion originates from its withers. During the contraction of the neck portion the shoulder blade move forward, and during the contraction of the chest portion the shoulder blade move backwards. The Trapezius muscle is responsible for moving the horse's forelegs forward and backwards. Soreness or dysfunction of the Trapezius muscle causes contraction of the muscle and restricted movement of the horse's forehand (Palmer, 2012).

2.7.3 The chest

The Transverse Superficial Pectoral muscles and Deep Pectoral muscle are the major chest muscles affected by riding. Horses do not have a clavicle bone which attaches the limb to the spine as in the human body. Instead, the horse has soft tissue, including tendons, ligaments, fascia and muscle, which keeps the forelimbs close to the neck, back and rib cage. In order for the horse to move freely through the forehand, the pectoral muscles need to be relaxed and supple to allow sufficient movement (Bromiley, 2007). The Transverse Superficial Pectoral muscles, when tensed, may cause the horse to have a shortened stride and resist movement of the foreleg. When the Deep Pectoral muscles are tensed, the horse may react when the girth is tightened, and the horse will show shortened extension of the forelegs during riding.

2.7.4 The back

The vertebral column and the rib cage consist of strong bones, ligaments and muscles. These structures provide anchoring for strong muscle groups. The major muscle of the back affected during riding is the Longissimus Dorsi muscle. The Longissimus Dorsi muscle originates from the horse's pelvis and attaches to the rib cage and inserts to the base of the neck. Contraction of the back muscle will cause the back to hollow. A contracted hollow back muscle causes pain and will prevent the horse from working correctly (Palmer, 2012). Due to the fact that the saddle is placed on the Longissimus Dorsi muscle, the horse may find it difficult to perform different movements if the muscle is tensed due to the saddle exerting pressure onto the tensed muscle. This then leads to the horse hollowing its back and lifting its head, resulting in the horse not being in the correct posture for the specific discipline.

2.7.5 The hindquarters

The conformation of the hindquarters and hind legs will determine the horse's performance ability in a given sport. There are breed specific variations in the natural angles formed by the joints of the hind legs. The greater the angle at the joints, the greater the predisposition is for sprinting or jumping. On the other hand, a straighter joint creates a greater predisposition for a long stride (Hourdebaigt, 2007).

The hindquarters of the horse is divided into three major muscle groups, the Gluteus Medius muscle, Biceps Femoris muscle and the Semitendinosus muscle. The Gluteus Medius muscles are crucial to the power of the horse. The Biceps Femoris muscle and Semitendinosus muscle are also known as the horse's hamstring muscle. The Gluteus Medius and the hamstring muscles are used in moving the horse's hind legs backwards. These muscles are involved in galloping, taking off for jumping and bucking/kicking. Tension or pain in the hamstring and Gluteal muscles may hinder the horse's hind leg to move forward under the horse's body, resulting in a shortened stride length and a decrease in the horse's ability to engage through its hindquarters (Palmer, 2012).

2.8 SWEDISH MASSAGE

Swedish massage is a Western form of massage. Per Henrik Ling (1776-1839) of Sweden promoted the therapeutic use of a variety of massage techniques and termed these techniques Swedish massage. The various massage techniques are classified as Effleurage, Petrissage, Friction, Tapotement and Vibrations (Hollis, 2009). By performing these specifically designed techniques, muscles relaxation, increased blood circulation and a feeling of well-being may occur. Swedish massage is the most commonly used massage therapy and is advantageous for someone who has never had any massage treatments before. Swedish massage can be applied on a person who has never had a massage before due to the fact that Swedish massage does not include manipulations of muscles and deep tissue pressure, which might be painful and therefore put off some clients. Swedish massage may also serve as an introductory massage for other massage therapies such as deep tissue or acupressure massage (Hollis, 2009).

The beneficial effects of Swedish massage were recognised in equine massage by the International Federation of Registered Equine Massage Therapists (IFREMT). From 1996 equine massage has been used to enhance the well-being of the horse (Van Veen, 2010).

2.8.1 Effects of Swedish massage

Observation of the animal kingdom suggests that rubbing of different types is useful to deal with the various discomforts of living. Domesticated animals lick and stroke wounded areas, puppies and kittens are licked to activate the digestive function and primates rub each other to relieve a disorder/pain. Humans also rub infants to void a wind and to comfort them. Furthermore, humans will also rub an area which has been bumped in order to relieve the pain. All of the above may be subjectively seen as benefits of massage (Hollis, 2009).

The performance of rubbing or stroking techniques during a Swedish massage increases the blood circulation which increases oxygen flow to the muscles and subsequently releases toxins from the muscles. The benefit that results from this is

Swedish massage might shorten the recovery time from muscular strains or exhaustion by flushing the tissues of lactic acid, uric acid and other metabolic waste. This benefit is observed as heat and redness at the area massaged (Hollis, 2009).

Swedish massage can also benefit the nervous system by soothing the nerves and reducing the stress levels. This benefit is observed by relaxation signs shown by the client receiving the massage. Relaxation is the most frequent effect of Swedish massage and may enhance the psychological state of the client receiving the treatment (Hourdebaigt, 2007).

Furthermore, Swedish massage may be used as an alternative treatment for muscular injuries and preventative treatment for future back and muscular problems (Haussler, 2009). Pre-exercise massage treatment may be applied to help warm up the muscles for exercise, whilst post-exercise massage treatment may prevent muscle stiffness (Hourdebaigt, 2007). Also, the horse may return promptly from injury with Swedish massage. Maintenance of the performance during high stressful competitive shows may be maintained, consequently minimising poor performance. During riding muscles are forced beyond normal state. Massage and stretching allow muscles to return back to their normal state (Hourdebaigt, 2007).

2.8.2 Different techniques

The effectiveness of the different Swedish massage techniques depends on the therapist's knowledge of the intention and outcome of performing the Swedish massage. Furthermore, the importance of accurately performing the different techniques for a Swedish massage to be effective can not be over-emphasised. The massage therapist must commit mind, body, heart and soul to enhance the effects of a Swedish massage. Different techniques were formulated in order to be performed in different intervals during a Swedish massage. One can not start with a Petrissage movement due to the fact that the muscles need to be warmed up before deep pressure can be applied. The following is an indication of the five different Swedish massage techniques (Casanelia and Stelfox, 2010):

a) Effleurage is a light, continuous movement applied to the skin with fingers, palms, knuckles or forearm in a slow rhythmic manner. An effleurage may be applied on all areas of the body, and both hands work together simultaneously. Effleurage movements are used to introduce the touch of the massage therapist to the client, promote relaxation and prepare the body for the treatment. Effleurage provides gentle, surface stimulation and draining. Effleurage directly affects the central nervous system. A very nervous horse may relax after stroking the back of the horse. The massage therapist always starts and ends a Swedish massage with an Effleurage (Hollis, 2009).

   Labyak and Metzger (1997) examined nine studies that sought to measure the effect of Effleurage (stroking) back massage on physiological indicators of relaxation, and concluded that this form of massage therapy was effective in promoting relaxation. The horse rider may calm the horse before a competition by only stroking the horse's body lightly, thus promoting relaxation, which may also enhance performance.

b) Petrissage/kneading techniques are a series of deep movements performed after Effleurage and are the foundation movement of a Swedish massage. The skin and muscular tissue are raised from the ordinary position and then squeezed, rolled or pinched with firm pressure, usually in a circular direction. Petrissage movements are used to manipulate tissue and muscles resulting in the breakdown of tension (Casanelia and Stelfox, 2010).

c) Tapotement/percussion techniques include quick, striking manipulations which are highly stimulating to the body. The technique is executed with both hands alternatively and provides brisk and invigorating stimulation. A faster rhythm stimulates the animal. It is used to perk up the horse before riding or exercising and to stimulate circulation before deep treatment (Hollis, 2009).

d) Friction techniques involve the moving of more superficial layers of the skin against the deeper tissues. Friction requires pressure on the skin while being moved over the underlying tissues. Friction presses one layer of tissue against another layer in order to flatten, broaden or stretch the tissue. Three known types of friction exist, namely circular, cross-fibre and compression

frictions. Friction provides deep tissue stimulation (Casanelia and Stelfox, 2010).

e) Vibrations are a continuous shaking or trembling movement transmitted from the therapist's hand and arm. Light contact is made and the hand is shaken back and forth as quickly as possible, gliding softly over the skin. Vibrations promote relaxation as well as lymphatic circulation (Hollis, 2009).

2.8.3 Contra-indications

A contra-indication is a situation in which a Swedish massage treatment should not be applied because of the possibility of being harmful to the horse. The following situations are contra-indications to a horse Swedish massage:

a) Skin disorders that would be irritated by either an increase in warmth of the part or the lubricants that might be used. Treating this condition may aggravate the disorder due to the increase in blood circulation during a Swedish massage.
b) The presence of superficial infections. Swedish massage is performed superficially and the presence of superficial infections may cause the infection to spread.
c) Do not massage a horse with a body temperature measurement above 39ºC. An increased temperature/fever occurs during serious illness. Massage will worsen the condition by increasing the blood circulation.
d) Avoid massaging the area of open wounds or healing wounds anywhere on the body.
e) Acute trauma to a muscle e.g. a torn muscle or area of internal bleeding. Massage can be resumed after 72 hours of injury.
f) A horse with Tetanus contra-indicates a massage due to the nerve stimulation during a massage that might be unbearable for the horse.
g) Calcification around joints or within soft tissues should not be massaged. The inflammation in these areas may be increased.
h) The presence of malignant tumours, since the increase in blood circulation may cause the malignant to spread.

i) Early bruising, because deep pressure during a Swedish massage may worsen the bruised area (Hourdebaigt, 2007; Palmer, 2012).

2.8.4 Duration of a horse Swedish massage

According to Hourdebaigt (2007) the first Swedish massage treatment, especially if the horse is being massaged for the first time, should not last longer than 20 minutes. The time of the Swedish massage should be gradually increased with each treatment until the full body Swedish massage is completed in approximately 40 minutes. According to Palmer (2012) the average time of a Swedish massage on the horse will be approximately 45 minutes. Monitoring the horse's behavioural signs is the most important factor during the Swedish massage treatment and the time should be adapted accordingly. Some horses prefer a shorter Swedish massage and other a longer Swedish massage depending on the mood of the horse. Some days the horse will be able to cope with a long treatment and other days the horse may become irritated and, consequently, the time should be adjusted accordingly (Hourdebaigt, 2007).

Furthermore, the horse may prefer certain massage techniques more than others (Palmer, 2012). Palmer suggests a "gold standard" schedule of massaging the horse once a week, a "recommended" schedule of once a month and "must have" schedule of once in three months (Palmer, 2012). In order to obtain the most beneficial effects of a Swedish massage, one should massage a horse at least once a week.

2.9 THE SOMATOLOGIST AS A HORSE SWEDISH MASSAGE THERAPIST

A somatologist can be defined as a professional with a holistic approach to the body, mind and emotions in terms of stress management, exercise physiology, skin analysis, diet and lifestyle (Vosloo, 2009).

A somatologist has the skills to perform various massages on humans, amongst others, Swedish massage. These Swedish massage skills can be used to create

specialised massage techniques to perform a massage on horses or canines. As with humans, massaging animals may prove beneficial to the animal's well-being and welfare by encouraging relaxation (Hollis, 2009).

The incorporation of animal massage as a specialised technique may broaden the somatologist's field of expertise by working in collaboration with a veterinarian. The Veterinary Act No. 19 of 1982 (RSA, 1982) does not permit working on an animal without permission obtained from the veterinarian employed by the owner of the animal (Hollis, 2009). The animal's veterinarian should be contacted to be informed of the massage, and to confirm the positive health of the horse before a Swedish massage could take place. The Swedish massage performed on a horse will need to be adapted from the normal human Swedish massage. The first adaptation would be the environment where the massage would take place. A human normally lies in a supine position on a bed, whereas a horse stands in a paddock or stable during a massage. Due to the effects of gravity, and to ensure readiness to react when a predator arrives whilst standing, the horse's muscles and appendicular skeleton are in a constant state of tension. Natural relaxing that normally comes from lying down will not occur in a horse. This will influence the somatologist's approach to the horse's Swedish massage. Furthermore, horses' predatorily instincts should be considered by paying attention to the behaviour of the horse during the Swedish massage (Hourdebaigt, 2007).

The second adaptation would be regarding the horse's muscle origin and insertion, which differs from the human muscle origin and insertion. Knowledge of the service anatomy is essential in order to know where the horse's muscles are situated to perform the Swedish massage movements correctly. The resemblance of a human and horse Swedish massage would be the massage techniques. Exactly the same massage techniques would be used for both types of massages (Hollis, 2009).

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CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The research study aimed to determine the effect of Swedish massage on the horse's performance ability by measuring the two complimentary parts. Firstly, it was determined by the pre-intervention questionnaire, measurements of the horse's heart rate, the blood tests prior to treatment, flexibility measurements and the recording of the horse's relaxation signs; and secondly by analysing the post-intervention questionnaire provided to the horse's owner/trainer/rider, the flexibility measurements and the blood tests after the ten treatments were captured.

3.2 STUDY LOCATION

The research study was conducted at pre-determined stable yards in the Bloemfontein area as listed in Table 3.1.

Table 3.1 follows

Table 3.1 Pre-determined stable yards

Stable Yard	Location	Discipline		
		Dressage	Saddlebred	Endurance
Equidream Stables	Bainsvlei	3		
Linda's Stable	Groenvlei	1		
Groenvlei horse and rider park	Groenvlei	4		
Human's Stables	Groenvlei	2	6	
Ronnie's Stables	Groenvlei		2	
Charle's Stable	Groenvlei		1	
Lizelle's Stable	Groenvlei		1	
Lienkie's Stables	Groenvlei			3
Michelle's Stables	Mimosa Park			3
Charlene's Stables	Groenvlei			4

3.3 STUDY DESIGN

A non-blinded, multi-site experimental design that was exploratory in nature was used to identify the effects of Swedish massage on the performance horse. The study analysis has followed a mixed-method approach by collecting and analysing qualitative and quantitative research data. Qualitative research was conducted through the practical performance of Swedish massage on the horse, whereas quantitative data was collected from the horse's owner/trainer/rider through pre- (Appendix C) and post-intervention questionnaires (Appendix D). The pre- and post-intervention questionnaires were informed and compiled after a literature review was

conducted. The type of questions displayed in the pre- and post-intervention questionnaire were open-ended questions (Denscombe, 2007).

3.4 STUDY POPULATION

Stable yards and disciplines were pre-determined. Dressage, Endurance and Saddlebred horses were selected due to the diverse riding skills required in the three disciplines (Sly, 2001). Dressage is defined as more flat work, precision riding, whilst Endurance riding encompasses riding for long hours over long distances. Saddlebred horses are popular show horses and are classified by smooth riding and sure-footedness, and they can be three- or five-gaited horses. The Saddlebred horse can perform a highly elevated walk, trot and canter as well as two artificial four-beat gaits, namely high stepping gait and extremely fast rack gait. The horses that participated in the study were all fed according to nutritional guidelines pertaining to the relevant discipline. The Free State Horse Society, Endurance Horse Society and Saddlebred Horse Society were contacted electronically and telephonically by the researcher in order to obtain lists of registered members of the identified disciplines for the study. All performance horses, irrespective of the discipline, need to be registered with a professional body, thus by utilising the lists obtained from the different societies all horses adhered to the same standards. The different lists of performance horses obtained were scrutinised, and through a stratified random sampling method, ten horses from each discipline that adhered to the inclusion and exclusion criteria were selected (n=30).

Photographs 3.1-3.6 display different performance horses used in the research study:

A) Dressage

Picture 3.1: A Dressage horse in a relaxed state (Photo: J Badenhorst).

Picture 3.2: Dressage horse performing at a Dressage competition (Photo: Marlies van Baalen: Photo image)

B) Endurance

Picture 3.3: An Endurance horse relaxing in its stable (Photo: J Badenhorst).

Picture 3.4: An Endurance horse on a competitive Endurance ride (Photo: Thompson, 2008).

C) Saddlebred

Picture 3.5: A Saddlebred horse relaxed (Photo: J Badenhorst).

Picture 3.6: A Saddlebred horse performing at a competition (Photo: Brooke Jacobs of Jacobs photography, 2013*).*

It is notable from pictures 3.1 to 3.6 that, during competition riding, the horse's muscles are working harder than when the horse is in a relaxed state.

3.4.1 Subject identification

Each participant (horse) was allocated with a number which ranged from D1 to D10 for Dressage horses, E1 to E10 for Endurance horses and S1 to S10 for Saddlebred horses. Subject identifications were used in order to positively identify each horse.

3.4.2 Inclusion criteria

The research study included the following horses:

- Performance horses competing in Dressage, Endurance riding and Saddlebred competitions.
- Horses between the ages of four to twenty years. These specific age ranges were selected, as these age ranges are regarded as peak training years for horses. The prime years for performing are between six and 16 years (RSA, 2014a) for Dressage and Endurance horses (RSA, 2010), and between four and 18 years for Saddlebred horses (RSA, 2014b).
- Horses with a height of 14.2 hands (144.3cm) and above. A height below 14.2 hands (144.3cm) is classified as a pony size and not a horse size (Pavord and Pavord, 2004).
- Horses with no visible signs of inflammation in the area being massaged or any muscle injury, and that exhibit positive health after the veterinarian examination.
- Horses being either a gelding or mare.
- Horses living in either a stable or paddock throughout the day or only at night.
- Horses with a moderate to intense exercise schedule.
- Horse's owner must be literate in English.
- Horse's situated in the Bloemfontein area.

3.4.3 Exclusion criteria

The research study excluded the following horses:

- Performance horses competing in disciplines other than Dressage, Endurance and Saddlebred.
- Horses with a skin irritation or rash that might be contagious.
- Horses exhibiting negative health after veterinarian examination.

3.5 THE RESEARCH PROCESSES

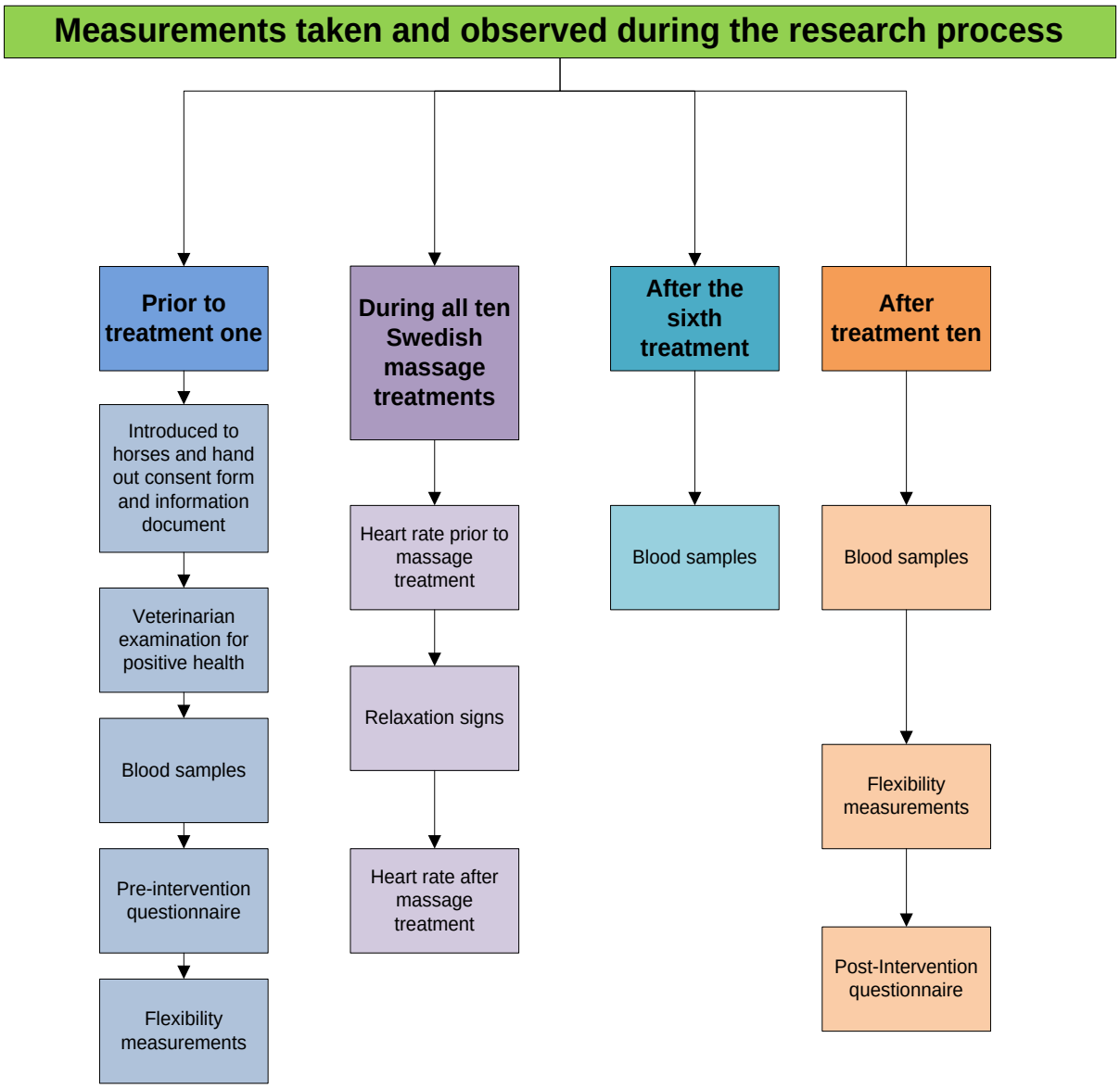


Figure 3.1 The research process

3.5.1 Pilot study

To determine the validity of the pre- and post-intervention questionnaires, a pilot study was conducted amongst four horse owners/trainers/riders. Suggested changes and recommendations were considered and implemented.

3.5.2 Processes before Swedish massage treatment

The horse owners/trainers/riders were telephonically contacted in order to schedule an appointment to recruit the horse/s for the research study. All scheduled appointments were made two weeks before the commencement of the first Swedish massage treatment. During the scheduled appointment, a consent form was provided (Appendix B) to the horse's owner/trainer/rider requesting permission to massage the performance horse/s situated in the pre-determined stable yard. After permission was granted, an information letter (Appendix A) was also provided. Furthermore, the researcher made use of the scheduled appointments to introduce her to the horses and to become familiar with the stable yard to minimise any influencing variables.

A week before the first Swedish massage treatment, a veterinarian assessed the vital life signs (Appendix F), and checked for any inflammation or injury to any muscles of all thirty horses to confirm positive health of the horses. During the veterinarian examination no horse has shown any musculoskeletal problems. After the veterinarian examination, two horses showed negative results (the two horses had Rhinitis), as a result of two new healthy horses were recruited by the researcher and examined by the veterinarian.

To determine the flexibility of the horses' muscles, the over-reach distance, back, neck and shoulder range of motion of each horse was measured (Appendix E). All thirty horses' neck, shoulder, back and hind quarter areas were separately zoned - the neck was categorised as zone one, the shoulder as zone two, the back as zone three and the hindquarters as zone four. All flexibility measurements were freely done stretches and not forced stretches - therefore active stretches. To encourage the horse to perform the stretches freely, a carrot was used to indicate the direction in which the horse had to stretch the back and neck.

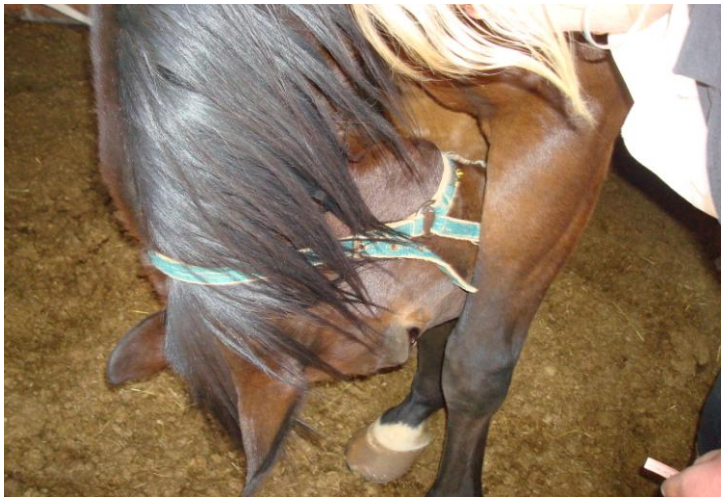
Picture 3.7: Neck flexibility measurement (Photo: J Badenhorst)

The neck flexibility (Picture 3.7) was measured by performing neck stretches and measuring the distance between the horse's shoulder and head. The beginning of the measuring tape was placed in the middle of the Masseter muscle aligned with the ear attachment. The end of the measuring tape was placed in the middle of shoulder blade aligned with the withers. The same measurement was done for the left and right side of the neck (Ettl, 2002).

Picture 3.8: Shoulder flexibility measurement (Photo: J Badenhorst)

The shoulder flexibility was measured by means of straightening the front leg and extending the front limb to the maximum lifting height, thus until resistance was achieved (Picture 3.8). The beginning of the measuring tape was placed behind the

horse's Carpus and the end of the measurement tape was placed on the ground. The same measurement was done on the left and right front leg (Ettl, 2002).



Picture 3.9: Back flexibility measurement with carrot stretching (Photo: J Badenhorst)

The horses' back flexibility (Picture 3.9) was measured by performing a carrot back stretch, and observing the distance the horse could stretch the back by placing the head between the front legs. The further the horse's nose reaches past the carpus, the more flexibile the horse's back (Ettl, 2002). The effectiveness of the measurements was identified by using a Likert scale. Table 3.2 indicates the measurement descriptions.

Table 3.2 The back flexibility measurement described as a Likert scale

Scale	Description
1	Extremely ineffective - above carpus, between carpus, and elbow 5cm below elbow
2	Somewhat ineffective - above carpus, between carpus, and elbow 8cm below elbow
3	Acceptable - above carpus, nose past carpus
4	Effective - below carpus, nose above carpus
5	Extremely effective - below carpus, nose below carpus

Picture 3.10: Over reach distance measurement (Photo: J Badenhorst)

Picture 3.11: Measurement on the ground of the two tracks (Photo: J Badenhorst)

The horses' over-reach distance was measured whilst the groom walked each horse (Picture 3.10) on a leach, and the researcher observed the placement of the horse's front hoof and hind hoof tracks made in the sand. The over-reach distance measurement is identified by measuring the over-reach distance of the hind hoof track past the front hoof track on the ground (Picture 3.11). The track made on the ground was measured from the middle of the frog cleft of the front hoof track to the middle of the frog cleft of the hind hoof track with a measuring tape. The same measurements were done for the left and right over-reach distances (Ettl, 2002).

A pre-intervention questionnaire (Appendix C) was provided to each horse owner/trainer/rider prior the first treatment to obtain the following data:

- breed of horse;
- horse's age;
- horse's daily feed consumption;
- horse's daily living environment;
- horse's disciplinary and frequency of competing;
- amount of time each horse is being ridden/trained per week;
- any physical discomfort of the horse during riding; and

- any observation noticed by the owner that might influence the horse's performance ability, e.g. bending the head to one side, hollow back, etc. (Palmer, 2012).

3.5.2.1 Before, middle and after blood sampling

Picture 3.12: Blood sample drawn from jugular vein (Photo: J Badenhorst)

Picture 3.13: Blood sample drawn by veterinarian (Photo: J Badenhorst)

Blood samples were drawn from the jugular vein (maximum of five millimetres) prior to the first Swedish massage treatment (Picture 3.12) by a veterinarian (Picture 3.13). Blood samples were also drawn by a veterinarian (Picture 3.13) after the sixth treatment and after the tenth treatment from the horses (n=30). The blood samples were tested for aspartate aminotransferase (AST) and creatine kinase (CK) by Pathcare Vet Lab. Blood samples were tested for AST and CK in order to determine the muscular health of the horse (Garlinghouse and Fleming, 2000).

3.5.3 Processes during the Swedish massage treatments

The first Swedish massage commenced on 16 June 2014, and the tenth treatment was concluded on 26 July 2014. This short time frame was selected in order to keep the ambient temperature similar during the massage treatments, minimizing any influencing variables. Different temperatures may influence horse's response. The massage treatments were completed after ten Swedish massage treatments to

influence the horse's muscles and psychological state positively (Hourdebaigt, 2007). A total of 300 massages were performed.

Horses (n=30) were massaged in the comfort of either the horse's own standard stable or paddock while kept on a leach by the horse owner or groom familiar to the horse to prevent the horse from tensing, minimising any influencing variables.

Picture 3.14: Calming horse by rubbing on Auricular muscle (Photo: J Badenhorst).

Picture3.15: Measuring heart beat at resting heart rate (Photo: J Badenhorst).

Prior to each Swedish massage treatment, the horse was rubbed on the Auricular muscle (Picture: 3.14) for ten minutes to relax the horse, measuring the heart rate at a resting pace. The researcher examined the horse's heart rate with a stethoscope prior to each Swedish massage treatment (Picture: 3.15).

Horses were massaged twice per week for five weeks at the same time each day for 40 minutes (Hourdebaigt, 2007). Back, neck, shoulder and hind quarter massages were performed starting at the Auricular muscle, Masseter muscle, Brachiocephalic muscle, Trapezius muscle, Longissimus Dorsi muscle, Gluteus Medius muscle, Biceps Femoris muscle, Semitendinosus muscle, Superficial Pectoral muscles, Triceps muscle and Deltoideus muscle, as these parts of the horse's body are mostly affected during riding/training (Hourdebaigt, 2007). Swedish massage movements mostly consisted of stroking and kneading movements and stretching of the muscles afterwards. Vigorous massage movements might have caused the

horse to get a fright, therefore the researcher concentrated mostly on stroking and kneading Swedish massage movements (Bromiley, 2007).

Picture 3.16: Recording observations on record card (Photo: J Badenhorst).

The horse's behaviour and relaxation signs during the Swedish massage treatment were observed and recorded on the treatment record card (Picture 3.16).

The horse's heart rate was examined with a stethoscope after each Swedish massage treatment (Picture 3.15) (Appendix E). The measurements of the heart rate before and after each Swedish massage treatment, as well as the horse's possible relaxation signs observed during the massage were recorded on a record card by the researcher after each massage treatment (Appendix E).

3.5.4 Processes after the tenth Swedish massage treatment

To determine any improvement in the flexibility of the horse's muscle, the researcher performed the after flexibility measurements, namely the horse's over reach distance (Picture 3.10), neck flexibility (Picture 3.7), shoulder flexibility (Picture 3.8) and back flexibility (Picture 3.9) with a measuring tape (Appendix E). Exactly the same methods as the before flexibility measurements were used in the after flexibility measurements.

A post-intervention questionnaire (Appendix D) was provided to the horse's owner/trainer/rider to determine:

- Any improvement in discomfort problems mentioned in the pre-questionnaire during riding/training by providing the owner with a Likert scale of one to ten, where one indicates no improvement, whilst ten indicates the biggest improvement.
- Any improvement in observations mentioned in the pre-questionnaire.

3.6 DATA ANALYSIS

Data from the data collection sheets, as well as the data gathered from the pre- and post-intervention questionnaires were captured by the researcher in a Microsoft ® Excel spreadsheet. Any further analysis was done by a statistician using SAS Version 9.2. Descriptive statistics, namely frequencies and percentages, were calculated for categorical data. Means and standard deviations or medians and percentiles were calculated for numerical data.

The appropriate analytical statistics were used to compare pre- and post-difference in performance between the treatment groups.

A comparison between the different disciplines took place in order to determine the possible influence that massage might have had on the different types of performance horses.

The four different zones were compared to determine which area has had the most significant response towards the massage.

3.7 ETHICAL ASPECTS AND GOOD CLINICAL PRACTICE

3.7.1 Ethical clearance

Ethical clearance was obtained from the Animal Ethical Committee at the University of the Free State (Appendix H).

3.7.2 Safety variables

The research study was considered to be safe to the participant due to non-invasive methods applied. The horses were only massaged topically.

3.7.3 Premature discontinuation of the study

Premature discontinuation of the research study did not occur due to the fact that the horses or their owners'/trainers'/riders' confidentiality have not been breached, and no unethical procedures occurred during the massage sessions.

3.7.4 Financial implications to the participant

The horse owners/trainers/riders did not have any financial responsibility towards the research study. The researcher drove to the different stable yards at her own expense, and the horse owners/trainers/riders were not expected to pay for services provided, nor did they receive any payment for services rendered.

3.7.5 Withdrawal criteria

Participation was completely voluntarily. None of the horse owners/trainers/riders withdrew their horses from the research study.

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CHAPTER 4: RESULTS AND DISCUSSION

4.1 INTRODUCTION

This study aimed to investigate the effect of Swedish massage on the performance horse. A total of 30 horses received the massage treatments.

Thirty horses were randomly divided into three disciplines; Dressage (n=10), Endurance (n=10) and Saddlebred horses (n=10). The objective of this research study was firstly, to obtain information regarding age, environmental stressors, breed, specific diets, disciplinary of the horse and horses' performance ability by means of the completion of a pre-intervention questionnaire by the owner. Secondly, the aim was to measure the heart rate and observe the behaviour of the horse before and after a Swedish massage in order to determine whether any physical and/or behavioural changes have occurred. Thirdly, the researcher aimed to evaluate the possible improvement in the horses' performance ability by means of a post-intervention questionnaire. Lastly, the different disciplines were compared to determine the effect that Swedish massage might have had on the selected horses' performance.

Pre-intervention (Appendix C) and post-intervention (Appendix D) questionnaires were compiled by the researcher and completed by the horse owners before and after the treatment. Each horse's flexibility was measured before the first and after the tenth treatments, whilst relaxation signs and heart rate were observed and recorded during each treatment. Blood samples were drawn from the horses (n=30) before the first, seventh and tenth treatment.

All the horses (n=30) were examined by a veterinarian to confirm positive health as stated by the Veterinary Act No. 19 of 1982 (RSA, 1982). According to the Veterinary Act, no horse may be treated without the permission of the horse's veterinarian.

4.2 DATA ANALYSIS

Data from the data collection sheets, as well as the data gathered from the pre- and post-intervention questionnaires were captured in a Microsoft ® Excel spreadsheet. Any further analysis was done by a statistician using SAS Version 9.2. Descriptive statistics, namely frequencies and percentages, were calculated for categorical data. Means and standard deviations or medians and percentiles were calculated for numerical data.

4.3 PRE- AND POST-INTERVENTION RESULTS

4.3.1 Pre-intervention results

A pre-intervention questionnaire was used to record the demographic and background information for each horse (Appendix C).

4.3.1.1 Demographic information and background of horses

The pre-intervention questionnaire was handed to the horse's owner before the Swedish massage treatments started in order to record the demographic information of the horses. All the horses were kept at different stable yards situated in the Bloemfontein area. Some horses were stabled in a stable by day or night, while others were kept in a paddock during the day or night.

Demographic information recorded in the pre-intervention questionnaire indicated that 70% of the Dressage and Endurance horses were geldings and 30% were mares. The ten Saddlebred horses were all geldings. In these disciplines stallions are not often used, but rather mares and geldings (70%). It is evident that horse owners who participate in the mentioned disciplines prefer geldings, although any horse gender may be used.

a. Age of the animals

The average age for all three disciplines (n=30) was 9.46 years. The Dressage horses' (n=10) ages ranged from four to 11 years, with an average of 7.9 years. The age range for the Endurance horses (n=10) was between eight to 11 years, with an

average of 9 years. The Saddlebred horses' (n=10) ages were between six to 17 years, and presented an average of 11.5 years. According to Evans (2002), in general, a horse between five and ten years is at its peak for training. In the performance horse industry each discipline's age ranges differ according to the rule book for each discipline. Therefore all the Endurance and Dressage horses average ages fell in the peak performance age range according to the rule book for Endurance (RSA, 2010) and Dressage (RSA, 2014a) but the Saddlebred horses(RSA, 2014b) were slightly older.

Dressage horses must be at least six years old to take part in International Dressage events. Local Dressage events determine the horse's age ranges according to the international standards (RSA, 2014a). For Endurance rides up to 99km, the horse must be at least five years old, whilst for Endurance rides further than 99km and the Fauresmith 200 National championship, a minimum age of six years is required (RSA, 2010). The minimum age required for Saddlebred horses are three years for junior horses and five years and older for senior horses (RSA, 2014b). All the performance horses included in the study adhered to the specific age ranges stipulated in each discipline's rule book.

The Saddlebred horses' average age was slightly older than the two other disciplines. This may be as a result of the fact that the Saddlebred horse rule book does not indicate a maximum age for a Saddlebred horse to participate in shows.

b. Horse height and breed

Table 4.1 reflects the horse's different heights in hands and centimetre for each discipline. Most of the Dressage and Saddlebred horses had an average height of 16.0 hands. The Endurance horses mostly had an average height of 15.0 hands.

Table 4.1 follows

Table 4.1 The horses (mean ± standard deviation) heights per discipline

	Dressage	Endurance	Saddle
Height in hands	16.00±1.00	15.00±0.41	16.00±0.48
Height in cm	163.76±10.30	153.67±3.28	163.93±4.92

[cm=centimetres]

Within the Dressage discipline, any horse breed and height can be trained. However, most of the horses participating in the research study were Warmblood bred horses. Endurance riding requires a smaller bred horse with endurance ability, stamina and speed. The horse which mostly resembles the mentioned qualities for Endurance riding is the Arabian horse and the Arabian cross horse (Arabian cross with Thoroughbred). The Endurance horse that was mostly utilised in the research study was the Arabian cross horse, which agrees with the literature. The only horse bred for Saddlebred horse riding is the Saddlebred horse. The Saddlebred horse discipline is breed orientated, which is the reason why only Saddlebred horses are used in this discipline in the study.

c. Housing conditions

The horses' (n=30) livery conditions were as follows: Most of the Dressage horses (n=9) (90%) were kept in a standard stable by night and paddock by day, whereas 90% of the Saddlebred horses were stabled by day and night. The majority (60%) of the Endurance horses were kept in a paddock by day and night, and 40% were kept in a paddock during the day and stabled at night. It is the owner's decision to decide where they want to keep their horse. There are no regulations regarding the livery of a horse. This explains the different livery conditions for the horses that partook in the research study.

d. Training schedules

Training and competing schedules differ for each discipline. The training territory ranged from sandy arenas to hard ground.

The Dressage horses (n=10) were mostly trained six times per week for a maximum of 45 minutes. Dressage training is limited to not more than one hour of training, as the horse's muscles are forced beyond normal evolved development, while the discipline also requires long periods of concentration. The Endurance horses (n=10) were mostly trained five times per week for two hours at a time. Endurance horses' training entails long hours of riding in order to increase stamina and endurance. The majority of the Saddlebred horses (n=10) were trained five times per week for 30 minutes. Saddlebred horses' muscles are trained very hard due to the artificial gaits practiced with the trainer. These artificial gaits are not a normal action for a horse, but they are specifically trained to perform them. The Saddlebred horse's muscles are also worked beyond the horse's normal evolved development, and therefore the horse cannot train for more than 30 minutes at a time.

Most of the Dressage horses were trained in a sandy arena, whilst some were trained in a sandy arena with rubber chips. Endurance horses were mostly trained on hard ground, although some were trained on sand. The Saddlebred horses were trained on different territories, including grass, sand and hard ground.

Soft, sandy arenas have less impact on the horse's body and muscles than hard ground. During riding, the surface of the ground should absorb and dissipate the force of the hoof contacting the ground. An ideal layer of ground feels resilient, giving cushioned support and being somewhat elastic. A riding surface which is not ideal may cause bruising to the sole of the foot and can cause a concussion effect up into the leg (Strickland, 2001). Bruising the sole of the foot and concussion may lead to symptoms of discomfort during riding, and the horse may compensate for the sore muscle (by using the opposite muscle to avoid discomfort from e.g. bruising) which may lead to muscle tension. These mentioned aspects of a resistance-free arena would be ideal for all horse-riding arenas, but most of the owners ride wherever they feel comfortable, not taking the horse's well-being into consideration.

The arenas of the Dressage horses that participated in the research study mostly resemble a resistance-free arena, whilst this was not always the case with the other

two disciplines. This might indicate that the Dressage horse's training surface has the least impact on the horse's body.

e. Competition schedule

The Dressage and Endurance horses in the research study mostly compete every four to six weeks, whereas the Saddlebred horses mainly compete four to five times per year. The Endurance horses have a minimum of five performance events per month (RSA, 2010), whilst the Dressage horses have a minimum of two shows per month (RSA, 2014a). The Saddlebred horses participate in show events during spring, autumn and summer, with a maximum of two times per month (RSA, 2014b). No regulations exist that force horse owners to attend a certain number of competitions. It is up to the horse owner to decide in how many shows the horse will participate. Each show attended by the horse can improve the horse's grading, which may increase the horse's value as well as the current level of competition.

4.3.1.2 Signs of discomfort recorded during riding

In the pre-intervention questionnaire, horse owners were requested to indicate the discomfort symptoms the horses displayed during riding. The symptoms were scored using a Likert scale of 0 to 10, where 0 indicated no symptoms experienced, and 10 indicated many symptoms experienced. Table 4.2 reflects the median score for the discomfort symptoms in each discipline, where a higher median score depicts a higher level of discomfort.

Table 4.2 follows

Table 4.2 Medians and ranges of discomfort symptoms experienced during pre-intervention of Dressage, Endurance and Saddlebred horses

Discomfort symptoms	Discipline		
	Dressage	Endurance	Saddle
	Median (min.-max.)	Median (min.-max.)	Median (min.-max.)
Horse tilting head to one side	2.0 (0.0-8.0)	0.0 (0.0-5.0)	2.5 (0.0-6.0)
Stiff on one rein	4.5 (0.0-7.0)	0.0 (0.0-4.0)	4.0 (0.0-8.0)
Bucking	0.0 (0.0-7.0)	0.0 (0.0-4.0)	0.0(0.0-10.0)
Twitching of tail	1.0 (0.0-6.0)	0.0 (0.0-0.0)	1.5 (0.0-8.0)
Moving away when saddled	0.5 (0.0-5.0)	0.0 (0.0-2.0)	1.0 (0.0-5.0)
Keep head low	0.0 (0.0-5.0)	0.0 (0.0-5.0)	1.5 (0.0-4.0)
Any abnormal behaviour e.g. difficult saddling or bridling	0.0 (0.0-4.0)	0.0 (0.0-4.0)	1.0 (0.0-6.0)
Resent grooming, touch or saddling	0.0 (0.0-5.0)	0.0 (0.0-2.0)	1.0 (0.0-6.0)
Any unexplained change in stride	0.0 (0.0-5.0)	0.0 (0.0-0.0)	3.0 (0.0-8.0)
Twitching of muscles when touched	0.0 (0.0-3.0)	0.0 (0.0-2.0)	1.0 (0.0-6.0)
Excessive shaking of head	0.0 (0.0-5.0)	0.0 (0.0-0.0)	1.0 (0.0-3.0)
Leaning on bid	2.0 (0.0-5.0)	0.0 (0.0-5.0)	2.0 (0.0-5.0)
React when girth is tightened	0.0 (0.0-5.0)	0.0 (0.0-2.0)	1.0 (0.0-6.0)
Refusal to take lead	0.5 (0.0-7.0)	0.0 (0.0-5.0)	1.0 (0.0-6.0)
Rearing	0.0 (0.0-0.0)	0.0 (0.0-2.0)	0.0 (0.0-5.0)
Refusal to walk backwards	1.0 (0.0-5.0)	0.0 (0.0-2.0)	1.0 (0.0-4.0)
Abnormally nervous horse	0.0 (0.0-6.0)	0.0 (0.0-5.0)	1.0 (0.0-6.0)

[min. =minimum quartile; max. =maximum quartile]

A horse displaying any of the symptoms recorded in Table 4.2 may experience some degree of muscle tension in an area, for example tension in the neck muscle. Table 4.2 shows that the symptoms mostly experienced by all three disciplines were where the horses displayed stiffness on one rein and leaning on the bid. A horse

that is stiff on one rein or leaning on the bid during riding may experience stiffness in one side of the neck muscle. The other symptoms experienced by two of the three disciplines were horse tilting head to one side (Dressage and Endurance horses), twitching of tail (Dressage and Saddlebred horses), and keeping head low (Endurance and Saddlebred horses). Tilting of the horse's head to one side indicates stiffness in the neck, whilst keeping head low and twitching of the tail may indicate stiffness in the back.

A normal muscle contracts and then immediately relaxes. Muscle tension develops when the muscle is overworked and does not release immediately after a contraction. The muscles then become chronically tensed, the muscle fibres remain closely packed, which in turn constricts the normal blood flow to the muscle. Poor blood flow leads to poor circulation of oxygen and nutrients to the muscles as well as the reduced removal rate of waste products. The muscle can therefore not return to normal functioning. This may lead to poor flexibility due to the fact that the muscle cannot relax immediately after a contraction (Wilson, 2010). Tension in muscles can lead to pain and discomfort, which may be shown by the horse as discomfort signs. Tension in a muscle, when not released, may lead to a tear in the muscle or damage to other connective tissue, and can cause a muscle injury. Muscles that are tensed with fibrocytes cannot relax on their own. This results in the body creating other areas of resistance in order to maintain balance in the muscles (homeostasis). If the body cannot fix this tension on its own, it will set up a compensatory effect. Compensation of a muscle appears when one muscle does not function optimally, either due to tension or injury, and another muscle takes over the function of the dysfunctional muscle. Any form of massage can improve the blood circulation to a blocked muscle, minimising poor flexibility (Bird, 2014).

According to Hourdebaigt (2007), the collection work during Dressage riding can cause the horse to tense up in the jaw and develop stress points in the neck. The Dressage horse may experience muscle tension in the neck which may lead to poor flexibility. Poor flexibility then leads to discomfort signs shown during riding, and the horse owner may portray the signs as the horse being stubborn. Signs of discomfort

by the Dressage horse, as recorded in Table 4.2, were aligned with general tension experienced by Dressage horses.

Endurance horses normally develop tension in the entire body; however the chest, back and hindquarters are mostly affected (Sly, 2001). According to the owner's response in Table 4.2, the Endurance horses only experienced tension in their back and neck, which may be an indication of the owner's lack of attention to signs of discomfort displayed by the horse during riding, and such signs being interpreted by the horse owner as the horse being stubborn.

The Saddlebred horse performs different artificial gaits which may cause stress points to develop in the neck, shoulder, forelegs, chest, abdomen and back (Sly, 2001). Table 4.2 indicates that Saddlebred horses mostly experienced tension in their back area. These results may also be indicative of a lack in paying attention to discomfort signs by the horse owners during riding, as mentioned earlier.

4.3.2 Post-intervention results

A post-intervention questionnaire was used to record the post-intervention results for each horse (Appendix D).

In the post-intervention questionnaire, horse owners were requested to report whether the discomfort symptoms indicated during the pre-intervention have improved, and if so, by how much. The level of improvement was measured using a Likert scale of 1 to 10, where 1 indicated no improvement, whilst 10 indicated exceptional improvement. For each of the three disciplines, Table 4.3 below shows the level of improvement for each of the discomfort symptoms.

Table 4.3 follows

Table 4.3 Medians and ranges of improvement in discomfort symptoms experienced during post-intervention of Dressage, Endurance and Saddlebred horses

Discomfort symptoms	Discipline		
	Dressage	Endurance	Saddle
	Median (min.-max.)	Median (min.-max.)	Median (min.-max.)
Horse tilting head to one side	5.0 (1.0-8.0)	7.0 (1.0-8.0)	4.0 (1.0-6.0)
Stiff on one rein	5.0 (1.0-7.0)	2.0 (1.0-3.0)	5.0 (4.0-7.0)
Bucking	3.0 (3.0-3.0)	1.0 (1.0-1.0)	1.0 (1.0-7.0)
Twitching of tail	7.0(1.0-10.0)	0.0 (0.0-0.0)	2.5 (1.0-5.0)
Moving away when saddling	2.0 (1.0-7.0)	2.5 (1.0-4.0)	1.0 (1.0-6.0)
Keep head low	6.5 (4.0-8.0)	6.0 (6.0-7.0)	2.0 (1.0-7.0)
Any abnormal behaviour, e.g. difficult saddling or bridling	3.5 (1.0-7.0)	1.0 (1.0-1.0)	2.5 (1.0-4.0)
Resent grooming, touch or saddling	4.0 (1.0-7.0)	1.0 (1.0-1.0)	1.0 (1.0-5.0)
Any unexplained change in stride	6.5 (5.0-8.0)	0.0 (0.0-0.0)	4.0 (4.0-6.0)
Twitching of muscles when touched	3.0 (1.0-8.0)	0.0 (0.0-0.0)	1.0 (1.0-5.0)
Excessive shaking of head	1.5 (1.0-2.0)	0.0 (0.0-0.0)	2.5 (1.0-4.0)
Leaning on bid	4.0 (1.0-8.0)	7.0 (7.0-7.0)	4.5 (2.0-7.0)
React when girth is tightened	3.0 (1.0-5.0)	1.0 (1.0-1.0)	3.0 (1.0-6.0)
Refusal to take lead	5.0 (1.0-10.0)	6.0 (1.0-9.0)	5.0 (3.0-6.0)
Rearing	0.0 (0.0-0.0)	1.0 (1.0-1.0)	6.0 (1.0-6.0)
Refusal to walk backwards	7.0 (3.0-9.0)	1.0 (1.0-1.0)	3.5 (2.0-5.0)
Abnormally nervous horse	1.5 (1.0-9.0)	5.0 (1.0-9.0)	1.5 (1.0-5.0)

[min. =minimum quartile; max. =maximum quartile]

Table 4.3 reveals that the symptoms that improved mostly in two of the three disciplines were horse tilting head to one side (Dressage and Endurance), horse keeping head low (Dressage and Endurance), improvement in horse's stride

(Dressage and Saddlebred), leaning on bid (Endurance and Saddlebred) and refusal to take lead (Endurance and Saddlebred). When a horse is tilting its head to one side or keeps its head low, it may be indicative of tension in the neck and back muscle. An improvement in these symptoms experienced by the horse could be as a result of massage of the neck, shoulder, back and hind quarter areas that represented zone one, two, three and four in the research study.

The performance of rubbing or stroking techniques during a Swedish massage increases the blood circulation, which increases oxygen flow to the muscles and subsequently releases toxins from the muscles, as mentioned earlier. The benefit that results from this is that Swedish massage might shorten the recovery time from muscular strains or exhaustion by flushing the tissues of lactic acid, uric acid and other metabolic waste. This benefit is observed as heat and redness at the area massaged (Hollis, 2009). Table 4.3 reflects an evident result that all the disciplines reported a notable improvement in at least five discomfort symptoms as a result of the Swedish massage treatments performed. Not all of the symptoms mentioned in Table 4.2 improved, but even other symptoms than those indicated in Table 4.2 improved, as indicated in Table 4.3. This could mean that horse owners paid more attention to discomfort signs after the completion of the pre-intervention questionnaire.

Table 4.4 The percentage improvement or deterioration of the horse's handling after the Swedish massages

Response	Dressage (n=10)	Endurance (n=10)	Saddle (n=9)
Better handling	40.00%	80.00%	55.56%
Worse handling	10.00%	0.00%	0.00%
No change in handling	50.00%	20.00%	44.44%

[%=percentage]

Table 4.4 displays the responses from the post-intervention questionnaire where the owner was requested to indicate any improvement in the horse's handling after the Swedish massage sessions. One of the Saddlebred owners did not respond to the question asked in the post-intervention questionnaire.

From Table 4.4 it can be depicted that the Endurance and Saddlebred horses benefited most from the treatment. Swedish massage may positively affect the horse's mental state by relaxing the horse. A relaxed horse may be easier to handle than a stressed horse (Hourdebaigt, 2007).

Table 4.5 The response of overall flexibility after the Swedish massages

Response	Dressage (n=10)	Endurance (n=10)	Saddle (n=9)
Better flexibility	80.00%	100.00%	88.89%
No change in flexibility	20.00%	0.00%	11.11%

[%=percentage]

The percentage distribution of the improvement in the flexibility of the horses is given in Table 4.5. Most of the Dressage horses' (80%) flexibility has improved greatly as a result of the Swedish massages provided. A definite improvement of the Endurance horses' flexibility was indicated by a positive response of a 100%. The majority of the Saddlebred horses (88.89%) have also indicated a positive improvement in the flexibility of the horse after the Swedish massages. One of the Saddlebred owners did not respond to the question asked in the post-intervention questionnaire.

Poor flexibility of a muscle can be caused by tension in the muscle. By rubbing or stroking tensed muscles, blood circulation is increased which leads to increased oxygen transportation and the removal of lactic acid from the muscles, as mentioned earlier. The quicker the lactic acid is removed, the quicker the muscle can return to its normal state, and more flexible muscles may be achieved (Hourdebaigt, 2007). The more elastic a muscle is, the better the ability of the muscle to perform different

manoeuvres, thus improving the horse's performance ability. A better performing horse increases the monetary value of the horse.

4.4 FLEXIBILITY RESULTS

In this section the pre- and post-intervention results for each flexibility zone will be displayed and discussed. The four zones that were included in the flexibility measurements are the neck, shoulder, back and hind quarter areas of the horses. The pre-flexibility measurement was taken before the first treatment and the post-flexibility measurement after the tenth treatment. Flexibility can be defined as lack of tightness in a muscle (Frick, 2010).

Firstly, the median neck flexibility measurements, both left and right side of the horse are displayed in Figure 4.1 for each of the three disciplines. It is important to note that an improvement in the flexibility of the neck is when the measurement has decreased. The pre-value for each discipline was taken before the first Swedish massage, and the post-value was taken after the tenth massage. Only the neck flexibility of the Dressage horses' left sides showed an increase in the median measurement results after the intervention; consequently the Dressage horses' left sides did not show a significant ($P>0.05$) improvement.

When comparing the median values within each discipline, observing the median difference between the pre- and post- measurements, the biggest median difference was observed for the left and right side of Saddlebred horses. Specifically, a significant ($P<0.05$) improvement was observed for the right side of Saddlebred horses. When comparing the median differences between all three disciplines, a significant ($P<0.05$) difference was also observed for the flexibility of the neck on the right side, with that of the Saddlebred horses being significantly different ($P<0.05$) from both Dressage and Endurance horses. Comparing the three disciplines, it was evident that the Saddlebred horses have shown the greatest improvement in the neck area. This can be due to the Saddlebred horse's neck muscles working exceptionally hard during riding in order to maintain their frame of a high-held neck and head position.

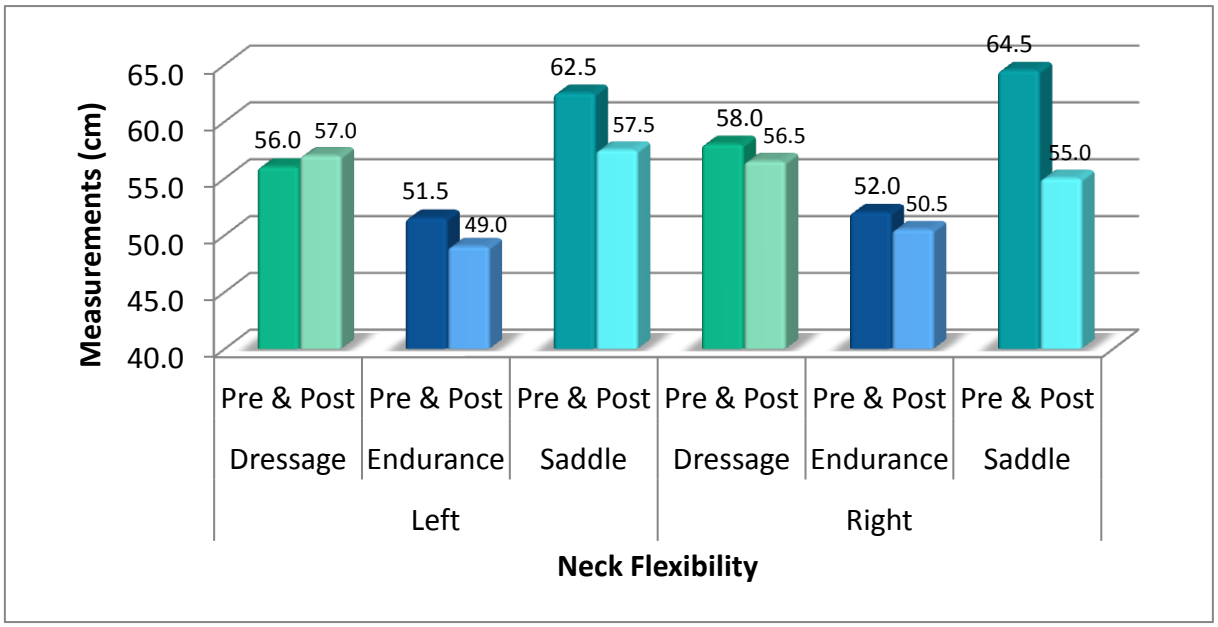
Normal functioning and flexible muscles operate better with their opposing partners, stretching further when the agonist muscle contracts, thus preventing compensation of muscles, as mentioned previously. Flexibility or suppleness and strength are two important components for the ability of muscles to perform (Ettl, 2002). Speed and proper performance is dependent on muscular strength and suppleness. When a horse is ridden either running in a straight line or performing delicate lateral movements, the muscle demands a certain amount of suppleness in order for rapid stride turnover. Suppleness involves rapid change of limb position or rapid change of direction. In order to achieve these rapid movements of the limbs, the muscle requires mobility in the tissues surrounding the joints. The more supple the muscle is, the greater the ability of the horse to perform certain manoeuvres. Elasticity or flexibility of the muscles, tendons and ligaments allows not only for controlled, quick movements, but also for the avoidance of pulling a muscle (Porter, 1998).

The horse's neck already takes a lot of strain without being ridden due to the horse's heavy head and neck. During horse riding, the horse rider uses the horse's neck as a "steering wheel", therefore the weight from the horse's head is shifted from side to side, influencing the balance of the horse and the neck muscle may compensate to support opposing muscles. This may cause tension in the horse's neck, which may lead to poor flexibility and poor performance (Dausend, 2005). When the left and right side of the neck in Figure 4.1 is compared in the specific discipline, there are notable differences in the left and right side measurements, which can be an indication of the neck muscles compensating to support the opposing muscles. The improvement in the measurements may indicate that Swedish massage may promote flexibility, minimising compensating muscles.

Good flexibility of the neck muscles increases the horse's athletic ability, balance and suppleness (Ettl, 2002). A professional horseman, Dunning (2014) states that good flexibility causes versatility and versatility results in an obedient horse. An obedient horse handles easier and also learns new training techniques easier.

Figure 4.1 illustrates that most of the 30 horses included in the study showed a significant ($P<0.05$) improvement in the neck area due to the Swedish massages.

This minimizes discomfort during riding and enhances the horse's performance ability.



[cm=centimetre]

Figure 4.1 Median flexibility measurements of the neck zone pre- and post-intervention (n = 30)

Secondly, the median shoulder flexibility measurements, both left and right side of the horse are displayed in Figure 4.2 for each of the three disciplines. Here an increase in the measurement indicates an improvement in the flexibility of the shoulder. The pre-value for each discipline was taken before the first Swedish massage, and the post-value was taken after the tenth massage. When comparing the median values within each discipline, all categories, except the left side of Dressage horses, showed a significant improvement ($P < 0.05$) in the flexibility of the shoulder. No significant differences ($P > 0.05$) between the disciplines were observed when the median differences were compared. This may be indicative that all the disciplines experience the same degree of tension in the forelimbs or shoulder area.

In order to understand the improvement in flexibility measurements, it is important to have knowledge of the anatomy and flexibility of the muscle. Flexibility is dependent on the visco-elasticity of muscles, ligaments and other connective tissue crossing

the joints. It is also influenced by two spinal reflexes initiated by the muscle spindle and the Golgi tendon organ (Frick, 2010). The muscle spindle is a stretch receptor composed of thin muscle fibres that can either respond to rate of length change or to static absolute length change. When a muscle is stretched, it activates the spindle reflex, the fibres contract and the muscle is shortened. The Golgi tendon organ composed of collagenous fibres and muscle fibres is located at the muscle tendon interface. Upon a muscle contraction, a force is applied to the Golgi tendon organ, which sends a message to the spinal cord. This results in relaxation of the agonist muscle and contraction of the antagonist. The Golgi tendon reflex enables the muscle to stretch, while the spindle reflex presents muscle elongation. Proper flexibility in a muscle will enhance the Golgi reflex and inhibit the spindle reflex. Imbalances in flexibility might promote a muscle injury due to the fact that the spindle reflex does not prevent muscle elongation and Golgi reflex does not relax (Frick, 2010). The Golgi tendon organs and muscle spindle cells work in collaboration to prevent a muscle injury. The more the muscle tries to stretch and the faster it tries to stretch, the more the Golgi tendon organs cause it to contract (Jacobs, 2014). These nerve cells can be influenced by massage. Golgi tendon organs react to sustained pressure by telling the muscle to relax. By applying pressure to muscle tissue during a Swedish massage, it may influence these mentioned nerve cells, which in return can influence the flexibility of the muscle. The research study results have indicated that during a Swedish massage different pressures of the different techniques applied have improved the flexibility of the shoulder muscle.

An increase in muscle flexibility and viscosity leads to enhanced range of motion of the joints. Improved range of motion enables the horse to perform the rider's requested aids more effectively, thus enhancing the horse's performance ability. In recent studies it was indicated that an improvement in range of motion may be primarily the result of muscle relaxation (Frick, 2010). A tensed muscle may have lack in range of motion, and this leads to poor performance. When a rider climbs onto the horse and starts asking a certain frame from the horse without any warm-up and force the head, neck or shoulders into a fixed shape, it may result into

irreversible muscle tension. The superficial fascia is the connective tissue found beneath the skin. This tissue links and covers blood vessels, nerves, muscles and bones. The fascia and muscle combine to form the myofascial system. In the myofascial system tension may also occur. Tension or fibrocytes limit the muscle movement, and this interferes with performance. Tension can also cause severe pain, reduced flexibility and tender trigger points (Jacobs, 2014). By performing a massage in order to improve tensed muscles of the shoulder, the limb's range of motion may be improved, entitling the horse to perform different movements better. The research study results indicated that Swedish massage improves the flexibility of the shoulder muscles thus improving the range of motion of the shoulder limb.

Stretching and performing warming exercises to the left and right front leg, may lead to the stretching of the back muscle, the flexor muscles of the fore limb and the deltoid muscle (Ettl, 2002). Flexible shoulder muscles enhance the horse's forehand movement, determine proper stride length and improve lateral movement. Swedish massage performed has improved shoulder flexibility, which in turn improved the range of motion in the forelimbs, meaning the horse finds it easier to perform asked aids of the rider - therefore enhancing the horse's performance.

Figure 4.2 follows

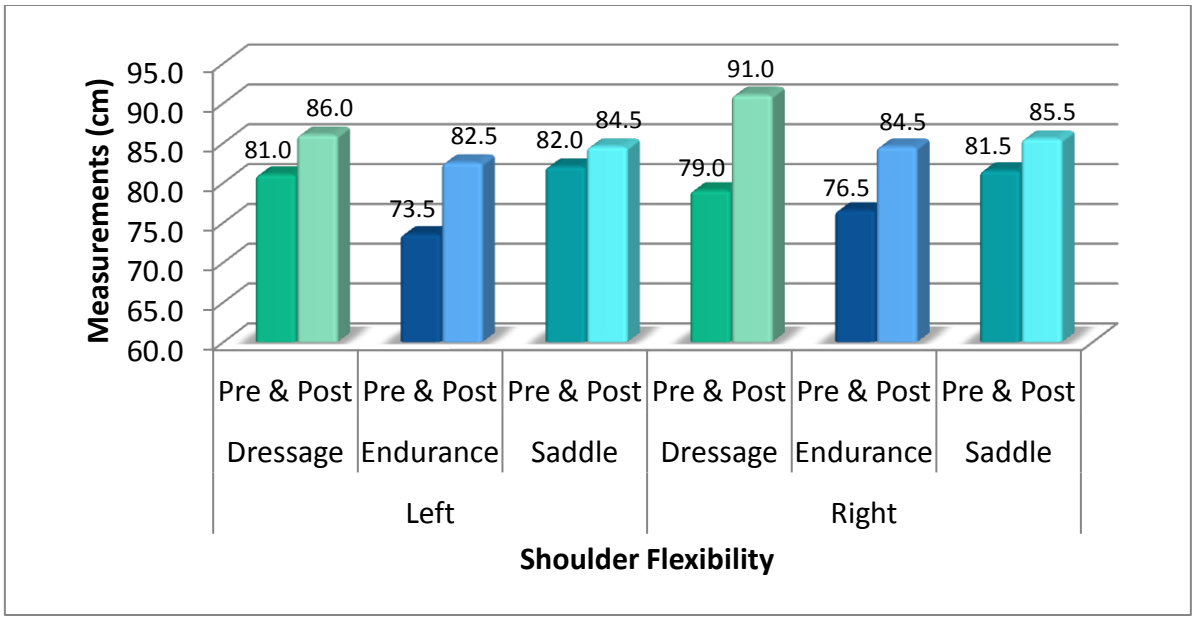


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Figure 4.2 Median flexibility measurements of the shoulder zone pre- and post-intervention (n = 30)

For the third zone (back of the horse), the median flexibility measurements are displayed in Figure 4.3 for each of the three disciplines. Here an increase in the Likert scale measurement indicates an improvement in the flexibility of the back. The pre-value for each discipline was taken before the first Swedish massage, whilst the post-value was taken after the tenth massage. All three disciplines showed a significant improvement ($P < 0.05$) between the median pre- and post-intervention measurements. The notable improvement in the back flexibility of the horse can be due to the horse's back muscles which are the origin for most forelimb and hindquarter muscles, thus when the horse uses its forelimbs and hindquarters for movement it places a great amount of tension on the back muscle. Tension in the back muscle may lead to discomfort symptoms in the forelimbs as well as the hindquarters. The back muscles of the horse work exceptionally hard. Furthermore, the saddle is placed on the horse's back muscles, which can lead to tightness in the back muscles. The horse's back muscles are in need of relaxation and proper flexibility due to the mentioned influencing factors which may be linked to the notable improvement in back flexibility. No significant differences ($P > 0.05$) between the three disciplines were observed when the median differences were compared. This

can be an indication that the horses' muscles work equally hard in all three disciplines.

To determine the horse's back muscle flexibility, an active back stretch is performed by having the horse stretch its head as far as possible between its legs. The further the horse can stretch below its Carpus bone, the more flexible the back muscle is. This active stretch is achieved by offering a treat between the front legs. The treat must be held at a position where the horse can reach maximum stretch of the back, thus the handler should not offer the treat before the horse has reached the maximum stretch (Ettl, 2002).

A flexible back will enhance the horse's overall movement and promote enthusiastic involvement during training. As mentioned, the saddle is also placed on the horse's back muscle, and tension in the back may lead to discomfort for the horse during riding (Palmer, 2012). Improvement in back flexibility through the performance of Swedish massage will make the horse more enthusiastic and minimise discomfort felt in the back muscle during riding. Swedish massage enhances the blood circulation, hence warming the muscles leads to balanced functioning of the muscles and improved flexibility.

Figure 4.3 follows

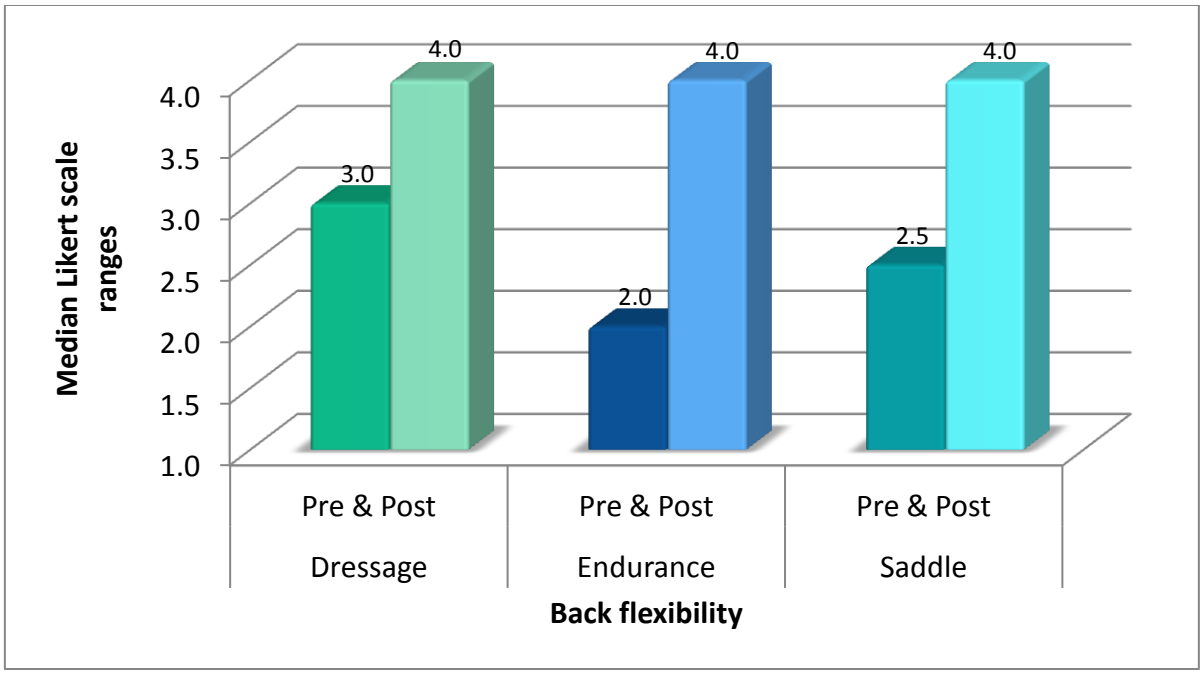

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Figure 4.3 Median flexibility measurements of the back zone pre- and post-intervention (n = 30)

Lastly, the median hind quarter flexibility measurements, both left and right side of the horse are displayed in Figure 4.4 for each of the three disciplines. Here an increase in the measurement indicates an improvement in the flexibility of the hindquarter. The pre-value for each discipline was taken before the first Swedish massage, and the post-value was taken after the tenth massage. Although not significant ($P > 0.05$), it is interesting to note that both the left and right side of the Endurance horses showed a decrease in their flexibility. No significant differences ($P > 0.05$) were observed within or between the disciplines.

The hindquarters contain a huge bulk of muscle, and in order to achieve positive improvement in flexibility it is believed to apply an enormous amount of pressure. However, the way the horse's body is designed, even light touch is transferred deep within in the body, therefore lighter movements can also benefit the hindquarters. Stiff hindquarters can be noticed by observing the horse's over-reach distance. When the horse struggles to place his hind feet in front of the hoof print made by the horse's forefeet, the hindquarters are stiff. A flexible horse will have a greater

distance between the forefeet track and the over-reach distance of the hind feet (Palmer, 2012).

A horse that shows signs of hindquarter stiffness will resist forward movement and have restricted backwards walking when aided by the rider. The degree of muscle strain and tension a horse experiences often depends on the activity level in which the horse competes or trains. Horses ill-prepared for the workload they are asked to carry out (inadequate warm-up, pre-existing muscle tension, working the horse to the point of fatigue and partaking in activities the horse is not accustomed to), can lead to muscle soreness and tension (Larson, 2012).

During this study lighter pressured Swedish massages were performed on the hindquarters which might have led to the decrease in flexibility. This might contradict literature which stated that light pressure also influences the bulky hindquarters. It has to be mentioned that seven of the Endurance horses involved in the research study, participated in the Fauresmith endurance ride during the research study, which placed a tremendous amount of strain on the horses' muscles. This might be linked to the results that were obtained.

Figure 4.4 follows

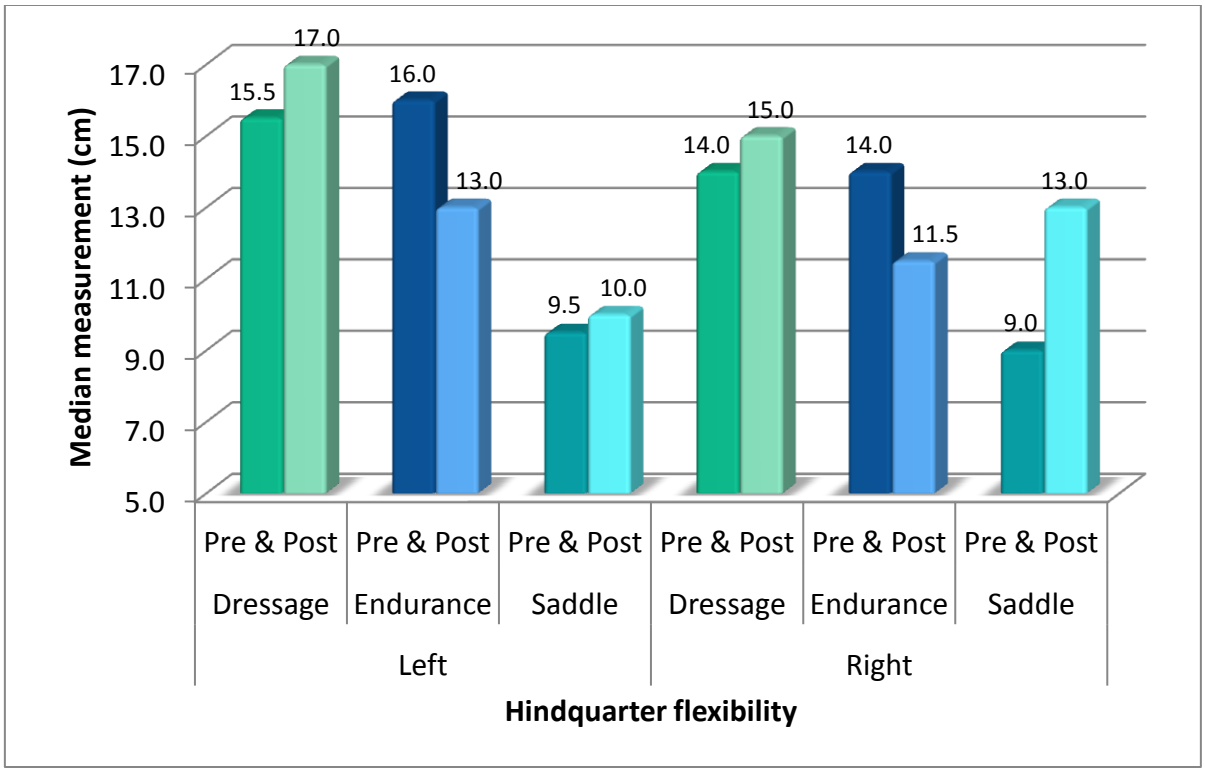

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Figure 4.4 Median flexibility measurements of the hind quarter zone pre- and post-intervention (n = 30)

4.5 BLOOD SAMPLING RESULTS

Multiple ranges between pre-, middle- and post-values for each blood sample are indicated in Table 4.6. The effect of Swedish massage on the blood samples drawn, aspartate aminotransferase (AST) and creatine kinase (CK) for the three disciplines are also indicated. The blood samples were drawn from the Jugular vein by a veterinarian before the first, after the sixth and after the tenth Swedish massage. These specific blood samples were drawn in order to determine the muscular health of the horses.

Table 4.6 The effect (mean ± standard deviation) Swedish massage had on the blood sample results of aspartate aminotransferase (AST) and creatine kinase (CK) for the three disciplines

PARAMETER	PRE-BLOOD TEST (n=10)	MIDDLE-BLOOD TEST (n=10)	POST-BLOOD TEST (n=10)
Dressage			
AST	298.00 ± 103.72[a]	272.70 ± 44.40[a]	275.50 ± 32.90[a]
CK	240.50 ± 162.82[a]	222.30 ± 86.34[a]	202.10 ± 30.37[a]
Endurance			
AST	322.60 ± 115.66[a]	287.40 ± 66.62[a]	330.89 ± 88.75[a]
CK	221.10±54.14[a]	177.60±34.56[a]	565.78±1119.63[a]
Saddlebred			
AST	251.60 ± 51.52[a]	228.30 ± 43.31[a]	262.20 ± 59.52[a]
CK	175.30 ± 27.83[a]	165.70 ± 39.69[a]	189.70 ± 57.50[a]

Means with different letters within the same row differ significantly: P<0.05

[AST= aspartate aminotransferase; CK= creatine kinase; Pre=before 1st massage; Middle=before 7th treatment; Post=after 10th treatment]

The Dressage, Endurance and Saddlebred horses' AST and CK levels were not significantly influenced by the Swedish massage treatments. The non-significant difference (P>0.05) can be due to the fact that seven of the Endurance horses participated in the Fauresmith endurance ride during the research study, which placed an enormous amount of strain of the horses' muscles. This could lead to an increase in the CK blood sampling results. Furthermore, one of the Endurance horses suffered from Exertional rhabdomyolysis, which is determined by an increase in CK serum levels. This horse's CK levels were very high. This could have influenced the final results. Also both the Dressage and Saddlebred horses were trained hard during the course of the study.

The non-significant difference (P>0.05) might be the results of the fact that the Saddlebred horses' muscles were over-trained the day or even week before the blood sampling was done. The blood enzymes AST and CK are influenced by

numerous factors. These factors include: the time when the sampling was obtained (before, during or after exercise), and any stressful events (a long, unplanned ride or recent vaccinations) (Garlinghouse and Fleming, 2000). Muscle injury and pain is normally identified through thorough physical examining, evaluation of CK and AST serums and thermography. AST and CK serums alone are not a sufficient indication of the muscular health (Larson, 2012). Insufficient research has been done on the effect of Swedish massage on these muscle enzymes. These enzymes are an indication of the muscular health of the horse and possible occurrences of diseases such as liver damage. It is therefore difficult to determine the exact effect that Swedish massage has had on the horses' AST and CK levels. Swedish massage is most effective in promoting relaxation, and not in improving the health of the muscle, like deep tissue massage. On the other hand, it is evident that Swedish massage does not negatively influence the horse's muscular health.

4.6 RELAXATION RESULTS

Table 4.7 provides the relaxation signs by indicating the horses' heart rate measurement differences before and after each treatment. Each horse's heart rate was measured with a stethoscope by the researcher.

Table 4.7 The effects (mean ± standard deviation) of Swedish massage on the heart rate measurements - measured before and after ten Swedish massages

PARAMETER	HEART RATE BEFORE (Beats/min.) (n=10)	HEART RATE AFTER (Beats/min.) (n=10)
Dressage	36.00 ± 4.00[a]	34.60 ± 3.60[b]
Endurance	32.50 ± 4.90[a]	31.60 ± 4.40[b]
Saddlebred	34.3 ± 4.60[a]	33.50 ± 4.00[b]

Means with different letters within the same row differ significantly: p<0.05

[min.=minutes]

Massaging the different zones had an overall significant effect in reducing the heart rate of the horses, as indicated in Table 4.7. A significant difference ($P<0.05$) was indicated in the Dressage horses' heart rate measurements. The average pre-treatment heart rate measurement was 36 beats per minute, and the average post-treatment heart rate was 34.6 beats per minute. The average pre-treatment heart rate measurement of the Endurance horses was 32.5 beats per minute, whilst the average post-treatment measurement was 31.6 beats per minute. A significant difference ($P<0.05$) is displayed. The Saddlebred horses showed a significant difference ($P<0.05$) in the results, with an average pre-treatment heart rate measurement of 34.3 beats per minute, and a post-treatment heart rate measurement of 33.5 beats per minute. A nervous horse's heart rate may increase dramatically during stress, and a relaxed horse shows a decrease in heart rate. The resting heart rate of a horse is when the horse is resting quietly in a stall, stable or paddock. The normal resting heart rate of a horse ranges between 25 to 40 beats per minute. Measuring a resting heart rate in relaxed, resting conditions is important because sudden excitement, fear or anticipation can elevate the heart rate rapidly to over 100 beats per minute (Humphrey, 2003).

Resting heart rate is one of the vital signs that can provide an excellent benchmark when it comes to assessing the general health status of the horse. An increase in the resting heart rate might be an indication that the horse has an underlying disease or disorder. From Table 4.7 it is evident that none of the horses showed an increase in heart rate due to fear, excitement or anticipation, therefore it can be deducted that the Swedish massages only relaxed the horses and did not make them nervous.

A further response to the Swedish massage that was measured was the horses' visual responses towards the massage, which were recorded on a record card. During the research study, the researcher developed methods of recognising the horses' visual responses to touch. These responses enabled the researcher to release accumulated stress in key junctions of the body which mostly affected the horses' performance. Lick and chew was a visual response, which showed a

significant difference (P<0.05) in the percentage between Dressage, Endurance and Saddlebred horses at treatment three and treatment seven. The Endurance horses showed a significant increase in relaxation over time, and responded by passing gas. Soft eyes, as another relaxation response, showed a significant difference in the percentages between the three disciplines, and were observed at treatment two (P=0.0191), five (P=0.0001), six (P=0.0018), seven (P=0.0398) and eight (P=0.0342). The horses that lowered their heads during the massage treatment showed a significant difference in the percentages between the three disciplines at treatment five (P=0.0155) and six (P=0.0053). The behavioural changes of the horses are an indication that the horses perceived the Swedish massage treatments as a pleasurable characteristic or "reward". This "reward" potentially allows the massage to have relaxation qualities on the horse (McBride, Hemmings and Robinson, 2004).

The somatosensory system in the body is classified as the touch centre of the body. It can either perceive pain, tactile stimuli or variations in temperature. Horses' tactile or touch is extremely sensitive. Their entire body is as sensitive as human fingertips. A horse can even feel a fly sitting on a single hair. By massaging the horse, the touch receptors are stimulated. Massage can communicate with these touch receptors, which in return leads to the release of neurochemicals; endorphins, dopamine, oxytocins and serotonin - the feel-good hormones. Due to the horse's acute tactile sensation, the release of these hormones can allow total body relaxation and promote healing (Gantsoudes, 2014).

A study conducted by Mcbride *et al.* (2004) indicated that massaging different areas can have a significant effect on lowering the horse's heart rate. During their study, the researchers indicated that, by massaging the horses' withers and mid-neck regions, a significant decrease in the horses' heart rates were established (McBride *et al*., 2004). From the findings in Table 4.7, it is evident that Swedish massage reduced the horses' heart rate during a full body massage.

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CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Performing massages on horses is a relatively new trend in South Africa. This new trend has not been researched extensively. There is a need to investigate the effects of massage on the horse in order to proof viability. In South Africa equine massages are performed by either a physiotherapist or a qualified equine massage therapist. These types of massages performed by a physiotherapist are aimed at specifically treating muscle and tendon injuries in horses, and not for relaxation and flexibility improvement in uninjured muscles. Also, not much evidence exists of the effects of Swedish massages performed on horses by a somatologist.

The researcher, as a somatologist and horse owner/rider, has knowledge in handling of horses and their behaviour. She has been involved in the performance horse industry for 14 years and is an experienced horse rider. Furthermore, she owns horses and has been competing in Dressage for nine years.

The aim of the research study was to investigate the effects of Swedish massage on the performance horse. Impending from the title, the findings, recommendations and conclusion will be discussed.

5.2 CONCLUSION

From the results obtained it was evident that Swedish massage has almost similar effects on performance horses as on humans. Relaxation was one effect achieved. This was evident from the numerous relaxation signs shown by the horses during the massage treatment, as well as the significant lowering in the horse's resting heart rate. Relaxation is also the effect of Swedish massage on the human body that is achieved most often. Through relaxation a person's well-being can be improved, thus influencing the person's state of mind positively by influencing the touch receptors in a positive way.

Another effect obtained was improvement in the flexibility of the horses' muscles in the different zones. By restoring the normal functioning of the muscles' ability to relax and contract, as indicated by literature, flexibility was improved. This was achieved by releasing tension blockages in the muscles which hinder the normal functioning of the muscle. The neck area (zone 1) of the 30 horses has shown an overall improvement in flexibility. This proves that Swedish massage positively affected the neck muscles of the horses. This will improve the horses' performance ability because, in all three disciplines, the horses' necks work hard to provide balance and support. Comparing the three disciplines, the Saddlebred horses showed the most improvement in the neck area. This indicates that the Saddlebred horses experienced a lot of tension in the neck before the Swedish massages, and that this tension was released after the massages. Saddlebred horses can mostly benefit from a neck massage in order to prevent tension in the neck area. During a full body Swedish massage for a Saddlebred horse, most of the massage attention should be focused on the neck muscles.

The shoulder area (zone 2) of the 30 horses showed an overall improvement after the Swedish massages. All 30 horses, in their different disciplines, use their shoulder muscles to move their forelimbs to perform the different manoeuvres related to the discipline. Dressage and Endurance horses responded best to a shoulder massage. In the Dressage discipline the horse has to perform different lateral movements with their forelimbs which influence their shoulder muscles. By receiving a shoulder massage, these horses' performance ability can be improved. In Endurance riding most strain is placed on the shoulder muscles to run long distances, and their ability to run longer distances might be improved with a Swedish shoulder massage. The horse's forehand muscles are for speed and the hindquarter muscles are used for power and endurance to run.

The back area (zone 3) showed a marked response towards Swedish massage in all three disciplines. This can be due to the fact that the horse's back muscles work exceptionally hard during riding for any discipline. A horse's back muscles carry the

rider, the saddle, and provide attachment for major muscle groups. The horse's performance ability can be approved through a back massage.

The hindquarters (zone 4) showed the least response of all the zones towards Swedish massage. The Endurance horses' hindquarters were stiffer compared to the before measurement, possibly due to the Fauresmith 200 Endurance Ride which took place during the research study. This endurance ride demands a lot of strain from the horse's hindquarter muscles due to uphill riding, rocky terrains, long distances of riding and the fact that the hindquarters of the horse is the power force. Swedish massage would have been beneficial if it was performed for longer periods after the Fauresmith Endurance Ride.

From this study it is evident that Swedish massage did not influence the AST and CK blood enzyme levels sufficiently. These enzymes are used to determine numerous conditions in the horse, one being the muscular health of the horse. It can be concluded that the Swedish massage neither affected the muscular health of the horses negatively (injuring the horses' muscles) nor did it improve their muscular health.

Some of the responses obtained from the pre- and post-intervention questionnaires opposed one another, as some owners indicated totally different improvement levels in the discomfort symptoms in the post-intervention questionnaire. This may show a lack of knowledge of the horse owners to identify signs of discomfort, and lack of attention towards the horse showing signs of discomfort during riding.

The results obtained are, however, temporary. A horse should receive a Swedish massage treatment at least once per week in order to maintain the results. It is recommended that the Swedish massage should be carried out before and after a competitive show to prepare the muscles for the vigorous exertion that will follow, as well as relaxation and improvement of muscle recovery afterwards. A horse can also benefit from maintenance Swedish massage treatments offered once a month, as it will release muscle tension and provide relaxation on a short-term basis.

5.3 RECOMMENDATIONS

Based on the results of the research study, the following recommendations are made:

It is recommended that Swedish massage be used only for preventing muscle injuries, and not for treating muscle injuries, as the massage therapist does not have sufficient medical knowledge to prescribe related treatments and/or medications. A veterinarian should still be informed and contacted to treat muscular injuries when lameness and pain is noticed by the owner.

The horse owner is responsible for ensuring that the horse's vaccinations and de-worming programme is up to date in order to prevent diseases from occurring and influencing the horse's performance. It is therefore recommended that the horse owner use Swedish massage treatments as a preventative measure against tension in muscles and to relax a nervous horse. If not treated, these might negatively influence the horse's performance.

5.4 RECOMMENDATIONS FOR FUTURE STUDIES

The following recommendations are made for future studies:

- To investigate the relaxation effects of Swedish massage by sampling and testing the horse's salivary cortisol concentrations, and to include a Likert scale of one to five to record the horse's response towards the massage.
- To investigate the effects of sports massage on the performance ability of the performance horse.
- To investigate the effects of Swedish massage on the lactic acid levels of performance horses.
- It is, however, very important to note that a background to and knowledge of horses are required in order to do the Swedish massage on horses.

5.5 SUMMARY

Currently in South Africa the debate as to whether massage benefits the horse in any way, is still on-going. This study proved that the horse does benefit from a Swedish massage in similar ways a human does. Humans regularly visit a somatologist for a Swedish massage to relax and recuperate. This can also improve the performance ability of a horse, as a relaxed horse may concentrate more effectively, thus responding better towards the rider's asked manoeuvres and riding aids. Furthermore, the horse will be more willing to perform the specific movements, as the horse will be free from muscle tension, pain and discomfort.

As mentioned earlier, a somatologist has the knowledge and ability to perform an effective Swedish massage on humans. The somatologist can effectively perform a Swedish massage on a horse. This can broaden the somatologist's spesialising field by working in collaboration with a veterinarian or the horse trainer. The only limitation to a somatologist performing a Swedish massage is that a somatologist can only perform a Swedish massage on horses effectively if the somatologist has experience in horse behaviour and handling horses.

The only way a horse can verbalise any discomfort experienced is through its behaviour. A horse receiving a regular massage may have less muscle tension, and the horse will be more willing to perform different manoeuvres. When the horse performs better, its level of performance and resale value will improve. The owner therefore also benefits from the horse's improved performance. A horse rider can relax a horse before a competitive show by grooming the horse with the intention to massage when a massage therapist is not present. Furthermore, the horse owner can use Swedish massage as a warm-up routine to warm up the horse's muscles before vigorous training.

Further research is required to enhance the results obtained and to use different massage techniques to determine the best type of massage to cause improvement in the health of the muscle and not just to relax the muscle.

5.6 REFLECTION

As a qualified somatologist and horse owner, the researcher experienced that the research study deepened her knowledge of both horses and the somatology profession. The insight gained from the research study will enable the researcher to provide knowledge to a somatologist and to encourage horse owners to be more attentive to their horses, and to cater for their horses' needs more effectively.

It is expected that the outcomes of this research study will contribute positively to the somatology profession as well as the horse industry. The somatologist's field of specialisation can be broadened, and the horse's needs shall be provided for. This will contribute positively to the well-being of the horse.

APPENDIX A: INFORMATION DOCUMENT

APPENDIX B: CONSENT FORM

APPENDIX C: PRE-INTERVENTION QUESTIONNAIRE

APPENDIX D: POST-INTERVENTION QUESTIONNAIRE

APPENDIX E: DATA COLLECTION SHEET PER HORSE

APPENDIX F: CLINICAL SHEET FOR VETERINARIAN EXAMINATION

APPENDIX G: APPROVAL LETTER FROM ANIMAL ETHICS COMMITTEE

APPENDIX H: STATISTICAL ACCEPTANCE LETTER

APPENDIX I: SCIENTIFIC PAPER SUBMITTED TO THE JOURNALOF NEW GENERATION SCIENCES