Investigation of Insect Bite Hypersensitivity IBH and Pruritus in Equids and Research into the Concept of a Smart Textile Delivery Systems to Treat the Condition

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Investigation of Insect Bite Hypersensitivity IBH and Pruritus in Equids and Research into the Concept of a Smart Textile Delivery Systems to Treat the Condition

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ABSTRACT: Equine insect bite hypersensitivity (IBH) is an allergic pruritic skin disorder and is the most common cause of skin complaint in horses effecting 5% of approximately 900,000 equines in the United Kingdom and caused by the insect bites of the genus midge, *Culicoides*, and the black fly, *Simuliidae*. Pruritus is a broader term that encompasses all skin complaints such as summer eczema, pollen, dust and feed allergy's, and photosensitivity. There has been little advancement toward more effective treatment for any of these skin conditions, and the current practice has not demonstrated any progress for an effective treatment for pruritus.

In this study current treatment of the condition and the experiences of the stakeholders were investigated to asses existing procedures used to treat IBH and pruritus; and alternative methods of delivering medication through a textile-based system were explored. In order to accomplish the aims of the study a mixed method process was followed to collate data from the equestrian industry, identifying any patterns in treatment and conditions of the horses. Additionally, members from Horse and Hound an east midlands equine forum, provided the information relevant to the concerns of the condition through a piolet study, and were instrumental in the development of the survey. The on-line survey provided responses from 56 stakeholders giving a broader spectrum of current practises and treatment. The same themes of environment, location, experience, current treatment was investigated; including current horse blanket use, food supplements and what participants would like to see in future treatments and protective horse blankets. The same themes were repeated and followed throughout the questionnaire and survey, and during the face to face interviews.

The data gathered through the face to face interviews and the on-line survey showed that (80%) of the participants felt there was no advancement in the condition; and their frustrations in combating the condition had not changed. The survey data showed (2%) of the participants were male. 18 different equine breeds were assessed, with the most effected breed of equine being the heavy equine breed. Current treatment practice for IBH and pruritus provided a baseline for future treatments. Protective horse blankets were still the most relevant in combating the condition; the face to face interviews provided comparable results for horse blankets as a primary source to combat the condition and provided in-depth information on the everyday impact in treating IBH and pruritus. Based on the above research, the study proposes to explore various functional textile properties to provide a more effective protective horse blanket that has optimal medicine delivery and enhances current technique of treating pruritus.

Keywords: equine insect bite hypersensitivity; pruritus; stakeholder equine experiences; semi-structured interviews; medical textiles.

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Abbreviations

Abbreviation	Explanation
IBH	Insect Bite Hypersensitivity
IgE	Immunoglobulin E-
ID	Irish Draft
IDx	Irish Draft Cross Breed
IS	Irish Sport
SF	Selle Francais
TB	Thoroughbred
TBx	Thoroughbred Cross Breed
RAO	Recurrent Airway Obstruction
RVCS	Royal College of Veterinary Science
IL5	Interleukin 5
WHO	World Health Organisation
GCs	Glucocorticoids
MLSE	Multiplexed Laser Surface Enhancement
BETA	British Equestrian Trade Association

1.0 Chapter 1: Introduction

1.1 Background

Insect bite hypersensitivity, (IBH), commonly known as sweet itch and pruritus, (any other skin complaint) in equines is a skin condition that affects over 5% of approximately 900,000 equines in the United Kingdom (Arnett, 2015). The condition affects equines between the ages of four and five, with no specific pattern or manifestation (Arnett, 2015). The condition presents itself in early spring lasting through to the winter months. However, current climate changes have exasperated the condition due to early spawning of vectors: the midge (Ceratopogonidae) and the black fly (Simuliidae) (Rendle, 2014). The saliva from the bite of the vector creates adverse reaction in the immune system of the equine. This results in an itch-scratch cycle that can cause mild to severe recurring skin deterioration in the mane, tail, ears, face and ventral midline. This has created an environment allowing no respite in the disease, and generally worsening each year, with symptoms manifesting as early as January lasting well into November (Wittmann and Baylis, 2017). This research has shown a progression of the condition in its severity and an increase of the vectors.

Once the equine is bitten the condition proceeds to undermine the immune system of the animal causing skin hypersensitivity. Swellings occur at the location of the bite and most common affected areas cover the mane, face, wither, rump and tail areas of the equine; more severe cases cover the whole body. The nature of the condition creates an itch scratch cycle once the itching begins. The areas become open and infected, causing several secondary problems in the form of hair loss, open sores, dry skin and infection (Wittmann and Baylis, 2017). Current research shows the prolific use of benzyl benzoate, a lotion to treat scabies in humans to be a popular treatment in the UK equine community for IBH and other skin complaints. Other medicines used in duality for human consumption to treat IBH are off the counter antihistamines, fly sprays and some homeopathic remedies including dandelion leaves and B 12 supplements (Moray Vet Group, 2018). This treatment approach is not a cure and acts only as a preventative measure if administered before an outbreak occurs. The most effective way to stop an outbreak is to use a protective horse blanket to cover the whole body of the animal to limit the contact of the vectors. Once a reaction has occurred, the condition can only be managed by using topical medicines, homeopathic applications and other home remedies. The annual global economic value of the equestrian sector stands at £300, billion and based on the figures from the on-line survey it shows the financial implications have a significant impact on the owners of equines with IBH and pruritus. The

annual costs of purchasing equine horse blankets to protect against IBH and pruritus are estimated at over £2.8 million in England, with an average purchase of two horse blankets per owner per horse (BETA National Equestrian Survey 2019).

Current combined research between biotechnology company Benchmark Holdings and Swiss firm Evax have identified a vaccine that suppresses the immune system, reducing the over-reaction to the bite of the midge and black fly; to be available by 2021 (Flanagan, 2016). However, a significant number of equines are reactive to needles causing partial paralysis and adverse reactions to the skin (Jones, 2016). The main causes of these reactions are caused by the silicon coating of the needle. Non-silicone needles are alternatives but only after an allergic reaction has been established. The problem is a combination of reaction at the injection site and a reaction to the material in the vaccination. The most common reaction is soreness and swelling at the injection site, some equines break out in hives all over the body leading to secondary infections. These secondary problems can be minor but can also lead to severe complications that can result in death (Smith Thomas, 2017).

There are several horse blankets that protect the equine against flies on the market with a varied price range, see table 3. Equines are notorious for getting their horse blankets off because of the ferocity of the itching caused by IBH, therefore it is common for a cheaper horse blanket to be purchased as many will be needed throughout the midge season. Along with the use of a protective fly horse blanket many topical applications to ease the itch are used, there is often a cross over with medicines used for human consumption to treat the condition in equines. Current research shows extensive advancement within the medical industry for trans-dermal applications for human consumption but none yet that could provide a solution for the treatment of equines with the condition IBH or pruritus.

There has been some significant advancement in horse blanket technologies for the equestrian industry, see table 4, but none yet for the treatment of IBH or pruritus. New horse blanket technologies currently only cater to muscle and tendon performance and their rehabilitation, and improvement of organ function and blood flow. There is some advancement on horse blanket design to combat IBH and pruritus, but no medicinal applications to combat the problem. Therefore, the importance to develop a trans-dermal delivery substrate for equines to combat the condition has potential.

1.2 Rationale to the Study

Management of IBH and pruritus due to allergic reaction by the skin in the equine is challenging for all the stakeholders involved. Progression of the disease and better treatment has seen little advancement. More research into a better method to treat IBH and pruritus is important for the welfare of the animal and the disposition of the owner. The current methods of treating the condition using protective fly horse blankets, fly sprays, creams and food supplements, provide some comfort but do not manage the condition. Significant advancement within the textile industry, particularly within development of smart textiles for medical applications show scope for adapting the technology to create a new horse blanket design for equines. Development of a trans-dermal substrate to combat the condition following microencapsulation and blending technologies of textiles could provide a solution to treating the condition. There are a variety of trans-dermal approaches to textiles within the equestrian sector, current horse blankets already utilise coating technologies that allow for waterproofing and coatings of fly repellents, however, microencapsulation and blending technologies of textiles to treat IBH could be the answer into stemming the severity of the condition. This study, therefore, critically examines the viability of a smart textile delivery system to treat the condition.

In this study gaps in literature on medical textiles for animal use were identified through an understanding of the relationship between wound care in animals and in humans. New technologies in horse blanket advancement showed no development in treatment strategies for IBH. However, current literature on advancement in smart textile technology did show the advancement and depth of research within the medical industry for use in treating humans. There is prolific research on the benefits of trans-dermal medical textiles for use in human health care and decades of research on the condition of IBH in horses. This study will aim to address the gap in the literature between the two subjects and provide possible solution for the treatment of IBH.

Advancement in smart textiles and trans-dermal delivery technologies could be a potential gateway to develop a new protective equine horse blanket to treat IBH and pruritus in equines. Pruritus is a condition that affects humans and animals, this study has focused on the condition in equids, but also identifies advancements in human health as a gateway of adapting medicinal trans-dermal techniques to treat the condition. Research into the challenges resulting from the condition and evaluation of existing treatments available on the market have determined the best practice for the care of equines and highlighted new developments in smart textile techniques that could be used.

1.3 Aim of the Study

This study aims to assess existing procedures of treating IBH and pruritus and explore alternative ways of delivering medicines through a textile-based system.

1.4 Objectives of the Study

1. To critically assess current practice for the care of equines with IBH and pruritus in the UK.
2. To evaluate existing treatments available on the market for IBH and pruritus.
3. To critically review smart textiles for the potential of a new medicated horse blanket to treat IBH and pruritus.
4. To analyse the health and wellbeing of equines from stakeholders within the equestrian sector.
5. To propose alternative improved textile techniques for treating IBH and pruritus.

1.5 Chapter Breakdown

Chapter 1 gives a clear explanation of the condition of IBH and pruritus in equines and addresses the impact this condition has on the equine and how the stakeholders involved are affected in caring for animals with this condition. In chapter 2 an extensive literature review examines existing and current information on IBH and pruritus and will explore new textile technologies under research to combat the condition. Chapter 3 explains the methodology, sample frame and processes to gain information and establish data on IBH and pruritus. Following a mixed method approach, face to face interviews, questionnaire and on-line survey were conducted to provide evidence into the current practices and treatment strategies on IBH and pruritus and the impact on all the stake holders. Chapter 4 provides the results of the online questionnaire, semi-structured interviews and focus group findings. Chapter 5 discusses the findings in the context of treating pruritus and IBH and chapter 6 draws inferences from the main findings, and recommends further work directly arising from this research in chapter 7.

2.0 Chapter 2: Literature Review

2.1 Insect bite hypersensitivity IBH - pruritus

Equine insect bite hypersensitivity IBH, also commonly known as sweet itch, manifests itself as a result of ineffective Immunoglobulin E (IgE). IgE, is an antibody that is only found in mammals, a blood test measures the IgE antibodies usually found in small amounts, when found in higher amounts this is an indication that the body overreacts to allergens (Rendle, 2014). IgE in equids are antibodies produced by the immune system; when the immune system is activated (for example, when an equine is bitten by the black fly or the midge), the immune system overreacts producing a higher amount of IgE antibodies. The over production of the antibodies travels to cells that release chemicals causing an allergic reaction (Knottenbelt 2012). Therefore, in equines, the balance of IgE antibody levels play a crucial role in preventing adverse reactions from insect bites. The equines that have a compromised IgE antibody suffer from IBH (Rendle, 2014). Pruritus encompasses all other skin afflictions that can be caused by allergies to the sun, dust, feed, bedding, liver dysfunction and chemical applications in the form of fly sprays. The reaction of the immune system is the same (Rendle, 2014).

As such, this research begins to address a gap in the current literature for this condition. The study explores the existing treatment plans and protective horse blankets within the equestrian industry, and research into any new textiles and technologies. The study addresses current information on trans-dermal delivery of medicines for human consumption and identifies the gaps in the advancement for animal care.

IBH is a frustrating recurrent problem experienced by many equine owners and is one of the most common allergic reactions affecting a wide range of equine and pony breeds, however this research showed that the heavy breed horse and pony were the most effected (Knottenbelt, 2012). The hypersensitivity is caused by the over production of antibodies that are triggered by the saliva of the culicoides, biting midges and possibly other biting insects such as simulidae, black flies (Rendle, 2014), Knottenbelt, 2012). The hypersensitivity leads to self-inflicted trauma that can result in alopecia, bleeding and crusting of the skin (Rijt, 2008). Chronically affected animals can also develop plica, fold in the skin, at the base of the mane and tail due to intradermal oedema as seen in figure 1 (Marti et al, 1992).

Figure: 1 Image of sever IBH with lichenification of the skin causing plica folds on the tail

(Horse and Hound (B) (2018) 30-05-2019

Figures 2 to 4 are images taken from the same equine at the beginning of a pruritic outbreak. Figure 2 is the subject at the end of April after exposure to the sun and shows the condition at the height of infection. Figure 3 is the subject after wintering out in a sheltered field and Figure 4 is after six days exposer to the sun. There are two conditions that cause equine skin to have an outbreak of this kind. The diagnosis in this case was an underlying problem with liver dysfunction causing photosensitive pigments to accumulate in the body. This affects usually the facial areas of the equine and the lower legs. This case is a very severe outbreak that has affected all the equines legs almost their entire length. The condition is aggravated due to persistent fly bites causing secondary infection, crusting, scabbing and open soars. The potential for a medicated bandage to treat and protect this equine fall under the same solution as a medicated protective horse blanket that protects against fly bites. Another reason for this condition is due to over sensitivity to sun exposure called photosensitivity; this occurs from a chemical reaction within the body and from external materials and causes the skin to become more sensitive to UV light. Equines with white markings on their bodies such as piebald and skewbald horses are more susceptible to UV skin dermatitis caused by the sun and can be protected with sunscreen, fly sprays, rug protection and night turnout. However, as seen in figure 2 the subject has affected areas on the legs thus making it difficult to have any form of horse blanket protection and did not respond well to fly spray protection which also caused an outbreak of blistering (Conley and Koontz, 2019).

Figure 2. Equine hind legs affected with severe pruritus causing alopicia. April 2018

(Author own image, 2018)

Figure 3. The same subject after the winter showing regrowth of hair and healing of the legions. April 1st 2019. (Author own image, 2019)

Figure 4. The same subject April 7th 2019, after six days exposer to the sun. (Author own image,2019)

2.1.1 Culicoides – An Overview

IBH presents itself in early spring lasting through to the winter months. However, current climate changes have exacerbated the condition due to early spawning of the vectors. The Culicoides midge as seen in figure 5 is most active at sunrise less so at dusk and found in hot and humid conditions (Rendle, 2014). Following a study by Rijt et al (2008), it was confirmed that the most common species of culicoides attracted to horses was identified as C. obsletus as seen in figure 5 (Rijt et al 2008). The greatest number of midges are found to be present where grazing is bordered by high hedging, wet land and wooded areas, water troughs and stagnant water ponds are prime areas for breeding (Rendle, 2014), (Carpenter, et al, 2008).

Figure 5. Culicoides Species (Rijt et al., 2008)

Culicoides find their prey by sight, in addition, the larvae can survive severe frosts, but they do not survive prolonged drought conditions (Wittmann and Baylis, 2017). The adult female midge is responsible for IBH, and they can be found in damp herbage, soil and decaying vegetation, and are most active at twilight (Rendle, 2014). The male vector is a nectar feeder, whereas the female needs a blood meal to mature her eggs (Carpenter et al., 2008). The hypersensitivity is caused by the allergens contained in the saliva of the flies, these bites invoke predominantly type 1 hypersensitivity (within six hours of the bite) creating a reaction in the immune system of the animal which in turn causes a cycle that to date has eluded a cure and effective treatment (Wagner, 2016) (Hellberg et al., 2009). All breeds and genders of equine are susceptible to the disease with most outbreaks of sores and lesions occurring between the ages of one and five. Once infected it is a lifelong condition for the equine as there is no cure, and the condition poses a real welfare concern due to the suffering it causes (Pilsworth and Knottenbelt, 2004).

Culicoides are poor fliers, making them less prevalent in exposed and windy areas with well-draining soil, and conversely a greater number are present where grazing is bordered with high hedging or wooded areas. The breeding site of Culicoides is typically in standing water, and the larvae are often found there (Onmaz, 2013). Culicoides are most active around dawn and dusk and in humid conditions, making these the times when the equine will be more likely to be bitten, and when management is essential Rendle, 2014, and Hallamaa, 2009, suggested IBH to be one of the equine diseases that most commonly impairs the quality of life of equines and is therefore a welfare issue with the potential to cause significant economic cost for equine owners with affected animals (Rendle, 2014) (Hallamaa, 2009).

This makes IBH a serious condition that requires continued research to establish effective prevention and treatment for the condition. Currently, a combination of physical barriers and chemical repellents have been suggested to be the most effective management strategies to control the Culicoides midge and the subsequent consequences of IBH (Rendle, 2014). Further investigation on pruritus and the causes are needed as IBH is the cause of most cases, other environmental allergens such as pollen, sunlight, barn dust, grass allergies are the causes of other pruritic problems for the equine (White, 2015). There is currently no cure for either condition (Schaffartzik, et al., 2012).

2.1.2 Symptoms of IBH and pruritus

The sores and lesions from IBH and pruritus come in different forms but are all equally debilitating. They range from dry, broken, thickening skin on the head, ears, wither, mane, rump and tail area, to all-over body swellings that can burst to form infected open sores, As seen in figures 6, this image shows the affected area on the mane of the equine. The equine has rubbed repeatedly due to the irritation of the skin completely removing the mane hair. In more severe cases the mid-line of the belly, the back, the sides of the head, the sheath or udder and the legs may also suffer (Parkside Vets, 2018). Pruritus as seen in figure 2 can be caused by several different reasons, in this image the condition is suspected to be caused from a reaction to the sun along with allergies and is a very sever case that this equine has had from birth, the open wounds encourage fly's which amplifies the problem.

Skin reactions to allergies are also a frustrating type of itch to resolve as they are difficult to determine. Reactions to food in the equine are rare and can be investigated by feeding a hay-only diet before re-introducing individual feed stuffs gradually to check for a reaction. Contact allergies to bedding can be found by changing to a hypoallergenic material, such as hemp or paper, while inhaled allergens such as mold, pollen and dust are the most difficult to investigate. These usually require specialist veterinary expertise (Parkside Vets, 2018).

Signs of IBH include, vigorous swishing of the tail, frequent rolling and attempts to scratch on anything within reach, constant pacing and seeking of excessive mutual grooming from field companions, this is not necessarily the case with other pruritic complaints. To limit the scratching, equine owners occasionally keep their equines behind electric fencing leaving no obstacles for them to rub on. However, sufferers may scratch their mane with their hind feet and bite vigorously at their own tail, flanks and heels. The equines are known to drag themselves along the ground to scratch their belly or sit on their hindquarters and propel themselves around to scratch the top of their tail on the ground (Parkside Vets, 2018).

Figure 6. Equine wither and mane with hair rubbed to the skin. (Author own Image, 2018)

Figure 7. Whither section of equine showing abrasions on skin from excessive rubbing and puncture sites (Author's own Image, 2018)

The image shown in figure 7 shows the mane hair rubbed to the skin and the puncture sites inflicted from the bites. The image seen in figure 8 shows the beginnings of irritation on the tail, a common place on the equine suffering from sweet itch. The right side of the equine rump, or hind end shows the beginnings of bleeding caused by persistent rubbing. At this stage even when protected by a horse blanket the rubbing will continue and the condition deteriorate.

Figure 8. Broken hair on tail of equine from persistent rubbing. Small laceration to the Right of tail from rubbing in the stable against wood panels (Author's own Image, 2018).

2.1.3 Aetiology and risk factors of IBH and pruritus

IBH does not occur in Iceland due to the lack of Culicoides, however, it has been found to be present in Icelandic equines that have been imported into areas where the Culicoides midge is present. A study by (Björnsdóttir et al., 2006) discovered that over 50% of Icelandic equines imported into the European continent from Iceland developed IBH within two years or more when exposed to heavily infested Culicoides areas, however, Icelandic equines born outside of Iceland have a lower or similar frequency of IBH as other breeds in Europe. Although the genes that are linked to IBH have not been identified, some studies have found that certain breeds are more susceptible than others (Eriksson et al., 2008). Studied have shown that Swedish-born Icelandic equines have found a prevalence of IBH of 8% in the breed. Schurink et al, (2012) identified several genomic regions associated with IBH in both Shetland pony mares and Icelandic equines. Schurink et al, (2014) also found that Shetland

Ponies had a significantly higher IgE allergen reactivity against most Culicoides when compared with Icelandic equines.

The prevalence of IBH varies worldwide from 5% in the UK (Arnett, 2015) to 37.7% in shire equines in Germany (Littlewood, 1998) and 60% in Queensland, Australia (Littlewood, 1998). Different breeds of equines are more susceptible to IBH, studies show that the thinner-skinned equines such TB, (Thoroughbred) a warm-blooded animal breed mainly used for racing are susceptible to many skin afflictions, with very fine hair and a much thinner skin, making it easier to penetrate by the midge. However, all breeds can in principle be affected, with the disease described for the Quarter horse, Arabian breed, Warmbloods, Draft horse, Friesian horse, Shire horse and other pony breeds (Braverman, 1988) (Larsen et al., 1988) (Fadok and Greiner, 1990) (Anderson et al., 1993) (Littlewood, 1998) (Steinman et al., 2003) (van Grevenhof et al., 2007).

Equines that are tri coloured, skewbald's (Brown, Black and White) as seen in figure 1. Are prone to skin problems due to the white skin which is more susceptible to sunburn, summer eczema and other forms of pruritus, as are piebald's (Black and White) equines. Equine breeds with specific coat colours may have an increased prevalence of IBH. For example, Black Paint Shetland Pony mares were found to have an increased risk of IBH when compared with Bay Mares' (Brown Equine), (Grevenhof, et al., 2007). However, both (Steinman et al., 2003) and (Grevenhof et al., 2007) had previously found, through their research studies that coat colour had no significant effect on IBH incidence. Research by (Vogelnest, 2012), shows there is a higher incidence in some breeds (e.g. quarter horses, German Shire horses, ponies and Arabians), (Vogelnest, 2012).

Nevertheless, it remains to be determined whether these apparent breed differences are due to genetic factors, environmental factors or a combination of the two, and whether there are specific genes that contribute to disease susceptibility. In a Dutch study, Grevenhof et al, (2007) found that specific habitats in combination with warm, dry weather increased the prevalence of IBH. Similarly, Vychodilova et al, (2013) establish that the presence and expression of IBH can be influenced by many non-genetic factors, including the degree of exposure to insect bites, seasonal variations and climatic variations between years. Concomitant health conditions may also have an effect as Kehrli et al, (2015) investigated that occurrences of IBH were increased in equines that suffered from recurrent airway obstruction (RAO) compared to healthy individuals (Kehrli et al, 2015).

Control of IBH is difficult due to the complex interplay of both hereditary and environmental factors in its pathogenesis and its tendency to get progressively worse in succeeding years

(Peterson, 2009). Few studies published explain how to reduce the risk of IBH through selective breeding (Barbet, 2014). At present there is no evidence of a simple dominant or recessive mode of inheritance, which makes selective breeding difficult to achieve, as there is uncertainty as to what genes to selectively breed for. Furthermore, IBH could be difficult to eradicate in breeds where there is a high prevalence of IBH but only a small subsection of the population with a high degree of inbreeding. Schurink et al., (2012) suggested that increased knowledge of the genes associated with IBH will contribute to our understanding of its biology, enabling more efficient therapy, prevention and selection to decrease IBH prevalence.

2.1.4 Existing treatments for IBH and pruritus

Current approaches to treating IBH vary, veterinary treatment is usually called upon when the condition has progressed to a point where treatment is needed using prescribed medicines. The homeopathic veterinary approach is based on a combination of natural ingredients but is considered ambiguous by conventional vets, as homeopathic remedies can be based on animal products and minerals; the central belief system of homeopathy is that substances get more powerful the more diluted they are; this hypothesis is considered a placebo by conventional vets and not effective (The Royal College of Veterinary Science, 2018). Often stakeholders do their own research and develop their own treatment, these vary from adapting existing prescribed medicines and mixing them or by using medicines that are prescribed for human consumption. Some of these approaches involve medication used in both human and veterinary medicine.

The Royal College of Veterinary Science (RCVS, 2018), states that where there is no suitable authorised veterinary medicinal product available, medicines for human consumption can be used as an alternative to treat animals (RCVS, 2018). Veterinary approach to treatments relies on steroids and cortisones, however, these persistent methods can cause severe side effects and secondary issues such as liver and kidney problems and laminitis. Vets only rely on corticosteroids as a last resort because of the risk of setting off laminitis (Clark, 2018). Laminitis is a secondary condition brought on by IBH and is a painful and potentially crippling disease that can be fatal to equines. The condition causes changes in the blood supply to the hoof and disruption to the interconnecting support tissues within the hoof; resulting in rotation of the pedal bone. Rotation of the pedal bone if severe enough is irreversible and can result in euthanasia (Eustace, 1990).

Steroids, or more specifically glucocorticoids (GCs), have been widely used in equine veterinary medicine for the treatment of non-infectious inflammatory conditions ranging

from respiratory problems, osteoarthritis of high and low motion joints and skin conditions (Marsella, 2013). Topical therapy, systemic glucocorticoid and antihistamines are all available for IBH prevention, but only work as preventive before the beginning of the allergy risk season, and with limited therapeutic success (Marsella, 2013). Fear of laminitis induction over recent years has resulted in administration of lower doses, or alternative medications being sought by some veterinarians (Cornelisse and Robinson, 2013).

One of the most common effective human medicines used to treat IBH and pruritus is Benzyl Benzoate; the lotion is used to treat scabies in humans (Horse & Hound, 2018). Benzyl Benzoate and disulfiram-based lotion is the treatment of choice in Sweden for scabies and for IBH (Jonsson 2019). Other leading products such as 'Stinky Stuff' is a relatively new treatment for sweet itch manufactured by a UK based company under the name Stinky Stuff (Axe, 2018). The main ingredient is a substance call 'Neem'. Neem oil is a naturally occurring pesticide found in seeds from the neem tree. It is a medicinal plant found in South Asia and is renowned for its unique characteristics; a bitter tasting garlic sulphur, to prevent insects breading and is used as an insecticide. When mixed with a carrier oil such as lavender oil, used for its healing qualities of antiseptic and anti-inflammatory properties, provides a good solution to midge control for equines (Axe, 2018). The treatment claims to have anti-bacterial, anti-fungal, anti-parasitic, qualities using only natural ingredients. It reports to soothe skin, repel insects and have minor wound healing capabilities, with good reviews.

By using a combination of human and animal treatments for IBH and pruritus there is a possibility in new treatment developement. Often existing treatments are modified to stem the severity of IBH, which often worsens over years of exposure. The main and best preventative treatment for IBH and pruritus has always been in the form of a protective horse blanket. To combine existing medicines with development of a new smart textile and design of horse blanket could be the answer to provide a robust treatment of the disease (Schurink et al., 2012).

2.1.5 Chemical repellents IBH

There are a multitude of chemical repellents and insecticides on the market for midge control, that either reduce the biting rate or reduces the Culicoides population size (Robin et al., 2014). There is a significant variation in the effectiveness of repellents and insecticides on the market and this has been proven by the World Health Organisation (WHO) that Pyrethroid-based insect powder, currently licensed and commercially available in Great Britain, has been found to have 100% fatality rate in exposed midge Culicoides up to two weeks post-treatment (Baker, et al., 2015). These results suggest it could be beneficial to

coat equine horse blankets with the chemical repellent, and to create a mesh guard around the stable. Although this may be an effective solution for bite prevention, it would prove to be extremely time consuming for the owner (Marsella 2013). Benzel Benzoate is one of the most commonly use treatment for IBH. It is a medication and insect repellent used to treat scabies and lice in humans and is applied to the skin in lotion form (World Health Organisation, 2009). Although unclear as to how it works in animals and is also toxic to cats, as a treatment for equines suffering from IBH it has great success (Horse and Hound (E) 2019). See table 3 bellow for the top chemicals used in the treatment of IBH or for midge control.

CHEMICAL	USE	EQUINE
Benzyl Benzoate	Treatment for scabies	Equine/Midge Repellent
Picaridin	Midge Control	Not for Equine Use
Deet	Human/Fly Repellent	Equine/Midge Repellent
Neem	Human/Fly Repellent	Equine/Midge Repellent
Citronella	Fly Repellent	Equine/Midge Repellent
Pyrethroid	Midge Control	Equine/Midge Repellent

Table 1. Chemical repellents their use and adaptions to equine use.

(Horse and Hound (E)2019)

2.1.6 Food supplements for the control of IBH

Food supplements are considered an alternative treatment to combat IBH and pruritus. Several supplements are available on the market, but there are conflicting results regarding the success. A study by O'Neill et al, (2002) suggests that fatty acid supplementation could combat IBH and pruritus and has shown variable levels of success. However, Friberg and Logas, (1999), conducted a double-blind crossover study with linseed oil supplementation, which showed no effect on the level of IBH or pruritus observed between the group supplemented and the controls. Nonetheless, the small sample size of the study group may not reflect the effects of linseed oil supplementation as to combat IBH on a larger scale

because of the diversity of breed types and locations of the sample participants (Logas, 1999).

Food supplements are used prolifically by stake holders to try to repel the midge and lessen the reaction to the bite. Garlic is a very common supplement added to food and is believed to change the smell of the sweat and the odour of the blood that the midge finds offensive. Turmeric is another very popular supplement used for human's consumption as well equines and has been used in ancient Indian and Chinese medicines. The turmeric compound is found to have powerful anti-inflammatory effects and is useful in alleviating skin conditions. Global Herbs a specialist in equine supplements has been using turmeric in its products for many years and add it to feed as well as an independent supplement. There are many food supplements used with varying degrees of success (Horse and Hound (C) 2017).

Turmeric	Human	Equine
Flaxseed	Human	Equine
Aloeride	Human Aloe-Vera	Equine
Camrosa	Nil	Equine
Naf-D	Nil	Equine
Herbs/Fatty Acids	Nil	Equine
Garlic	Human	Equine

Table 2. Feed Supplements to Combat IBH (Horse and Hound (C) 2017)

2.1.7 Vaccinations for the treatment of IBH and pruritus

Current investigation undertaken by Benchmark Holdings, a company specializing in agriculture and animal health, is working with a Swiss equine biotech firm Evax AG, on developing a vaccine that may be available by 2021. The vaccine uses technologies used in human medicines that mimic the virus (Jones, 2017) The vaccine targets interleukin 5 (IL-5), a substance produced by the equine's immune system.IL-5 is the master-regulator of white blood cells called eosinophils. Antonia Fettelschoss-Gabriel, PhD, of the University Hospital Zurich states, 'eosinophils are well known to play a role in allergic reactions. These cells contain large granules with toxic enzymes that, once released, are capable of causing massive tissue destruction.' (Barakat., Mccluskey 2018, online), (Albert., et al, 2018). The vaccine has the potential to eliminate the need for continuous husbandry and treatments, alleviating the continued interruption and financial burden IBH cause's (Jones, 2017).

A vaccine is not appropriate for all equines affected by IBH. Allergic reactions caused by the vaccination itself are an issue with some equines causing symptoms of partial paralysis and adverse reactions to the skin (Jones, 2016). The main cause of these reactions is the silicon coating of the needle. Non-silicone needles can be used but only after an allergic reaction has been established. The problem is a combination of reaction at the injection site and a reaction to the material in the vaccination. The most common reaction is soreness and swelling at the injection site, some equines break out in hives all over the body, leading to secondary infections.

A main problem of treating IBH with invasive needle treatment is the allergic reaction to the silicone in the needle which can cause paralysis usually in the neck, (normal injection site) making it impossible for the equine to bend to eat or drink (Jones, 2016). These secondary problems can be minor but can also lead to severe complications that may result in death (Smith and Thomas, 2017). Research undertaken by Marsella (2013), recommends immunotherapy as a treatment option over the longer term, however Wilson et al, (2001) found that the wide range of proteins and varying antibody patterns and reactivity to IBH from equine to equine would mean treatment would have to be tailored on an individual basis. This requires immunotherapy to be tailored to each individual case. Therefore, on a commercially affordable and practical level, this approach would not be viable (Wilson et al., 2001).

Potential new therapeutic approaches to manage IBH have also been explored. Anti-IgE therapy, a treatment for allergic conditions has been shown to have some success in the treatment of human atopic eczema and may be beneficial for IBH (Heratizadeh and Werfel, 2016). Furthermore, Jonsdottir et al. (2016) found that by administering small amounts of pure Culicoides allergens 'cintralymphatic' can induce a high immune response which could provide a positive approach to immunotherapy treatments for IBH. However, future trials are required to determine if this is an appropriate and effective management strategy (Jonsdottir et al., 2016).

There has been advancement To treat IBH and pruritus in the last decade A new product was introduced in 2009 called Cavalesse containing the active ingredient Nicotinamide, a type of vitamin B3, which helps reduce skin inflammation by decreasing the production of histamine from the immune system; a trigger factor responsible for causing itchy skin (Corner House Vets, 2017). It is not a cure but can be a very useful aid in the management of this condition, in both active cases and when given before the season starts (Corner House

Vets, 2017). Further trials into protective horse blankets utilizing microencapsulation and trans-dermal applications are also being explored as a solution to treat IBH and pruritus.

2.1.8 Existing protective equine horse blankets

Many products are available on the market for the management of IBH, including a wide selection of protective horse blankets. A variation of textiles is currently used for protective horse blankets and in most cases, have a sprayed coating of fly repellent. The life span of these horse blankets is limited due to the elements they are exposed to, the effectiveness of each treatment approach has been questioned about any advancement and vary in price and quality, see figure 9 (Baker et al., 2015). There are many protective horse blankets on the market to prevent the attack of the midge and the black fly. These horse blankets vary in price, durability and functionality. Textiles differ from Lycra that stretches to snuggly fit the body to the more commonly used polyester breathable mesh style horse blanket. Theses horse blankets do not have any fly repellent on them and are machine washable. Most of the current fly horse blankets do not have any type of medicinal properties in them, some have a sprayed-on fly repellent and insect control, none have an anti-itch feature.

Figure 9. IBH protective horse blanket made from stretch Lycra.
(Author's own Image, 2019).

The image seen in figure 9 is a common example of a protective horse blanket, the horse blanket in this image is breathable but not waterproof and can be very hot for the equine in the summer months. This horse blanket has no medicinal properties and cannot be used to treat IBH. It is a very outdated and impractical method of protection but is the only product available. Following research in the trans-dermal delivery of medicines, the advantages over

traditional routes of protection and treatment for equines suffering from IBH and pruritus have potential and many benefits. Apart from potentially resolving the problem this method of treatment delivery would cut down on medical waste and allow for direct application to the wounded area (Prausnitz and Langer, 2008).

However, there are limitations to transdermal delivery, the processes within the equine industry are in their infancy with limited delivery systems in horse blankets. The process of transdermal delivery systems for human consumption have changed dramatically in the last decade and have more than tripled; new combinations of medicinal delivery systems are being produced every 7.5 months, with more than one billion patches manufactured each year (Prausnitz and Langer, 2008). With advancement such as this it is credible that a suitable alternative in protective and treatment blankets could be made available for the equestrian industry (Prausnitz and Langer, 2008)

	BR Classic Fly Horse blanket	Breathable polyester mesh fabric	£59.95
	Shires Sweet Itch Combo Fly Horse blanket	Lightweight and breathable	£71.99
	Horseware Rambo Vamoose Sweet Itch fly horse blanket	Shower Proof and Hard Wearing. Colour Combinations	£144.95
	Bridleway Sweet Itch Bug Stoppa Horse blanket	Hard-wearing and Breathable	£69.95

Table 3 Current IBH protective horse blankets

The above table shows the most purchased IBH protective rugs and their prices

Horse and Hound (A) 20

2.1.9 New textile technologies in equine horse blankets

Current research of existing protective horse blankets shows no advancement for a complete and effective treatment to combat IBH or pruritus. Existing horse blankets still utilise the same methods of textile and coating techniques of fly repellents and design and no advancement of integration of medicines to treat outbreaks of secondary problems caused by IBH.

Analysis of current commercial and manufacturing industries in equestrian horse blanket development, and evaluation of the progress will determine future benefits of development of a better treatment method. Investigation into current IBH protective textiles have shown huge advancement in combating IBH. All the new horse blankets on the market combine advanced technologies to existing materials. Most of the horse blankets are still made from 100% polyester, breathable and water repellent. All are advertised as lightweight and functional, using fast drying materials and are UV- resistant (Horse and Hound (D) 2019). New technologies in horse ware blankets for equines have been produced for the new 2019 season, but as yet none with medicinal capabilities to treat IBH and pruritus (Horse and Hound (D) 2019), (Kramer 2019).

Each of the new horse blankets advertised on the market for this upcoming 2019 season have new additional features as seen in table 4. The new features vary from fringes on the bottom of the equine horse blankets to repel midges and fly's, to inserts of different materials within the horse blanket for comfort to help alleviate chaffing. Back on Track products are made from a ceramic material called Welltex which contain ceramic particles fused into the fibres of the textile. This technique benefits the reduction in muscle tension and improved blood supply (Kramer 2019). There is a new study on the pattern of zebra strips and the correlation between the thickness of the stripes and how this appears to confuse the biting flies, this is further discussed in section 2.1.10 (Caro, et al. 2014)

New equine horse blankets have been developed using Nano Technologies by fusing Nano nylon filaments containing minerals within the fabric fibres (Kramer 2019). Other technologies include the Bucas Recuptex horse blanket that incorporates a steel mesh worked into the horse blanket fibre creating a magnetic field, creates blood stimulation to ease muscle aches and cell regeneration (Kramer, 2019). Cell regeneration is an important factor in IBH as recurring cell damage from excessive rubbing and scratching is an issue (Kramer, 2019). Other new technologies in equines horse blankets have incorporated silver anti-microbial technologies to reduce swelling in equines. It has also been shown to eliminate many types of bacterial and fungal micro-organisms and is considered to conduct

electricity better than any other fabric, eliminating static (Kramer, 2019). New sweet itch horse blankets have been modified with new designs, changing the shape and fit of the horse blankets. Theses horse blankets are still made from the same materials 100% breathable, water resistant rip stop polyester, some include UV protection, and some are coated in fly spray, none however have been upgraded with technologies to combat IBH (Horse and Hound (D) 2004).

Below as seen in table 4 are the newest horse blankets on the market that incorporate innovative technologies to treat certain conditions in equines. There is merit to consider commercial advancements in human healthcare and smart textile applications as a way forward in treatment for the animal sector. It is possible by combining the techniques of microencapsulation and similar technologies as a form of transdermal delivery of existing generic equine medicines or Nano Particle Coatings of medicines to develop a sample substrate. Prausnitz.and Langer, (2008), state that smart textiles and their systems have a huge potential for protection and as such are already in use for protective applications that shield from heat, chemical applications, or for horse blanket delivery. Smart textiles are very versatile and can be used in many dimensional structures, their advantage is the scale of the area that they cover (Prausnitz. and Langer., 2008).

	**Infrared Technology Equine Rug** Nano Particle Technologies Fusing Minerals with Nylon Fibres £161.95
	**Bucas Recuptex** 40% Steel Mesh Recuptex fused with 60% Polyester £162.00
	**Showmaster Fly Protection Breastplate** Tasselled Front Breast Plate 100% Polyester, Elasticated £21.90
	**Thermo Master Full Neck Falina Zebra Fly Rug** 100% Polyester UV Protection and Breathable with Zebra Stripes £94.90
	**FAL Silver Interactive Rugs** X- Static Anti-Microbial Textile Fused with Pure Silver £49.00
	**Amigo Vamoose Fly Rug** Colour Combination Technology £149.50

Table 4. new innovative smart textile equine rugs (Horse and Hound (D) 2019)

(Kramer 2019)

2.1.10 Smart textiles and horse blanket delivery systems

Current research undertaken by Professor Tim Caro and a team of biologist at the University of California believe it is the unusual monochrome patterns of the zebra that repel the biting flies, as seen in figure 10 (Caro et al., 2014). There has been over a century of interest in the functionality of the zebra stripe, the study conducted by Caro et al, (2014) showed that it is possible, due to the thickness and density of the zebra stripe, can lead to confusion when the biting flies tried to land. After examining all the variables of habitat and locations of other African hooved animals, it was determined that all existing explanations were ruled out except that of repelling flies. Further research is needed to determine the reason behind these findings, but research so far suggest that it could be a solution to design clothing for humans in a specific strip pattern to resemble that of the zebra to deter humans being bitten. The research explored habitat and locations all over the world and results showed that the stripes on the zebra was denser where there was more annoyance from biting flies. This discovery can contribute to a new design in equine horse blankets to help combat the number of midges and biting flies landing on them (Caro et al., 2014).

Figure 10. zebra herd

Photo Etienne Steenkamp on Unsplash (2019)

(Prausnitz. and Langer., 2008). state, ‘The last ten years have seen the emergence of new multi-disciplinary approaches to textile research. As micro-, nano-, bio- and information technologies and biomaterials have continued to evolve to new stages of maturity there is an extraordinary array of new possibilities for enhanced functionalities within textiles, from new fibre structures, composite materials and coatings at the nano and micro levels to the visible integration of wearable electronic assemblies into clothing’ (Prausnitz. and Langer., 2008).

Currently transdermal patches are used widely in hospitals as a form of horse blanket delivery to directly target the wound area. This approach if used in a protective equine blanket could provide a useful solution in targeting affect areas of IBH and pruritus. Antimicrobial textiles have attracted a great deal of interest in recent years due to their potential for reducing the transmission of infection in medical and healthcare environments. Antimicrobial properties can also improve the performance and lifespan of consumer products, and therefore, these fabrics are increasingly used in the wider textile and apparel industry (Sun, 2016). Many of the current outdoor equine horse blankets produced today have antimicrobial properties see table 4 for examples. However, new horse blanket technology has yet to incorporate microencapsulation, trans-dermal and other technologies as a way of delivering medicines with larger delivery options for example, a complete horse blanket with medicinal delivery capabilities.

Advantages of transdermal horse blanket delivery compared to other forms of horse blanket delivery for equines such as oral, intramuscular, intravenous and topical is that dermal delivery provides a controlled release of medication (Prausnitz., Langer., 2008). Medicated adhesive patches that are placed next to the skin deliver a specific dose of medication through the skin and into the bloodstream (Healthline, 2018). This technique has been found to promote healing to an injured area of the body (Healthline, 2018). It is possible to develop a porous membrane containing a reservoir of medication to be released through activation from body heat of the equine, specifically in the areas reacting to the bite of the vector. However, disadvantages to this type of transdermal delivery, is that the skin is a very effective barrier; as a result, only medications with small enough molecules can be delivered by this method (Bartels, 2011). By producing a substrate that includes barrier material for infection control, wound care material, anti-itch, breathability, flame resistant and hydrophobic properties would be ideal, although a major concern within the horse owner community is the weight of the blanket used in the summer months (Bartels, 2011). Transdermal horse blanket delivery has made an important contribution to medical practice

but has yet to fully achieve its potential as an alternative to oral delivery and hypodermic injections (Prausnitz and Langer, 2008).

In the last decade, technology has progressed at speed with transdermal techniques reaching the animal kingdom, particularly equines. This has been in the form of adhesive patches applied to wounds using the techniques of either the Rate Controlling Membrane (RCM), which consists of four layers, Backing Layer, Reservoir, RCM, and Adhesive or the Matrix system, which allows for longer-term wear, due to its hydrophilic capabilities (Ma et al, 2005). Studies undertaken by Venkatraman and Gale (1998), argue the benefits and drawbacks of these two delivery systems; both of which have only been tested on humans. The solution to this problem may lie in the design of the patch, the nature of the backing materials and that of the adhesive, it may prove difficult to apply this to an equine. However, if technology can lengthen the wear period of a trans-dermal patch design and provide an optimum coverage area, it may be possible to adapt the technology for horse wear. (Venkatraman and Gale, 1998). A successful transition in development of new horse blanket treatment to be used with the capabilities of transdermal delivery must be pharmaceutically equivalent to the standard used for human consumption; and must be administered in the same manner; in this case through the skin (Koegler and Cowley 2005)

One of the main drawbacks to TDDS for equines will be the horse blanket combination and the area of the body to be covered. In this case several awkward areas on the equine; the durability of the TDDS will be dependent on the wear and tear and in this instance, persistent rubbing and rolling could prove a problem. If there is no consistent and uniformed adhesion between the TDDS and the skin, this will result in varying degrees of delivery and effectiveness (Koegler and Cowley 2005). However, new textile technologies approaches of TDDS for equines has become recognised as a viable option within the industry. Further research into textiles with the capabilities to deliver a TDDS in a wearable form is needed.

2.1.11 Microencapsulation

Microencapsulation is a process in which small molecules, called monomers, combine chemically to produce a very large chainlike or network molecule, called a polymer. At least 100 monomer molecules must be combined to make a product that has certain unique physical properties. The formation of stable covalent chemical bonds between the monomers sets polymerization apart from other processes, such as crystallization. Usually at least 100 monomer molecules must be combined to make a product that has certain unique physical properties, such as elasticity, high tensile strength, or the ability to form fibres that differentiate polymers from substances composed of smaller and simpler molecules; often,

many thousands of monomer units are incorporated in a single molecule of a polymer (Nelson, 2002).

Microencapsulation is used in many fields; and the process has attracted much attention for delivering and target-carrying in food and medicines, with considerable interest for controlled horse blanket delivery systems. The different approaches to encapsulation include polymer bonding. This process takes a natural ingredient such as seaweed, which is considered one of nature's power plants because of its tremendous healing properties and is fused or bonded with a textile using the encapsulation process which captures or encases the medicinal properties within the textile. More natural plant-based options are being explored due to their existing medicinal capabilities over manufactured chemical options (Janarthanan and Kumar 2017)

Further research into antimicrobial textiles have also attracted a great deal of interest in recent years due to their potential for reducing the transmission of infection in medical and healthcare environments. 'Antimicrobial properties can also improve the performance and lifespan of consumer products, and so these fabrics are increasingly finding applications in the wider textile and apparel industry' (Janarthanan and Kumar, 2017 :201). Other possibilities following research by (Zhang and Jin, 2001) recently developed fibres using the shells of crustaceans, and have produced a product called "Tencel C," a lyocell fibre, which is a polysaccharide used in cosmetics and renowned for its anti-itch, active cell regeneration, and antibacterial action (Janarthanan and Kumar, 2017. :200). Along with the possibilities of this application being developed into a form of horse blankets for equine use, this process is an alternative to synthetic uses of encapsulating medicines to treat, therefore an environmentally friendly alternative (Zhang and Jin, 2001).

2.1.12 Advanced textile research

Smart textiles for protection provide a wide range of capabilities and have been developed to sense and react to environmental conditions. Their integration into protective clothing has led to the development of products with greatly enhanced protective capabilities. The cross over into protective wear for equines needs exploring but is completely possible (Prausnitz and Langer, 2008). The requirements for a textile to facilitate treating IBH would base its structure upon traditional wound care materials and various types of gauze, nonwoven materials, laminated materials with perforated plastic films and possible new mixtures of polyester and silks textiles (Prausnitz and Langer, 2008).

Existing protective equine horse blankets are still the most relevant and current forms of IBH and pruritus management and include a wide selection and range of cost and quality. These blankets are made from polyester material usually with a honeycomb design and normally with only a spray coating of a fly repellent. The life span of these horse blankets is limited due to the elements they are exposed to and once rained on repeatedly lose their waterproof coating their durability and protective elements. The textiles of these horse blanket differ from lycra which stretches snuggly to fill the body of the horse and although can be heavy when wet but are breathable.

There is a selection of new horse blankets on the market for 2019 with technological capabilities and features varying from fringes to deter flies and midges, to manipulations and mixing different materials within horse blankets for other uses (Kramer 2019). A new textile, welltex, contains ceramic particles fused into the fibres of the textile are leading the way with benefits for equine health, however, this new technology only benefits the reduction in muscle tension and improved blood supply (Kramer 2019). Further study on the pattern of zebra stripes show a correlation between the thickness of the stripes and how this may appear to deter biting insects. Most of the current horse blankets on the market are made from polyester, however, as seen in table 4 new textiles have been explored for delivery of other treatments. New research has shown an advancement in combining other materials and technologies such as nylon nano particle fusing techniques and anti-microbial textiles using pure elements of silver to create midge deterrents (Kramer 2019). There has also been advancement in design of the protective horse blanket with current research showing colour combination technologies to try and deter midges from landing on the equine. (Horse and Hound (D) 2019).

There is significant research showing current commercial advancement of medical textiles within the equestrian industry that address several problems as discussed above. However,

there is no current research showing these technologies to address a medically relevant protective horse blanket to combat IBH. The advancements address tendon problems blood flow and muscle problems. There are numerous magnetic blankets to stimulate blood flow and to strengthen tendons using Nanotechnology fusing nylon filaments that contain minerals within the fabric of fibres.

Cell regeneration for equine's afflicted with the condition IBH is an important factor in a new design for horse blanket the durability and waterproof elements are also a factor. A company called Atex Technologies that provide best performance in medicine delivery is at the cutting edge of new developments for medical textiles. However, this is for human consumption and not the animals, more specifically the equine sphere. Research done by Atex highlight that a slight change in material can present new possibilities for the treatment of wounds. Further research following these technologies and looking at existing materials that horse blankets are made from such as neoprene which is 100% polyester or stretch lycra consisting of nylon and spandex and also forms of crepe which is spun polyester could provide a solution to adaptation to develop a new textile (Atex technologies 2019)

By manipulating small changes within these existing textiles, current research has not explored for the possibility of an IBH protective horse blanket, the slight differences in the materials and medical structures could change the clinical results and provide a better performance horse blanket (Atex technologies 2019). Multiplexed Laser Surface Enhancement (MLSE) technologies enables a revolutionary breakthrough that performs a system of using synthesis technology that develops a functional form of converting enhanced hydrophilicity, hydrophobicity, fire retardancy and antimicrobial functionalities without the use of harmful chemicals treatments for textile applications is to be considered as a possibility for further research. This process using gas and plasma beam technologies change the molecular make up of textile allowing for medicines to be administered within the textile. Samples would need to be developed and tested under laboratory conditions to determine suitability (Textile centre of excellence 2019)

Research conducted by Prausnitz and Langer, (2008). discusses the Systex project, a European project that has accomplished the enhancement of smart textile development. The key area being protection. The research explores textile and material structures that sense and react to environmental conditions and stimuli. This research would be relevant for the equestrian industry particularly IBH and could provide a solution to eliminating midges and other flying biting insects landing on the equine before the bite (Prausnitz and Langer, 2008).

2.2 Chapter Summary

The main points in this literature review have explored the current situation faced by horse owners dealing with IBH and Pruritus and the current treatments available. It is recognised that conventional horse blanket delivery systems have a reputation to fail when treating equines (RCVS 2019). The usual methods of horse blanket administration in equines have their drawbacks and cannot always be effective (Ma et al., 2005). Research shows that controlled horse blanket delivery achieves prolonged horse blanket release and site-specific delivery, and polymeric micro-/nanoparticulate and transdermal horse blanket delivery systems have great promise **(**Ma et al., 2005). It is acknowledged that there are still obstacles to overcome in terms of production and textile delivery systems. The methods and materials to develop a suitable protective horse blanket must follow the principles of existing technologies such as microencapsulation, polymerisation and bonding.

Existing technologies are finding their way into the equine world, with new developments to help promote organ and blood flow function, tendon regulation, and some antimicrobial components in horse blankets to help eliminate bacteria and infections. It is clear however that there has been little advancement in a treatment process for the condition IBH and pruritus. The main key points for the management of IBH are control of the itch to prevent self-trauma; the resolution of secondary infections and the prevention of additional midge bites (Baker et al., 2015; Marsella 2013). The management and treatment of IBH is a challenging one and all available approaches to IBH control have their limitations and show that all aspects of treatment will need to be tailored to the individual situation and will involve significant adaptation.

It is evident from current literature that there is no predominant or consistent course of successful treatment for IBH or pruritus Therefore, to provide a horse blanket to cover the body of the equine, which is the most effective form of protection from the vectors, with medicinal qualities to treat, soothe and prohibit secondary conditions has great potential as a new form of treatment. Many approaches to deal with IBH have been explored: treatment from vet practitioners, administration of topical creams, steroids, and antibiotics; home remedies, and homeopathic alternatives. However, exploration into adapting trans-dermal smart textile options for treatment of IBH in equines is in its infancy and this research will contribute to our understanding of host-parasite interactions and further development of transdermal applications and micro-encapsulation technology.

3.0 Chapter 3: Methodology

3.1 Introduction

Focus on the current situation faced by all equine stakeholders experiencing IBH and pruritus, this research followed interpretivism philosophy, Through the social constructions and relationships within the equine field much of the approach to dealing with the condition was represented by persuasion of peers in the field and criticism of current practice. Often a shared opinion was followed about a treatment approach. The many factors surrounding the condition and treatment strategies were open to persuasion depending on the social environment the equines were kept in and as to which treatment practice to follow. Observation of the participants that were interviewed showed a pragmatic view and approach to any course of action taken, but also displayed the possibilities of being easily persuaded to follow a different pattern. This could be explained by the deep frustration of no advancement in treatment and hoping for the ideal solution.

Mixed method research critically evaluated existing studies to establish a baseline for current analysis of the problems relating to IBH and pruritus and how the condition is affecting the equestrian industry today. Information established from the literature review, pilot study and semi structured interviews provided the foundation to develop the questions for the questionnaire. The sample frame included the Horse and Hound forum, an established and recognised focus group with experience about IBH and pruritus and was the forum for the pilot study. The online questionnaire developed from the pilot study showed more depth to the questions about IBH and pruritus. Participation from equine professionals, horse owners and equine practitioners in the format of face to face semi structured interviews provided a relevant data base of resources for the research. The pilot study provided information to identify relevant themes to be addressed to gain a thorough understanding of the problem (Ishtiaq, M. 2014) (Creswell, 1994).

Identification of relevant questions were used in development of a pilot questionnaire and provided information to create an appropriate online survey to explore the current practices for the treatment of IBH and pruritus in the UK. The survey highlighted an understanding of all affected parties in the industry and included analysis of existing treatments and observations of the condition in its current state and the progression from initial trigger point to varying degrees of deterioration. Discussions with equine owners, national organisations, veterinary professionals; plus, photographic evidence of the health, wellbeing and behaviours of affected animals demonstrated the emotional and financial impact on owners

and their equines. The face to face Interview's, existing data base analysis, questionnaire and photos determined an up-to-date record of the treatments and problems associated with the condition. Collaboration with equine practitioner ensured all ethical standards were met about involvement with affected animals. Analysis of current commercial and manufacturing industries in equestrian horse blanket development, and evaluation of the progression for new medical textile horse blankets will determine the future benefits in development of a better treatment method.

3.1.1 Research Philosophy

The methodology of this study followed a multiple philosophical approach, following pragmatism, and interpretivism; There was a wide range of factors to be considered involving opinions of stake holders. Numerical data served as factual balance allowing for a purpose of finding new paradigms. Understanding pragmatic philosophy design recognises the many ways of interpreting the information and photographic material gathered in this study, no one view of the participant can give the whole picture to the problems faced by IBH or pruritus, and often the varying degrees of severity of the condition were interpreted very differently with concern to treatment strategies. Following this approach, it was evident that although the condition of IBH and pruritus have at the very least stayed the same, so has the treatment strategies (Sanders, et al., 2012)

3.1.2 Questionnaire Themes

The questionnaire themes were designed on a broad spectrum of information researched from the literature review and current practices in the treatment of IBH and pruritus. The pilot study provided the baseline of the questionnaire with the themes broken down into key areas. This process showed a continuous and repetitive problem or concern for the horse owner or equestrian practitioner. The themes were as follows.

1. Information on existing protective horse blankets.

2. The condition of the equines captured through photographic evidence.

3. Detailed research into the existing treatments used to combat IBH.

4. Environmental elements and conditions the equines were kept in.

5. The emotional and financial impact on the participants.

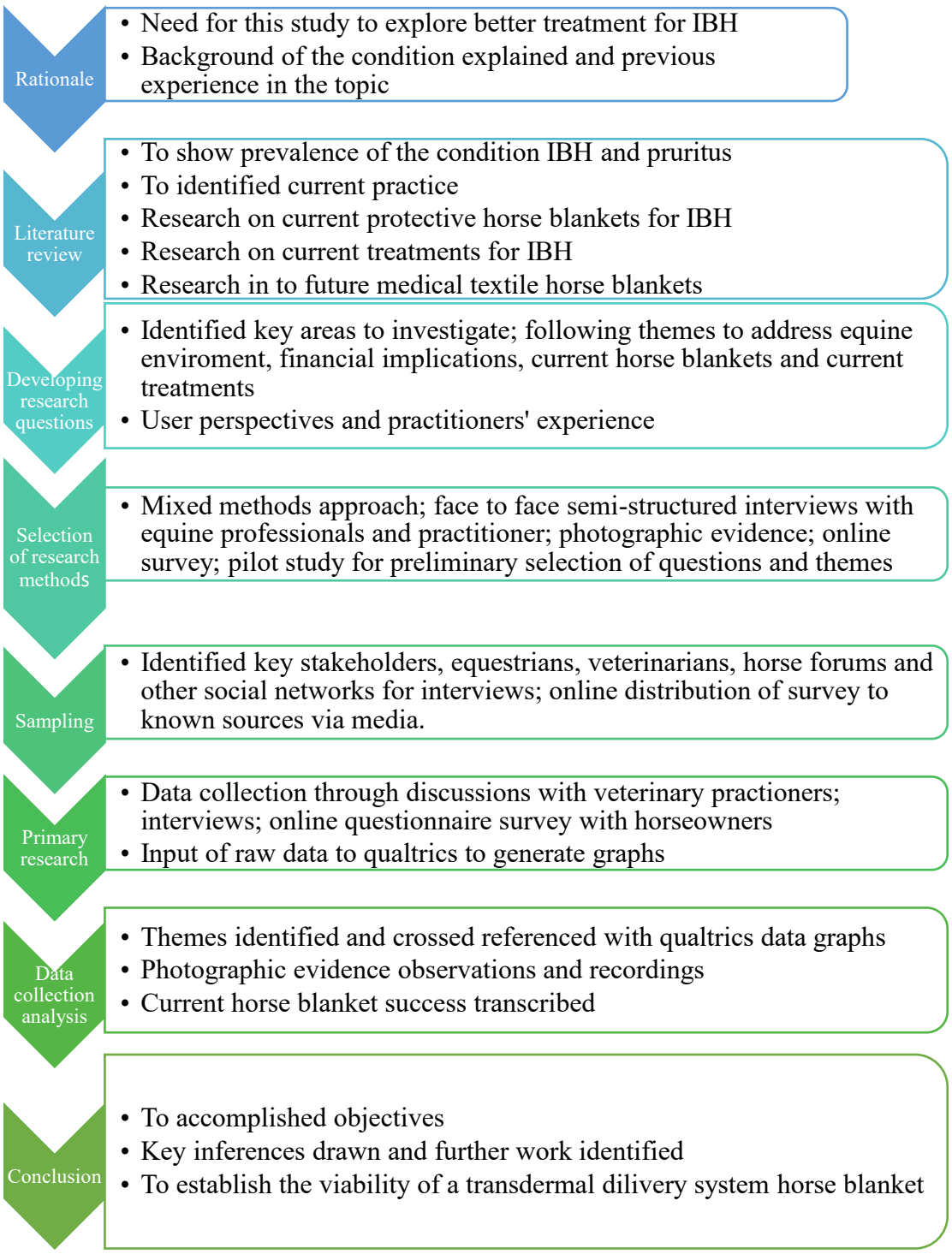

Table 5 Methodology structure

3.1.3 Qualitative methodology-interviews

Following the principles of qualitative methods, numerical data was gathered using semi-structured interviews, allowing for a diverse approach to gauge the emotions of the stake holders. The identification of the interview participants was kept as pseudonyms as Interviewee 1 through Interviewee 7, these participants were not totally anonymous as their age, gender and some information on their equines is discussed within the research. The relevance to this was important as the chosen participants varied on their levels of equine ownership, age, experience and professional status. This wide spectrum of knowledge and the data collected from these participants adds significant weight to this research, and without some identification of the interview participants a clear understanding of the problem would not be recognised. This was agreed upon within the consent forms and agreement was made that in the event of withdrawing from the research all prior information would be kept (Ishtiaq, M. 2014) (Creswell, 1994).

Observations from the interviewees gave an indebt overview to the condition of IBH and pruritus. The experiences of the interviewees realised the emotional impact of the condition that quantitative methods do not measure. Each response was unique to the individual and obtained through open-ended questions. Qualitative analysis followed a social element to the research which was necessary to understand all the variables of the problems with the condition and the impact it has on all the stakeholders. This line of research provided information and understanding that numerical data could not provide.

A target audience of equine owners answered a list of open-ended questions to build a picture of the relationship between the disease and their effects on the equines. The list of questions can be found in Appendix 3. A list of questions was devised prior to the interviews. Questions were added to the list throughout the process as new topics arose. All the questions were agreed to by the interviewees. A list of topic areas was discussed and agreed upon between the researcher and the participant to ensure enough information was gained to achieve the main aims of the study.

3.1.4 Interview structure

Questions for the interviews were broken down into five broad areas. First, owners were asked to assess the current state of their equines' condition; they were asked if the condition had worsened since purchase and if they were aware that their equine had the condition before purchase. They were asked to describe the signs of IBH and pruritus and any observations of the times the condition seemed to aggravate their equine more. The

interviewees were asked questions over a period of five months; at the Hight of the equines condition, and twice after, following the course of the condition at the end of the cycle and at the beginning of the cycle in the new 2019 season, which according to the interviewees started in January 2019 and never showed any significance of respite.

Secondly, Owners were asked about the environment their equine was kept in; the amount of time in the stable and the amount of time in the field, how often did the equine change field or paddock and if stabled, what type of bedding was used and how long was the equine stabled for. Owners were asked to identify how bad the midge count in their environment was and if they thought the pruritic problems were midge related or based on other allergens in the environment.

Thirdly, questions on owners' practice of treatment were asked, specifically the type of horse blankets that were used, the cost and success of their horse blanket choice. Questions on other treatments were asked and if any of the treatments were home-made, how successful these treatments were and what was the cost. Owners were asked on how many occasions did they need veterinary intervention. Owners were asked if they thought there was improvement with the uses of treatments and with the use of the protective horse blankets. Type of horse blanket was determined, and time spent in the horse blankets, if the horse blankets were laundered and the frequency of laundering. Owners were asked if the horse blankets they were using had any fly repellent coatings or types of treatments in the horse blankets to combat IBH; and if they thought the horse blankets were still functional after launder or use after a one-month period. Owners answered questions on what changes they would like to see in treatment and in horse blanket design.

Fourth, Owners were asked what the emotional impact on their life was after caring for an equine with IBH or Pruritus.

Fifth, Owners were asked to summarise the annual financial impact on treatment cost and horse blanket cost.

The seven interviews were conducted by the researcher to maintain consistency and a semi-structured approach was followed to allow for spontaneous conversational flow. The list of questions followed an unstructured design to ensure all the relevant areas were covered, see Appendix 2 for question and interview list. The interviews took approximately 40 minutes, and included the background information on the participant, their experience with equines, time as an equine owner, and their experience and opinions on the topic of IBH. The interview questions put forward to the veterinarian were of a more structured and detailed

nature to obtain a medical opinion on the condition and a professional objective on what is needed to combat IBH.

Each of the interviews were held at the equine facility of the participant. Before the interviews took place, inspection of the equines and their condition were recorded photographically. Treatments were recorded within the interview and photographic evidence of materials and horse blankets used to protect the equine were taken. In all cases, each participant used a protective horse blanket of similar expense. Using semi-structured interviews, an understanding of the participants was gained. Each participant was asked the same questions and a detailed response was required. The interviews were recorded orally, time was taken to write down the responses and at the end of the interviews the participant read back the notes and added or deleted any information that had been taken.

The text of the interviews contained the speech of both the researcher and the participant, and all critical phrases and answers were recorded. Each participant agreed for their equine to be photographed, this was carried out by the researcher. Each photograph was taken using the camera of an iPhone and then formatted to show only the affected areas of the equine. All interviews can be found in Appendix 2 (Horseman et al, 2017).

3.1.5 Quantitative methodology

A list of twenty-five questions was presented to the participants on the online survey. These questions can be found in appendix 3. The questions followed the same line as in the face to face interviews. The questions put forward to the participants of the online survey included members of equine forums and social media. Whilst these participants maintain their anonymity, all are members of the equestrian profession and thus experienced in their field and qualified to answer the questions put forward to them (Ishtiaq, M. 2014) (Creswell, 1994).

3.1.6 Survey structure and design

Information was gathered by following five basic topics, One, assessment of IBH and pruritus; Two, Treatment of the condition, what methods being used and the effects and success of these methods; Three, the environment the equines are kept in and the stabling habits. Four, the success of the protective horse blankets used, the consistency with which the equines are protected by using a protective horse blanket, for example, are the equines covered over a twenty-four-hour period? What quality of horse blankets are being used? What are the cost costings of incurred; Five, emotional impact on the stakeholders regarding caring for an equine with IBH or Pruritus. A pilot study questionnaire of a broad spectrum

of questions on IBH and pruritus, were answered by 10 participants. Questions found in appendix 3. The questions covered all the elements pertaining to the subject, covering welfare of the equines, cost, environments, treatments etc. The information gathered from this was used to develop an on-line survey asking people a set of 25 questions with multiple-choice options and a comment box for extra information. The on-line survey was live for a period of two months allowing for enough time for responses. The survey was distributed using social media and several on-line horse forums. The relevance of the on-line survey will provide data that will enable comparisons between the two methodology approaches and determine any correlations between information evidenced in the literature review (Fowler, 2014).

Following objectivity and statistical measurement, the quantitative method reinforced information gathered from the face to face interviews and the questionnaire. Both methodology approaches gave merit to reinforce and support the data gathered. The purpose and benefits of following multi-based approach, i.e. survey, questionnaire, and face to face interviews will provide a record of a wider phenomenon of the current situation and the advancements in treatment. The information gathered from this research and existing information addressed in the literature review will allow for an up to date prognosis on the way forward in new textile treatment possibilities (Denzin and Lincoln, 2005).

Numerical data tests the wider theory and explains patterns in the problems associated with IBH in a mathematical language (Ishtiaq, M. 2014) (Creswell, 1994). Evaluation of research provided by numerical data, although When qualitative and quantitative data are analysed and compared, together they will show a pattern, if any, to the current state of the emotional and financial factors and the scale of IBH, and any relevant developments in its treatment. Qualitative research will also provide a wider range of the complexities of IBH that Quantitative data may not be able to provide (Denzin and Lincoln, 2005). Research shows that any qualitative research is not based on a single approach, it encompasses the human factor and its environment. In the case of establishing the current situation on IBH, the opinions of stakeholders are crucial (Denzin and Lincoln, 2005).

3.1.7 Research Sampling Frame

Research sampling frame included equestrian hobbyists, equestrian professionals and equestrian practitioners. The participants of the on-line survey were selected from an acknowledged and respected horse forum. The Horse and Hound horse forum insists on an application request before allowing any access to the forum in which any information may be gathered. All questions put to the existing members of the forum were accessed for

relevance and authenticity. This process provided a genuine interest in the subject matter allowing for honest responses and was important to gain information from participants with experience on IBH and pruritus. The face to face interview participants were selected from a well-established body of equestrians with a varying degree in experience, age and horse ownership. This approach allowed for a varied degree of information and knowledge which was important to gain a clear understanding of the condition. To see full interviews, see Appendix 2. Table 6 shows the interview participants methods of treating IBH and pruritus (Fowler, 2014).

3.1.8 Data Analysis

Relevant pieces of information will be taken from the face to face interview transcripts and coded showing similarities in the information. Concepts of underlying patterns and repeated information will be categorised into themes and labelled. Connections between the most important information from the categories will be discussed in the results section and compared to existing relevant information. A systematic approach will analyse the data collected from the on-line survey. Numerical evidence will be compared to any patterns produced from the qualitative data research and categorised to prove any hypothesis relevant to the research.

Analysis of the data provided from the on-line survey, questionnaire, and face to face interviews will provide information to base an educated perspective into development of a new textile treatment base. The data will be analysed by comparing the opinions of the data from the face to face interviews along with the questionnaire and on-line survey. Formulating the results from the information gathered, and analysis of new textile advancements will provide a baseline to produce a new smart textile deliverer system to treat IBH and pruritus.

.3.1.9 Visual observation: photographic evidence

Photographic evidence of IBH showed the severity of the condition, and pictures of existing equine horse blankets that currently treat IBH and pruritus. Evidence of equine participants show different stages of pruritus over a period of ten months, from the beginning of the outbreak, following the stages of the disease (Authors Original 2018). Photographs of specific sites of pruritus showed a timeline of the condition. This process enabled the participants to have an in-depth understanding of the complexities and challenges of the condition that they had become accustom to in their everyday dealing with IBH. Visual evidence showed the condition in real time and the location (Achterberg, 2008).

Photographs could be considered emotive; however, they show the honesty of the condition showing the progression of the condition, this is invaluable for this research and using the same interview participants allows for a time line on the condition and the treatments used and their effectiveness as this provides a wealth of information of analytical and contrast in information, that can be used effectively when determining a new method of treatment (Achterberg, 2007).

Being able to physically see the condition IBH and pruritus and follow the progress over a period gives the viewer a better understanding of the condition. Quantitative and qualitative research data are valuable; however, IBH is a condition not commonly known by the lay person and photographic evidence is critical and acts as a primary source of visual recording of research. Photographic evidence captures and gathers information that can easily be forgotten, particularly in the case of recording the stages of IBH. The photographic process will allow for analysis of the effects of IBH and a clear evaluation can be made for a different approach to treatment (Aabakken, 2008).

3.1.10 Chapter Summary

Quantitative and qualitative research methods highlighted the similarities between the all the categories addressed in the survey and in the face to face interviews. The predominant factor from the information gathered was that the current protective horse blankets had not advanced in technology to stop tearing and were not durable enough if coated with insect repellents. Stakeholder opinion on the cost of treatment including the horse blankets was also of high priority; objections in the rising cost of commercial products without any advancement on treatment was a big concern. Stakeholder opinions and attitudes determined the need for advancements in medical textiles to treat the condition. The information gained from exploring medical textiles and textiles with transdermal capabilities shows promise for further research in developing a smart textile horse blanket for treatment for IBH.

The photographic evidence of IBH and pruritus showed a reliable recording of the phenomena of the condition, and where the images of figure 2 were compared to the follow up images of the same subject, a clear observation of the speed with which the condition can take hold is given, . It will be important to gain information based on quality of information rather than quantity. As there has been no significant advancement in the treatment of IBH the quality of the detail of information will be crucial in developing a new textile with medicinal capabilities. Although quantitative data is important and will show more scientific results; the importance of individual opinions cannot be underestimated. Without understanding the processes and effects of IBH and pruritus on the stakeholders established

through their experiences and the social impact the disease has, it will be impossible to move forward and provide a new solution to the problem.

A pragmatic methodology approach highlighted emerging patterns when comparing survey results to the participant interview responses. Having face-to-face interviews had the added benefit of providing social cues such as body language that provided extra information to the verbal response (Opdenakker, 2006). Furthermore, synchronous communication was achieved with the researcher and the participant by reacting off one another and resulted in more spontaneous responses being achieved (Opdenakker, 2006). Statistical measurement of the condition was recorded following the quantitative model. Graphs diagrams breakdown the statistical data and give a clear perspective of the results, measuring all relevant questions and aspects of IBH and pruritus. Social behaviours and the emotional state of the stakeholders were also measured. Following the quantitative model, analysis of the results allowed for distance between the stakeholders and the researcher, eliminating any bias when looking for paradigms between the two.

By following a sampling frame engaging hobbyist, professional and equine practitioners a thorough and broad line of questions were developed to address the current situation on IBH. Based on the questions targeting the cost, quality and effectiveness of existing horse blankets, table 3 represents the current and most popular used protective blankets. Data collected from the online survey and semi structured interviews evidence the same use of protective blanket to combat IBH. Table 6. Shows the treatment plan followed by the participants of the online survey highlighting the horse blankets used. In figure 22 a breakdown of monies spent on protective horse blankets shows that 42% of equine owners spend £100 or less on protective horse blankets, only 4% spend over £500, and the average spend was 31% of equine owners spending between £100-£200. The most common complaint consistent with all the sources participating within the research was the lack of an effective protective horse blanket.

3.1.11 Ethical Considerations

The project was conducted in line with the MMU research governance and ethics was granted from the Research Ethics Committee – Faculty of Arts and Humanities (A&H 1718-73). All the interview participants were asked to provide their written consent for participating in the study after reviewing the participation information sheet that provides details of how the interview will be conducted. All consent forms were stored in password protected PC and data were analysed anonymously. Written permission to use the photographs of the equines showing the skin condition were also obtained.

Participant	Equine. No	Equines affected	Treatment Plan	Horse blankets Used
Participant. 1	2	1	Fly Spray, Anti Histamines	Shires Fly Sheet
Participant. 2	1	1	Fly Spray, Steroids, Feed Supplements, Benzol Benzoate, Sudocrem, Sulphur Powder, Anti Histamines	Premier Equine Fly Horse blanket
Participant. 3	Multiple	Multiple	Fly Spray, Anti Histamines, Cortisone Injections, Feed Supplements, Steroid Injections	Boett Horse blanket
Participant. 4	1	1	Fly Spray, Anti Histamines	Premier Equine Fly Horse blanket
Participant. 5	2	2	Fly Spray, Anti Histamines	Premier Equine Fly Horse blanket
Participant .6	5	3	Fly Spray, Anti Histamines	Premier Equine Fly Horse blanket
Participant.7, vet, (Multiple)	Multiple	Multiple	See Interviews Appendix 2.	

Table 6. Interview Participants treatment plan

4.0 Chapter 4: Results and Analysis

4.1 Introduction

This chapter will address the results from the on-line survey, questionnaire, and semi structured interviews and follow a sequential gathering of data collection to address any pattern formation. Within each data set of results, analysis of experiences with the condition, treatment of the condition, environmental and financial circumstances, and opinion on future treatments are presented. The data set was analysed as follows; analysis of the interviews, recording the responses to the informal line of questions and categorised accordingly following the same themes throughout. Assessment of IBH and pruritus; treatment of the condition and the horse blankets used to protect the equine; environment the equine is kept in; financial implications; time spent on management of the condition and emotional implications for the stake holders. Current and treatments, are presented along with new textile technologies in commercial horse blankets.

4.1.1 Interviewee experience of IBH and pruritus; interviews

There was a distinct difference in management knowledge, strategies and techniques used to combat IBH and pruritus between the participants. The emotional affects and time constraints appeared to have more of an impact than that of the financial implications. This section will provide the questions and responses from the face to face interviews based on the experience and knowledge of IBH and pruritus. From the responses of all the interview participants, it was established that once it was understood the equine had the condition it was not a question of selling the equine but more of a 'I can find a treatment that works'. The data collected from this study reflects that owning an equine is a lifestyle choice and its was accepted that problems would come with it. The data collected shows a correlation with the lack of effective treatments, this is evidenced here within the face to face interviews, and also a lack of understanding to the mechanics of how the equines immune system responds to a bite from a midge or black fly; and in fact, this lack of knowledge could be why the participants of this study always left it too late before applying a protective horse blanket.

Question One: Does your horse have IBH or pruritus? What do you know about the condition?

> *'I knew that midges caused a reaction in equines, but I wasn't quite sure how or why. I did know that there are other skin conditions caused for other reason, the equines on the track have all sorts of skin complaints. It seems*

that once they are affected, they always seem susceptible, and there's nothing you can do about it really. I am retired now and have an equine for a hobby, he's very itchy and because I am now in an environment where the sole care of him is my responsibility, I have learned a lot more about the possible causes. I buy special horse blankets to protect him that cost a lot of money, but if he even manages to keep them on for more than 48 hours, they don't really protect him and definitely don't treat his broken skin'

(Interviewee 6, retired jockey)

'She had very angry looking bare skin on her legs. I thought it was caused by the sun because she has pink skin.' 'I didn't know that it could be caused by a fly bite. I had the vet to her, and they said it could be a mixture of things, they said it could be caused by fly's and midges, they also said it could be the sun. We had her checked by several different vets who were at a loss to the cause of the condition. Blood test were done to check her liver and it was suggested it could be a reaction to the sun or it could be eczema. Either way the open soars attract the fly's and the midges, she is in constant discomfort'.

(Interviewee 2, hobbyist owner)

'I knew Rhino had sweet itch, but I didn't know to what extent, I felt limited to what I could do to help him as I work full time and didn't have the time to be there for him all the time. If there would have been a horse blanket that did what it said on the label that would have been so much more helpful. To avoid the midges, I would have to get up at five in the morning and be riding for half five, which was just about an hour before the midges seemed to swarm. This made life difficult. I then had to try to get time off work to try and bring him in from the field before the midges came out in the evening, it would always seem that the midges were always out though. It makes my life very stressful especially now because it seems that the midges never go away'.

(Interviewee 4, hobbyist owner)

4.1.2 Current treatment and food supplements

All six equine stakeholders agreed that the use of a protective horse blanket was an effective management strategy to act as a physical barrier to the midge so they could not bite the skin of hypersensitive equines: One of the interviewees recognised the level of treatment their equine required but acknowledged that their level of treatment did change over time. This was due to overuse of steroids and cortisones which become less effective over time. Horse blanket use has been acknowledged as the most effective prevention, however as discussed in the interviews, the participants found it difficult to find a reasonably priced horse blanket that would last. When asked how the routines differed the livery yard owner was the only member of the group that had gone beyond conventional treatments stating:

Question Two: What treatment and current food supplements do you use?

> *'You've got to work your whole routine around how you are going to manage treatment; this affects me as I have a large livery yard to run and I compete at competitions. It's a lot to ask my staff who already have a massive amount to do, to then trek across several fields three times a day to check he's not going bonkers with the midges or to make sure his horse blanket is on"*
>
> (Interviewee 3, competition owner, livery yard owner)

As discussed with interviewee 3, they believed the itching and scratching was a learned behaviour copied from the mother of the equine, this copying of behaviours is also referenced in research included in the literature review.

> *I have had to become very creative to try to manage Ozzy's itching, Ozzy was born and bred at home, his mum had sweet itch and I did notice that very early he started to copy her. I have kept a very close eye on his behaviour and have tried many different approaches. I have spent thousands of pounds in trying to make him more comfortable and have moved him to every different part of my land to try and combat the midges. He was sometimes going through two horse blankets a day because he would itch so much, he would simply destroy his horse blankets. This gives you an idea of how crazy he got with his itching. I tried all sorts of potions like, "ditch the itch", fly*

spray, creams, homemade potions, human anti histamines, nothing worked. It got to the point that he would itch so much he would rip his horse blankets right off himself then he would get so crazy when that the flies were on him, he would colic. In one week, he had colic every other day which resulted in a vet call every other day'

(Interviewee 3, competition owner, livery yard owner east midlands)

The veterinarian supported the use of horse blankets as the most effective management strategy and believed that prevention was key to combating the condition. However, the veterinarian also reported that often equine owners left it too late to blanket their horses and could prevent outbreaks of a serious nature if earlier protective blankets were used. All the participants also reported in addition to using horse blankets as a barrier they all used a dietary supplementation in a bid to manage IBH.

'physical barriers, horse blankets, money spent on topical treatments and knowledge of the condition, across the board all aspects of the onset of sweet itch are missed and on average people allow it to progress too far before intervention. I advise clients that the best way to combat sweet itch is to invest in an all-over sweet itch horse blanket and that it is worth spending the money on, a good one'. Corticosteroid injections or creams were also sometimes used as a management strategy for IBH:

(Interviewee 7, Veterinarian)

'During the summer I give him human antihistamines (citirezine) on advice from a friend I also douse him in fly spray on his body and on his horse blanket when it's on. I also hog his mane'.

(Interviewee 4, hobbyist)

'I feed her garlic as I was told that that helps to deter flies and midges from biting because it makes their blood smell'.

(Interviewee 1, hobbyist)

To help relieve the symptoms of ozzys IBH, I give him antihistamines, my vet said it was ok to give him up to 8 tablets a day and would not be harmful to him I don't know if it helped at all and it defiantly didn't cure it'.

(Interviewee 3, competition owner)

'Yes, I would go with the use of antihistamines, maybe for the mild cases. I also advise on the use of Aloe Vera and calamine as it is very soothing'.

(Interviewee 7, veterinarian)

'If the case is severe then, yes, the track vet would come and give steroid injections, this had to monitored very carefully though as some of the substances couldn't be used too close to race day'.

(Interviewee 6 retired jockey)

Sweet itch is not something we are regularly called out to see. If the owner has enough knowledge, they can prevent and contain the condition, however, this flips from us to be called out to a condition that could have been controlled to one that is out of control. By the time the vet is needed the condition is usually very bad'.

(Interviewee 7 veterinarian)

4.1.3 Environment

All the participants were aware of the habitats of the midges, however, only the vet and one of the participants had an in-depth knowledge of the midge and the environment in which they live and were aware of the changing lifecycle caused by unseasonal changes in the weather. Apart from the vet, none of the participants were aware of the Latin name *Culicoides.*

Question Three: what environment is you horse kept in?

> *"Because I was told she had sweet itch when I bought her, I have always kept her in horse blanket's for protection in the summer, she just seems to be a very itchy equine anyway, I think it's the habit she is kept in, and she still itches in the winter".*
>
> (Interviewee 1, hobbyist owner)

From a behavioural perspective, three of the interviewees believed the itching of the equine became a learned behaviour that they would perform initially in response to the hypersensitivity as soon as the weather changed, and then would continue even after the condition was sufficiently managed:

> *'They're covered up 24/7 and are never given a chance to actually start to rub, because I do think it's learnt behaviour As well as anything else'*
>
> (Interviewee 1, hobbyist)

> *'My equine she gets so itchy, and so used to the fact that even if you are soothing it (the itch) she carries on itching because it's sort of habitual. My girl, Nula, itches all the time even in the winter and rubs her mane and tail off when there are no midges. It's weird to see and leaves me at a loss of what I can do for her. I can't believe that there is no better solution, especially in my job where I sell products to vets, that there is nothing that anyone has come up with to combat this horrid skin complaint'.*
>
> (Interviewee 1, hobbyist)

4.1.4 Financial implication

Question Four: What are the financial implications? Would you buy a horse knowingly with IBH or pruritus?

Although all participants were aware that their equines had sweet itch, their approaches were different, this was mainly down to finance and time:

There was a mixed opinion when discussing the consideration of buying an equine with IBH or pruritus. As seen in figure l9, 70% of the participants did not know their equine had the condition sweet itch upon purchase. However, of those surveyed as seen in figure 17, 46% stated they would still have purchased their equine, and 16% of participants stated they would not purchase any equine knowing they suffered from the condition. The financial implications as seen in figure 22, show that the minimum spend is still at £100, with 42% saying they had spent at least that amount. 4% of the online survey participants had stated they had spent £500 plus; It was also evidenced from the face to face interviews that often a second form of employment was necessary to be able to afford treatment and in all the interviews it was expressed the anxiety and mental stresses to be able to provide appropriate care.

> *'It's tricky because I tend to buy them at a young age and as I have said earlier it doesn't come through until they are older so it would put me off, but at the same time if the animal was good enough, I know I could manage it, and I have had to on more than one occasion get a second job so I could afford the treatment'*
>
> (Interviewee 3, competition owner)
>
> *'No, I definitely would not again, because it stops you doing so many things. They never look good or well and the time and money that's involved makes it not fun at all and has caused me extreme anxiety and stress. The whole point of owning a horse is that it's meant to be fun, instead I worry constantly about how scruffy my horse looks and how much time in the management and treatment is involved.'*
>
> (Interviewee 1, hobbyist owner)

'no, because of the time and money involved in an equine with sweet itch.' 'There is the cost of extra horse blankets which are very likely to need replacing frequently due to rips from the equine itching. If stabling the equine, there is the cost of hay and bedding. And then there is the cost of the vets for the cost of steroids, antihistamines and benzyl, which will possibly be needed on a long-term basis.'

(Interviewee 6, retired jockey)

4 of the participants that were interviewed agreed that purchasing an equine with IBH or pruritus would depend on the circumstances: All participants agreed that IBH was an inconvenience and that it incurred additional cost and time:

'It would depend on where I keep my equine; If I didn't have my equine where I do now, I would have to reconsider what I would do. My equine has sweet itch, but I can manage it quite well where I keep him').

(Interviewee 4, hobbyist owner)

'I have spent thousands of pounds on horse blankets, vet bills and home remedies, I am too invested now, if I felt like I couldn't continue I would have him put to sleep')

(Interviewee 3 competition owner)

'There is the cost of extra horse blankets which are very likely to need replacing frequently due to rips from the equine itching. If their sweet itch is so bad then you must stable them, this incurs extra cost in bedding and feed. stabling the equine, there is the cost of hay and bedding'.

'I had to get the vet to give Ozzy a course of injections that did help short-term, but financially it was crippling.'

(Interviewee 3, competition owner)

'I think definitely it impacts their welfare, it's very difficult to detach yourself from the situation when you have an equine with a bad skin condition because you have become already too invested. But if you were to take a step back you would

probably understand that the equine is not happy and that you don't really have the money to treat it; really if it's that bad you should just have the equine put down'.

(Interviewee 6 retired jockey)

4.1.5 Current horse blanket use

All the face to face interview participants acknowledged a problem when trying to find a suitable protective horse blanket:

The main factors in finding a suitable protective horse blanket were cost, suitable fit and design, and durability. The better the horse blanket the higher the cost, this is seen in figure 22 participant spend. Only 4% of the participants could afford the spend of £500 plus on horse blankets, the remaining participants spent less but acknowledged that they would often purchase at least two protective blankets each year as the cheaper blankets would not stand up to the wear and tear. A constant factor in equine horse blanket wear was the changing weather; The more expensive blankets were made of a heavier and closer woven polyester, and although breathable become very hot in the summer, see figure 9 It was also acknowledged that if the weather changed to rain the horse blankets would need to be changed to avoid rubbing on the horse in sensitive areas such as the whither and chest of the horse. These constant changing variables makes it difficult to manage when most of the participants had jobs that did not allow for them to leave to change the horse blankets if needed.

'Routine-wise, it's quite hard when it's red hot to ask an equine to wear a fly horse blanket. It's probably actually easier to have them out during the night when it's cooler and have them in during the day, the best scenario is to make sure you get the fly horse blankets on before the midges start to hatch, so if my equines go out in February and its mild enough for them not to have a winter horse blanket on, their fly horse blanket goes on instead

(Interviewee 3, competition owner and livery yard owner)

'Lots of youngster are itchy, but at five years old he began to break his skin and became obsessive about itching, I washed his mane and tail regularly, he ruined every horse blanket I put on him including a boett horse blanket costing over £400.

I knew the midges came out at night the worst on my land between 3.30 and 9.00pm. I noticed that, although the midges were out in the morning early, there were more swarms and were more intense in the evenings'

(Interviewee 3, competition owner livery yard owner)

'During the summer months she has to be in a fly horse blanket, but she is actually in a fly horse blanket for probably nine months of the year'.

(Interviewee 1, hobbyist)

'ozzys sweet itch caused him to colic every other day his sweet itch was so bad, because he was colicing so badly he then got another injury'.

(Interviewee 3, Competition owner)

'I had a Shetland that was a companion pony for all my youngsters, he had terrible sweet itch, he had a tiny boett horse blanket that he constantly destroyed. He suffered terribly and his skin was always bald and infected. I used to use Benzol Benzoate on him which helped. In the end he died, and I do think it's because of the stress of the constant itching.

(Interviewee 3, competition owner)

4.1.6 Future treatments

Future treatment to combat IBH and pruritus was high on the agenda for the interviewees when discussing what was needed:

All the face to face participants agreed that a more suitable protective horse blanket was needed and the potential to have an all in one protective and medicated blanket would be the best solution. Participants agreed that to be able to tend to their horse in the mornings before work and apply a horse blanket that would protect from the biting midges but also treat any existing outbreaks would be a relief.

'Obviously it takes more time, on the track these equines must be washed before they train, then after they train then before

they race and after, its very time consuming and the equines are very uncomfortable especially because they get so hot. It would be brilliant if there was such a horse blanket that could protect and treat.

(Interviewee 6, racing yard employee)

'A lot of it is management really, that is what I recommend to people as it is the best way to deal with it.'

(Interviewee 7, veterinarian)

The management strategies that participants had implemented were found to often involve an integrated approach of both physical barriers and chemical repellents:

'She has a fly horse blanket on at all times, even in the winter under her winter horse blanket, and cream is applied every day of the year'.

(Interviewee 2, hobbyist)

'I have used all the possible treatments out there, fly horse blankets, stabling, and applying lotions daily. If there was ever a sweet itch vaccination, then I would give it a try, or following this research, if there is a horse blanket produced from this research, I would be first in line to try it'.

(Interviewee 2, hobbyist owner)

'Obviously by keeping my equine in an area where you are less likely to encounter midges or possibly stabling the equine in the early hours and in the evening, this isn't really possible for me though because of my working hours'.

(Int 4, hobbyist owner)

'Equine owners need to find some stables that are away from any sort of standing water or even rivers it would be best, high open ground is the best'.

(Interviewee 7, veterinarian)

'I don't think that anything on the market is that effective. Nothing I use on Nula works or stops her from itching. We all know what causes it, but no one knows how to stop it, which I

find hard to believe in this day and age. Nothing stops her from itching her mane and tail out'.

(Interviewee 1, hobbyist)

'I think once they have it, it will always come back there is no way really of stopping it.'

(Interviewee 6, retired jockey)

'I have had ponies and equines go over electric fences, jump them or through it to rub, I have experienced that first-hand, its heart breaking, but what do you do? My home bred, Ozzy is like my child, I would never put him down unless he was so miserable that I had no choice. It cost me fortunes, but I don't care. I wait for a better way to treat this condition and believe that it will come soon'.

(Interviewee 3, competition owner)

4.2 Introduction Results of online survey

To reach a broader target audience an on-line survey provided a platform to engage with stakeholders experiencing the conditions resulting from IBH and pruritus. This method of data gathering allowed for the paradigms between the interviewees and the survey participants to be recorded. This method of gathering data on the subject gives accurate recording of the results and will provide a structured analysis of the problems associated with the condition. The structure of the survey for this research was made clear and easy to use for the stakeholders, this was an important factor to gain honest answers and allow for specific questions relevant to the study. and to get people to participate.

Results from the on-line questionnaire supported the information gathered from the face to face interviews. This can be seen in the data collected and put into table format. It shows an overview of the current situation on a national scale that encompasses the differences in locations, breed, environment, financial impact and monies spent on treatment and horse blankets. Figure 22 shows the locations and spend demographics.

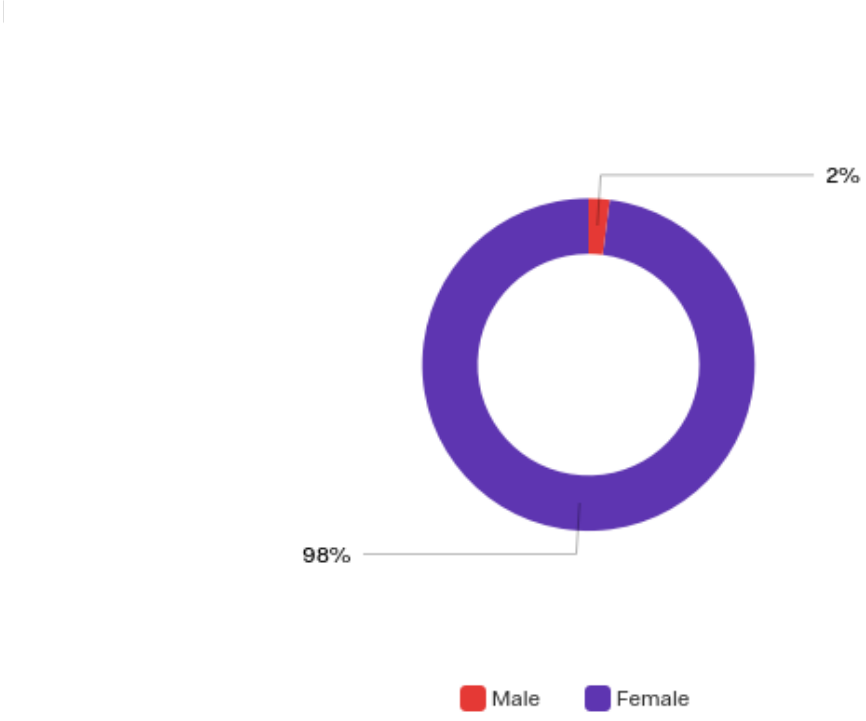

Figure 11. Representation of male and female participants

The above graph of 56 responses shows that only 2% of the responses came from male participants. Based on this response it is clear to see that ownership of equines in this study is primarily women. There is speculation to this, it could be that fewer men are pre disposed

to participating in surveys or it is suggested that ownership of equines by the male gender are more likely to be interested in competing rather than ownership as a hobby and thus keep their equines in a more ridged routine.

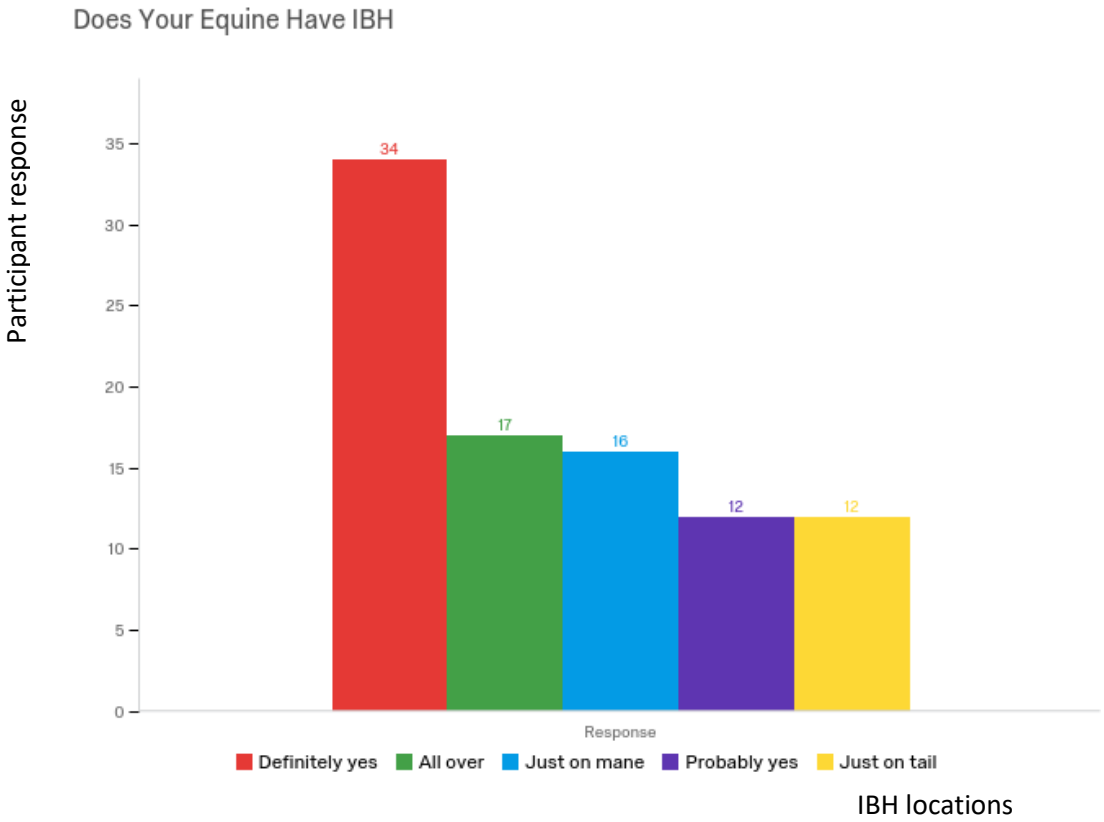

Figure 12. Response to IBH in equines

Figure 12 detailing anonymous stakeholder responses on equines with IBH show 34% participants knew that their equine had IBH. The remaining results show a variation of the condition and the degree of severity. 12% of the participants interestingly were not sure if their equine was suffering from IBH. 41% reported that their equines only had sweet itch on the mane of their equine. 61% reported to their equine having IBH all over the body.

Figure 22 records that the highest responses came from the east of the country, with the exact locations being reported from the midlands. Of the 19 participants from the south, most of the locations were recorded from the new forest. From the north, were Yorkshire, and the one participant from the west was Liverpool. Only 49 participants were recorded as the remaining 7 answered the survey from outside of England.

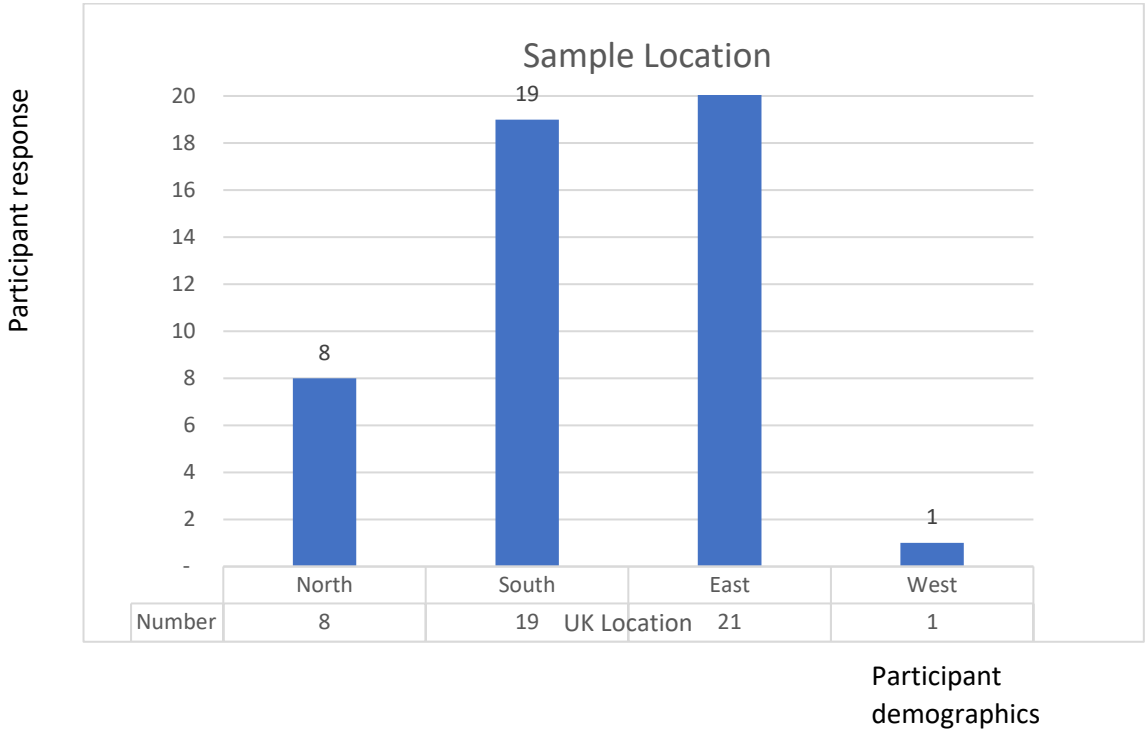

Figure 13. Stakeholder location

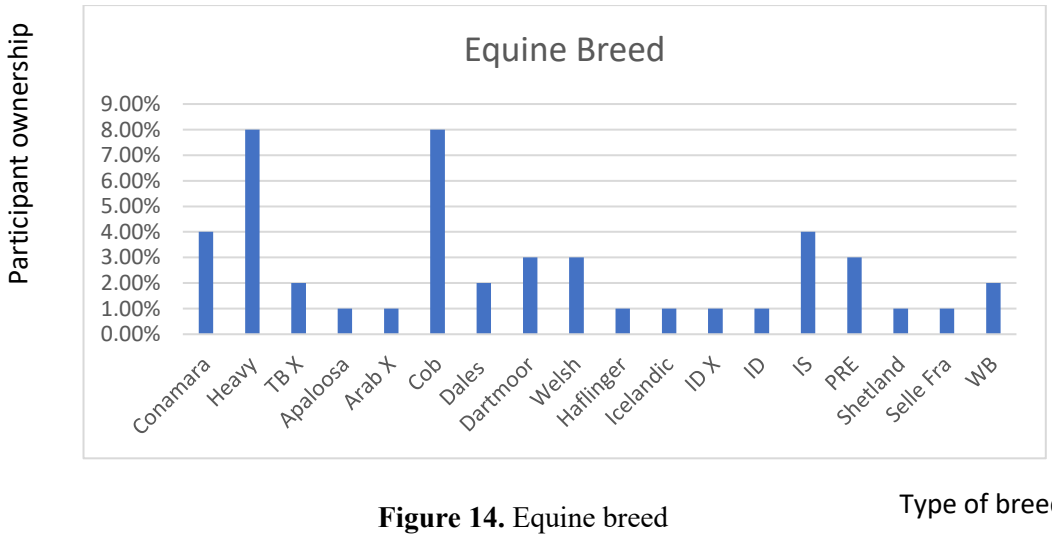

Figure 14. Equine breed

The results from the survey predominately show the breeds most affected with IBH are the heavy breed and the cob. Further research into the possibility that this is an issue with that specific breed is needed. The survey data shows that participants with the heavy breed equine all used protective horse blankets to shield and protect their equine.

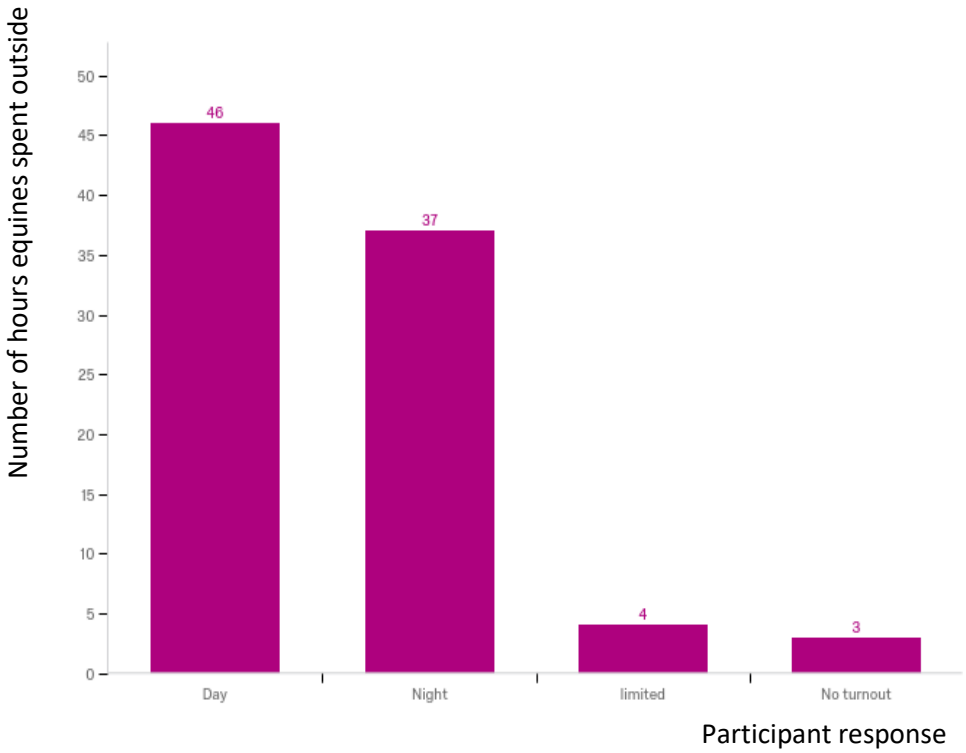

Figure 15. Field time turn out

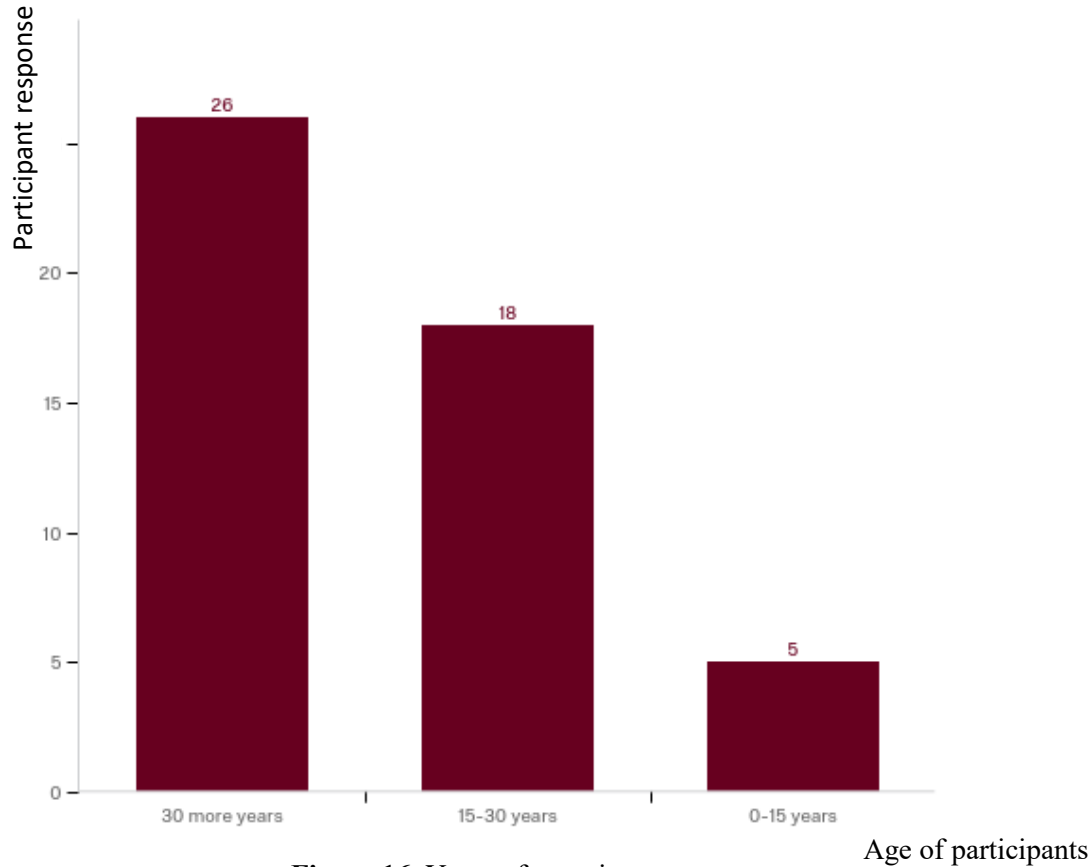

Figure 16. Years of experience

The survey results show that the experience of equine ownership does not necessarily reflect the experience in the condition IBH or how to treat it, when compared to the information gathered from the semi structured interviews. Each of the participants that were interviewed had a basic knowledge of how to manage their equines IBH. All the participants interviewed used a protective horse blanket of above average quality. The results from the survey show that 46% would still purchase equines with IBH

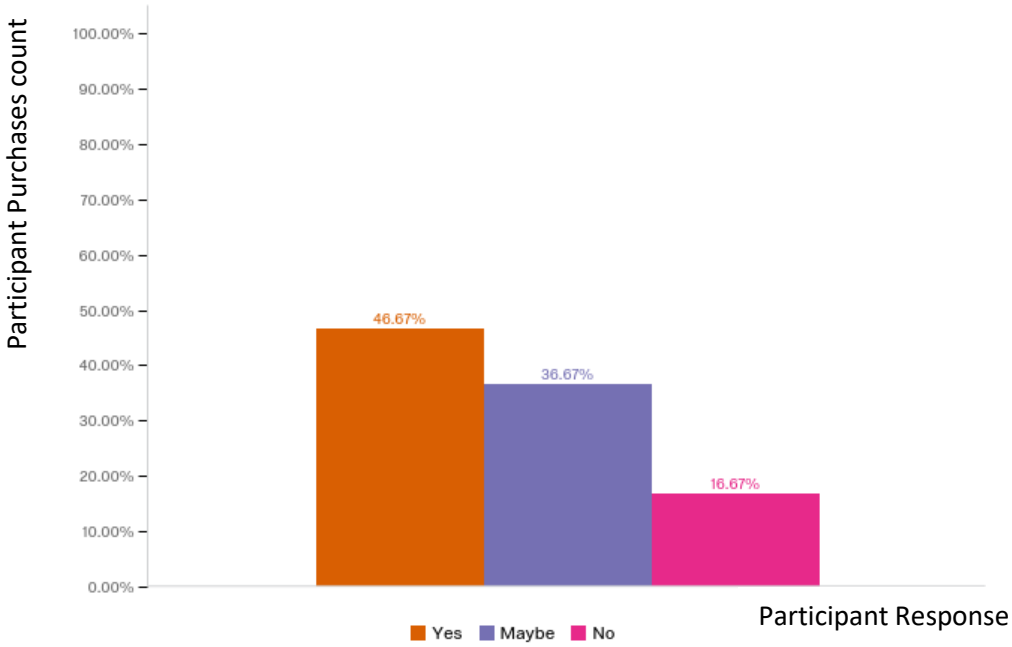

Figure 17. Equine Purchase with IBH

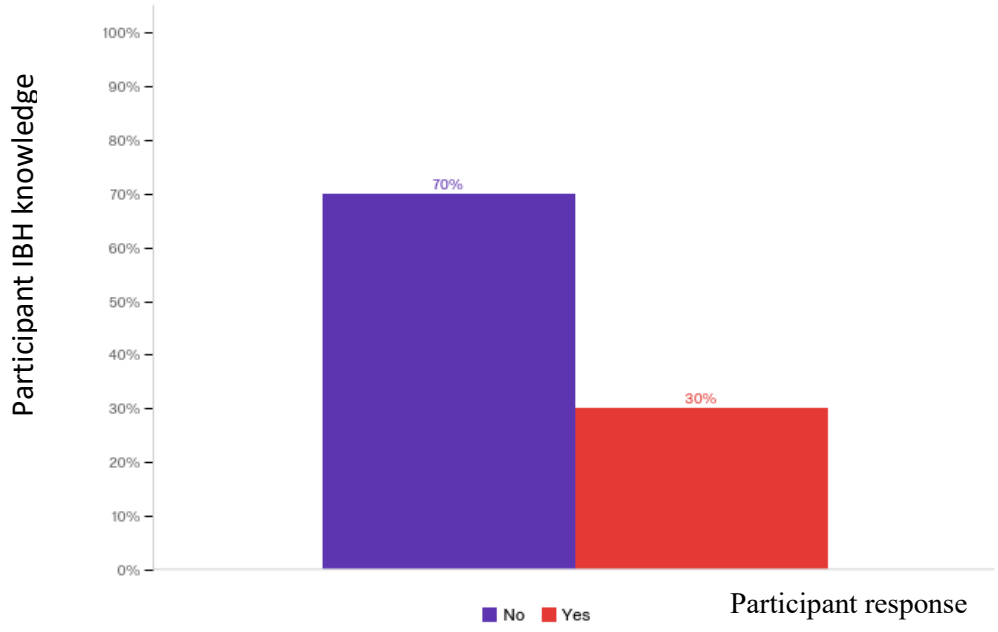

Figure 18. Knowledge of IBH and pruritus prior to purchase

70% of the participants from the on-line survey did not know their equine had sweet itch before purchase.

Below the graph shows the largest percent of stakeholders are not affected by (IBH) and the condition does not inhibit their activities.

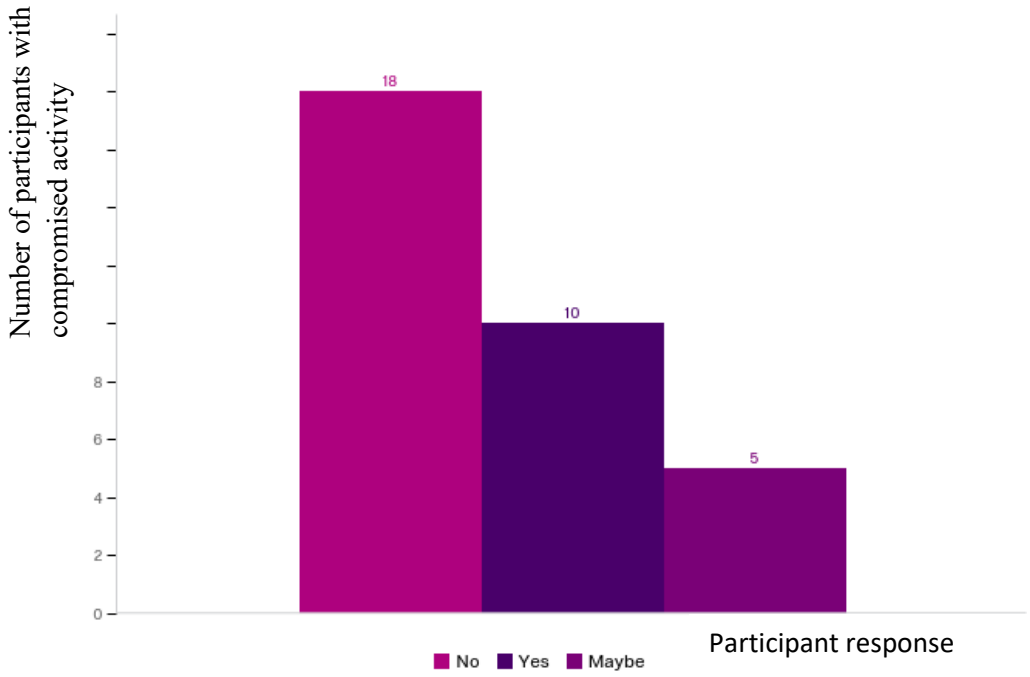

Figure 19. Compromised activity due to IBH

Not all survey participants answered this question: 54.5% said that their equines sweet itch did not affect their routine or riding habits. 15.5% said maybe but couldn't be specific how it might affect them, and 12.5% said yes definitely, that it affected what they did. Only 12.5% of the on-line survey participants thought that the condition of their equine got worse every year, 75% did not think that the condition of their equine got worse and 12.5% were undecided.

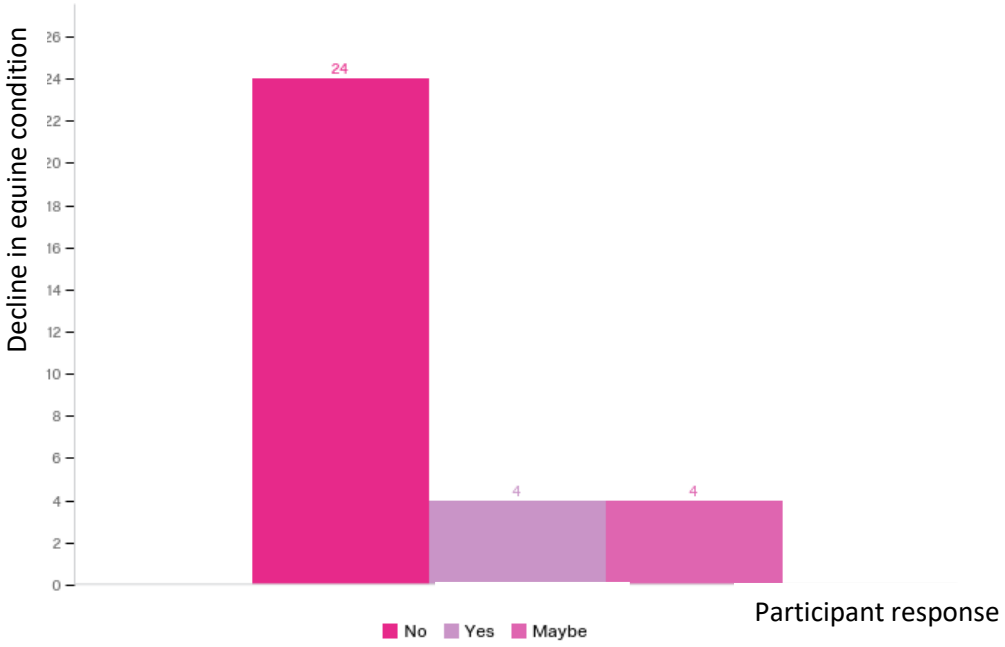

Figure 20. Representation of yearly decline of condition

12% said the condition of their equine got worse every year, were 75% of the participants said the condition did not get any worse. Only 12% were not sure. This suggest that 75% of the participants are successful in management stratgies of sweet itch. However, some of the participants stated that their horses would be itching even after applying protective horse blankets; after horse blankets have been applied and the equine is seen to be rubbing it is because the horse blanket was applied too late.

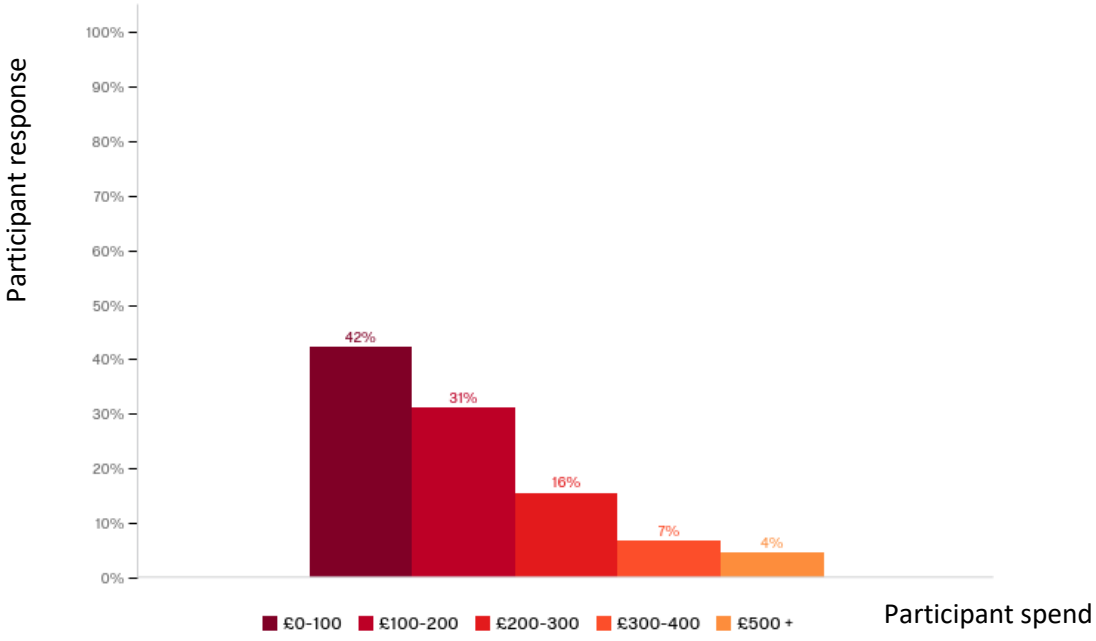

Figure 21. Stakeholder annual spend on treatment and horse blankets

Survey results show that only 4%, a small percentage of equine owners spent £500 or more, most owners spent £100 or less the average spend at 32.56%. This supports the hypothesis that management is key in the combat of the condition, and that the use of protective HORSE BLANKETSs and the environment are the key components that must be acknowledged, education on the condition is the way forward. This concept is viewed as key by the participating veterinarian.

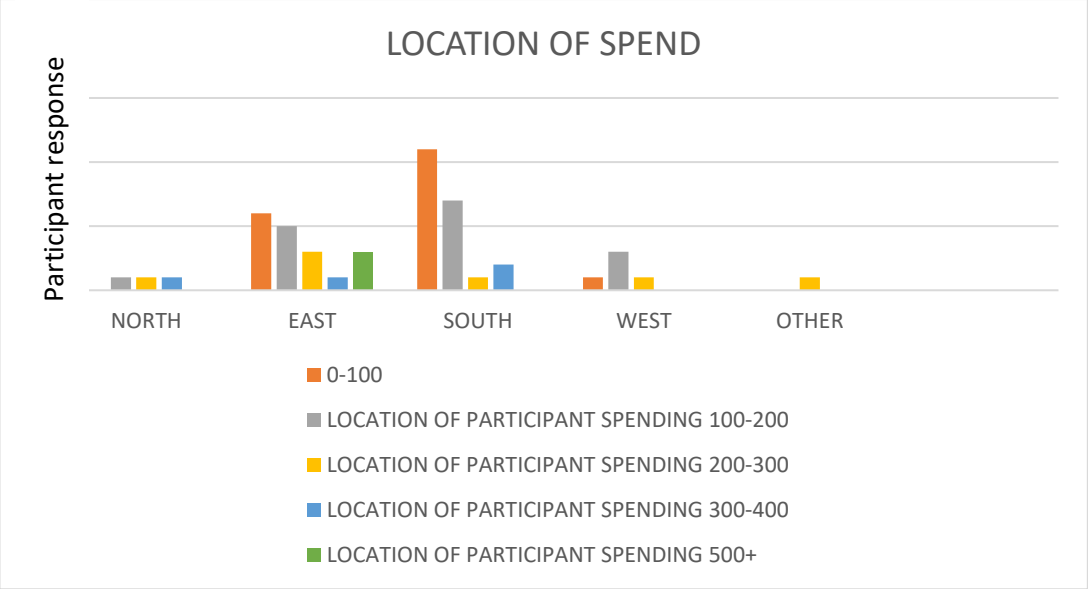

Figure 22. Stakeholder demographics and location spend

The results of participant location show that the highest spend occurs in the East of the country. This demographic also included the midlands in the survey. The south had the most participants spending, but not the greatest in monetary amounts, 11 participants in the south spending between £0-100 compared to 3 participants spending over £500. The participants had the lowest spend with the west only marginally spending more. This could suggest that disposable income is greater in the south and the midlands, reinforcing the north south divide. The one other participant spending between £200-300 was from North Carolina in the USA.

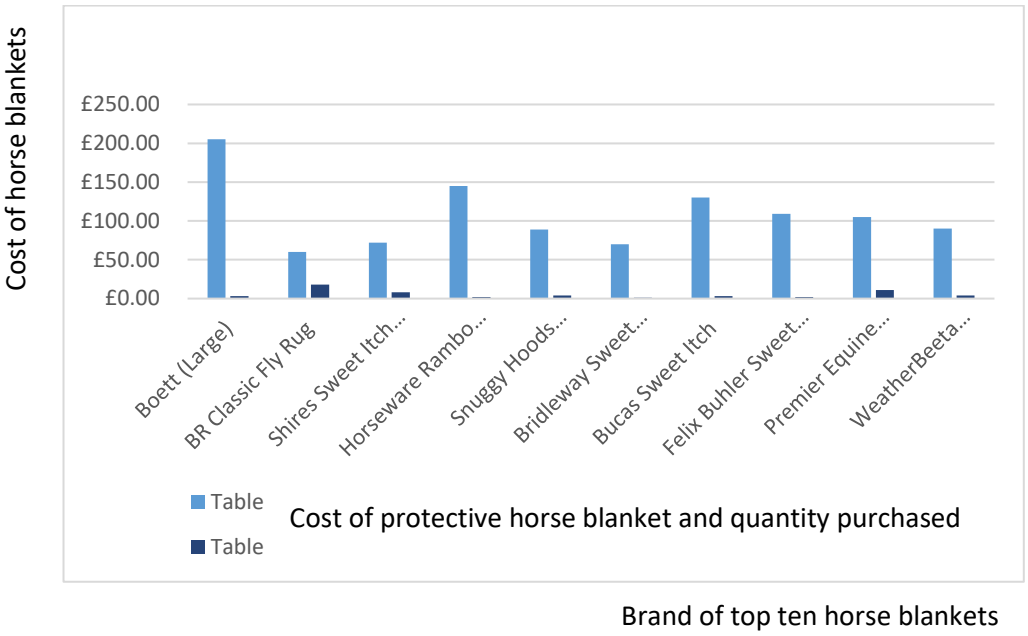

Figure 23. Top equine horse blankets used to treat IBH and pruritus

This table shows the cost in light blue, and and quantity of each brand purchased, in dark blue. The Boett horse blanket is the most expensive IBH horse blanket currently on the market, only 3 of the survey participants purchased this horse blanket (shown in the dark blue) and the 3 participants location was in the south of the UK. This possibly confirms the demographics of the north south divide in wages and disposable income. The BR Classic Fly Horse blanket is the least expensive on the chart and the demographics of purchases were inclusive of the whole of England with 18 of the participants buying this horse blanket. Premier Equine was the second highest in purchased horse blankets with 11 of the participants buying this horse blanket. The results from the survey showed that this horse blanket had the best feedback for functionality and price.

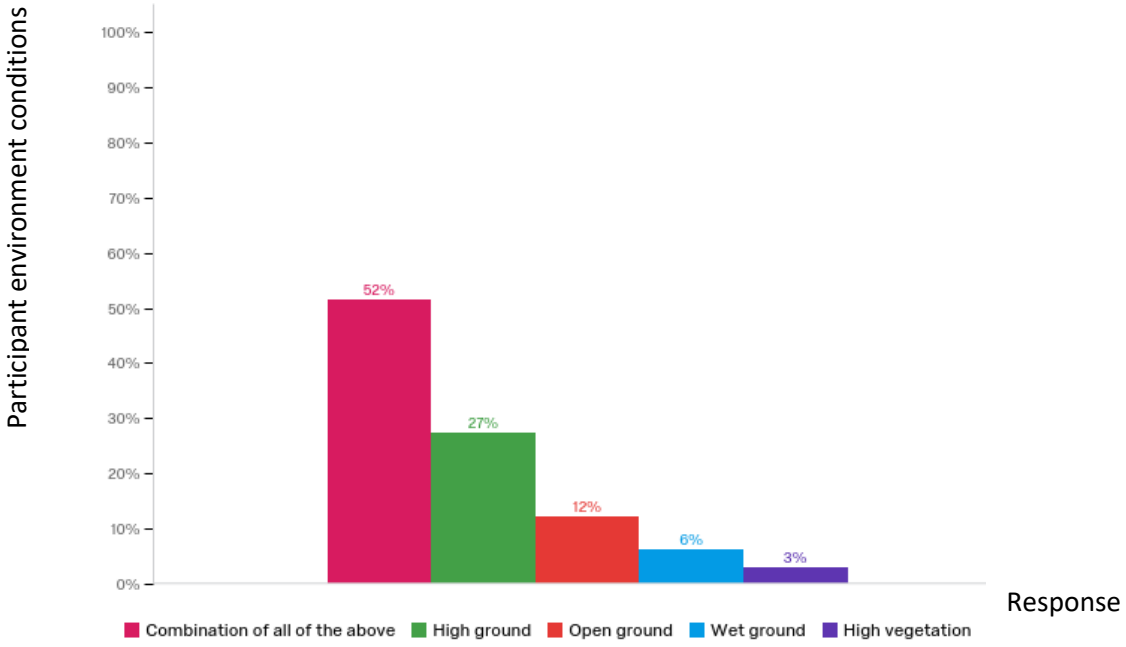

Figure 24. Equine environment and % of time spent in that environment

51.52% of on-line participants agreed that the environmental facts contributed to the condition IBH: 51.52% of the participants displaying a combination of keeping their equine in a combination of enviroment were from the east and the middle of the country.

Six of the participants took midge avoidance into account as a preventive management strategy to control IBH. Midge avoidance was by either stabling at time of the day when midges were most active, or moving equines into an area where midges were less likely to breed and inhabit:

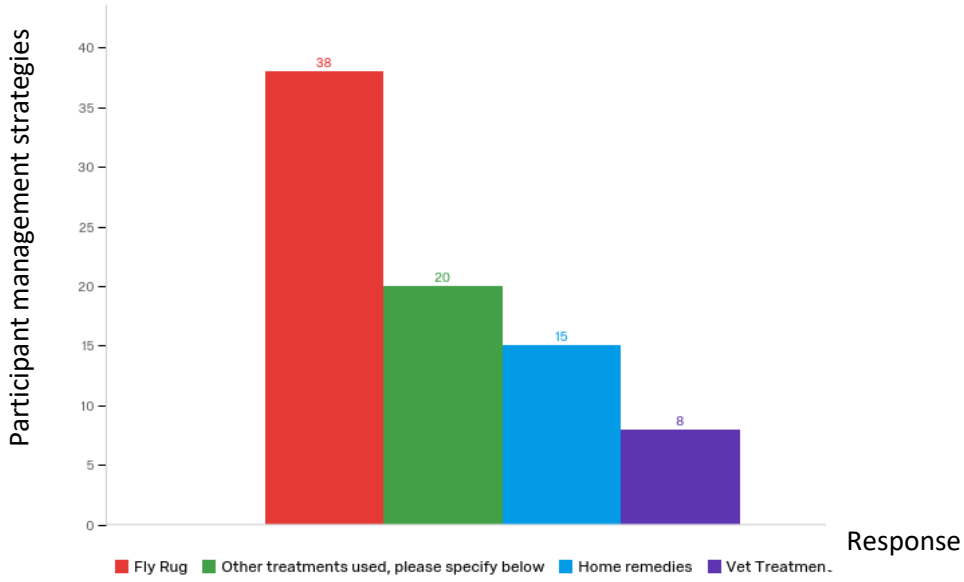

Figure 25. Participant management strategies

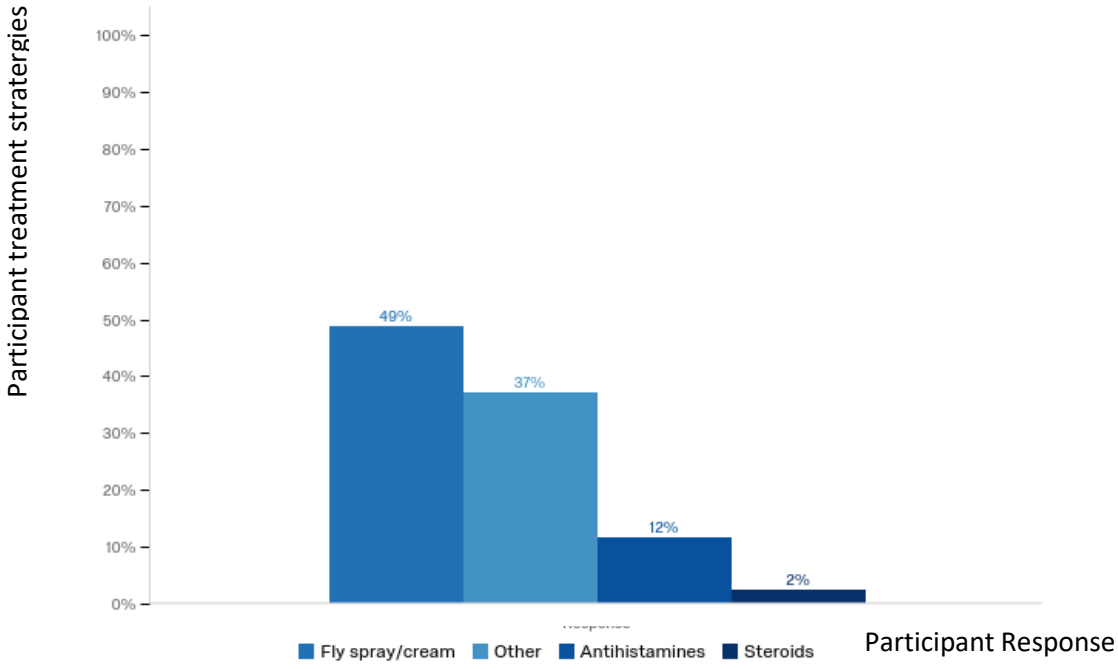

Figure 26. Participant treatment strategies

Only 25% of the survey participants changed their treatment process to combat the condition. This suggests that the current treatment used is enough and fit for purpose. Alternatively, this could also suggest that equine owners have little faith in the current treatments and are unwilling to try anything new. 58% of survey participants did not believe that any progress had been made in new treatment for IBH. 41% of participants believed there had been progress made in new treatment for IBH. the stronger opinions of the participating interviewees swayed the less confident participants when it came to be experimenting with new treatments.

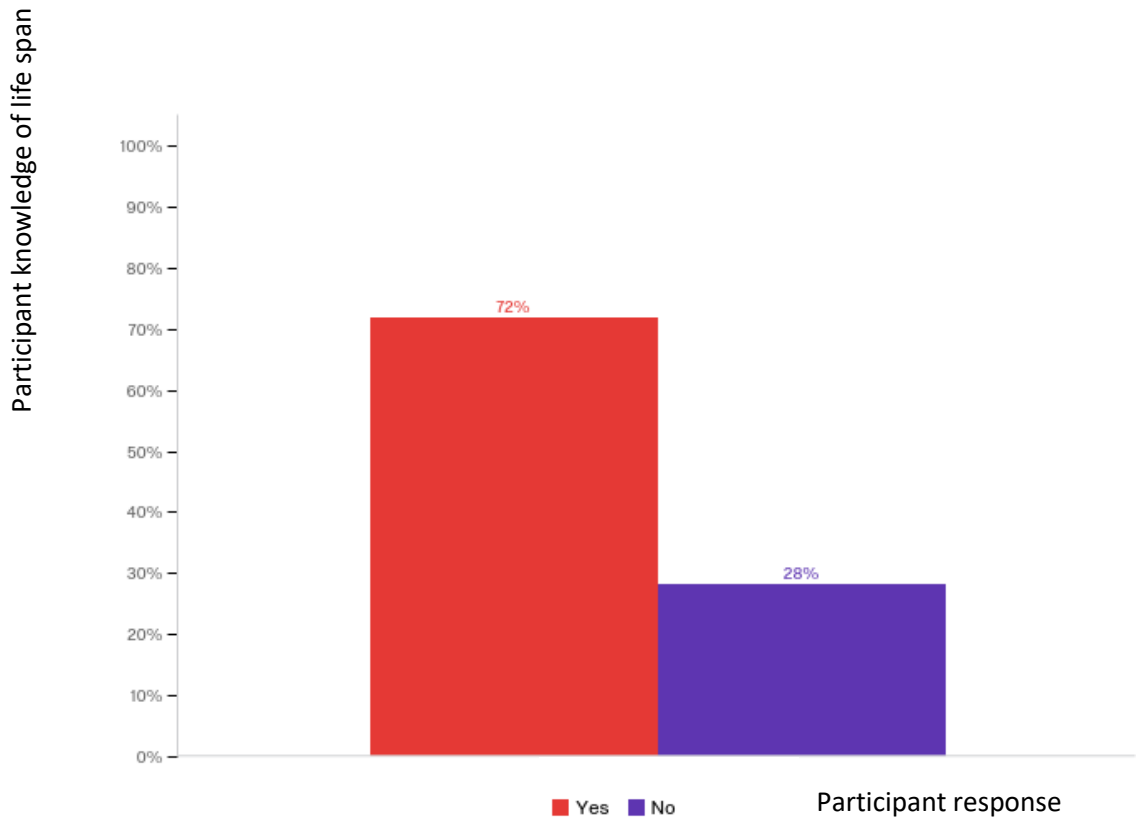

Figure 27. Changing lifespans of the midge and black fly

65.63% of the survey participants believe that the midges are swarming for longer periods, this could be a result of the changing climate. 34.38% do not think there is a difference in the length of time the midges are active, this could be representative of the population that don't agree there is any change in climate. The veterinarian acknowledged that there has been changes in the climate:

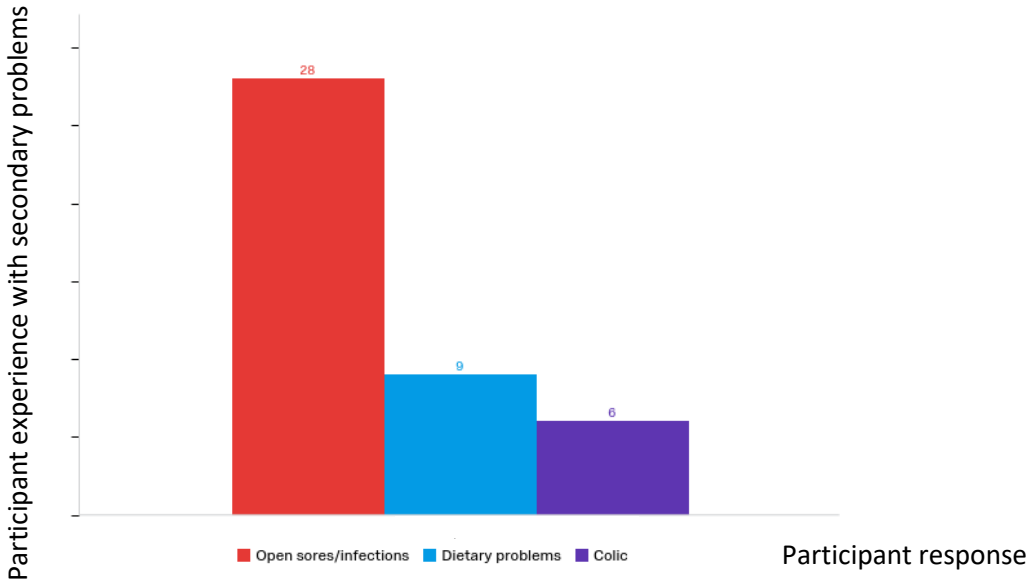

Figure 28. Secondary problems caused by IBH

Results show that there was a clear sense of frustration amongst stakeholders about how successful management of IBH could be treated in the field or in the stable: All the participants that were interviewed, and from the participants from the on-line survey, it was recorded that, although the condition was difficult and frustrating, the welfare of the equine was most important, although difficult to manage, the welfare at some stage, depending on the severity, they would consider euthanasia. All participants agreed that the welfare of the equine was compromised.

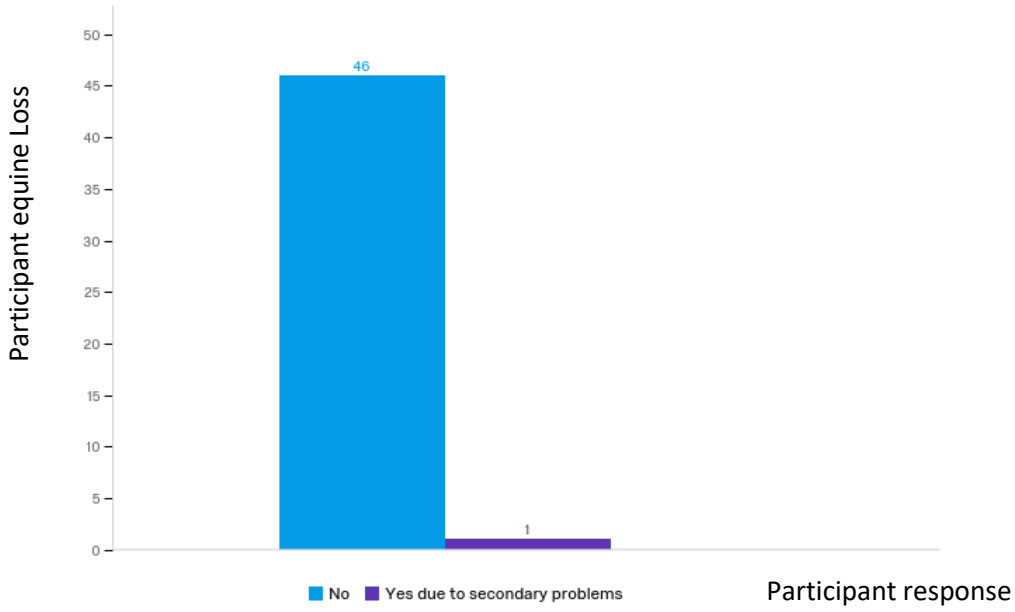

Figure 29. Number of equines euthanised due to IBH or pruritus

Only one participant expressed that their equine had to be euthanized from complications of IBH, however the interviewees all had considered the option of euthanizing their equin.

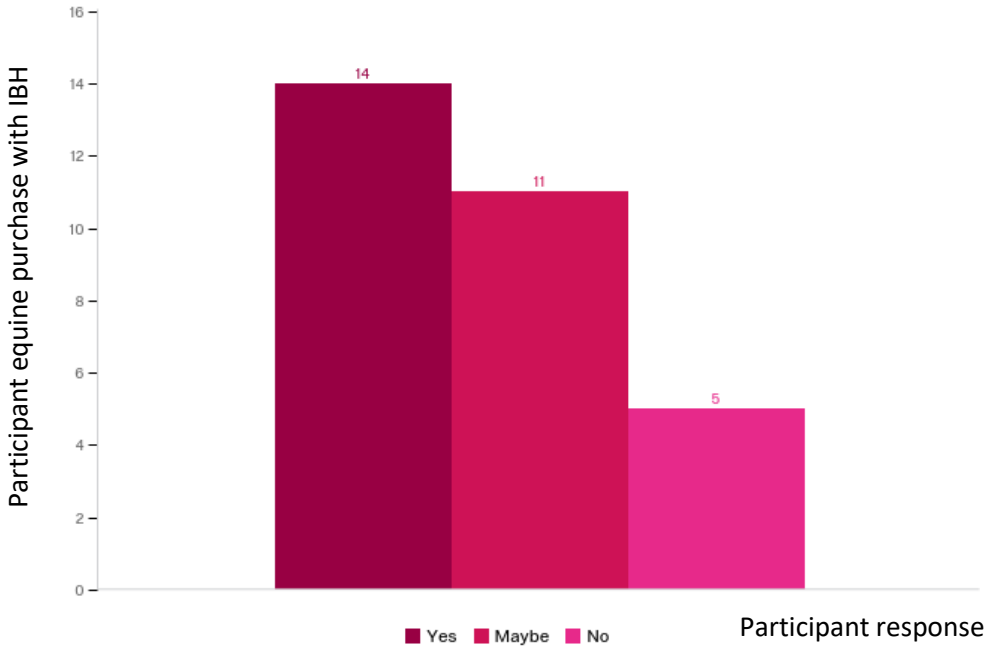

Figure 30. Results showing participant purchase of equines with IBH

4.3 Chapter Summary

All the participants had a general knowledge of the condition IBH and pruritus and were in ownership of an equine with the condition. (results) The results from the survey show the concerern of IBH and the current treatment is not as relevant as at first anticipated, and as exspressed by the participants that were interviewed, this is a condition that has been managed to a degree that enables a continued measure to deal with the situation. However, the results did also conclude that a better protective horse blanket with treatment capabilities would be greatley received, but in the event that no such tretment were availible, it would not deter participants from purchasing or dealing with IBH. This is indicative of equine owners who, with the passion that they have for their hobby will continue to adabt to the circumstances of dealing with problems of IBH.

5.0 CHAPTER FIVE DISCUSSION

5.1 Introduction: Interviews

This line of study critically assessed the current practice of all the interviewees, the results from the interviews were put into categories to better analyse the data and followed the same themes; 1. interview experience, all seven participants, including the vet, owned or had previous experience with the condition and had knowledge about the vectors, the midge, its feeding pattern and habitat. Only two of the participants were aware that the black fly was also a cause of IBH. The experience age range of the participants was wide, the youngest participant having dealt with treating IBH from as early as 10 years old, the oldest participant was in her fifties and had had horses all her life. Although all participants used a protective horse blanket, there was significant differences in cost and quality of horse blanket. Not all the participants agreed that the most expensive horse blankets worked any better than a cheaper horse blanket, and as their horses usually destroyed at least one-horse blanket in the height of the midge season they felt it more cost effective to purchase a cheaper horse blanket.

An open line of questions on the condition IBH and pruritus were asked to establish the progression of the condition in an informal setting. This allowed for open answers and adaptability to the interviewee's nature and priorities. In each case the body language and social cues were similar in the sense of emotional distress of the participant and the emotions reflected for the condition of the equine. It was also discussed in interviews that the itching could be a learned behaviour which was also not manageable. The 7 semi structured interviews conducted with the participants all claimed that they had experienced at different stages, either their equine copying another equine itching or in one case, two foals born to the same dam that suffered from sweet itch, copied the itching ritual. One of the interviewees was quoted in saying 'Equines begin learning the day they are born, and young foals will observe how their mothers react and copy their behaviours' (interview 3).

It is possible that once the habits of itching have occurred it will continue regardless of biting insects and will still result in secondary problems, A noticeable change in temperament and behaviour in equines have been reported by the stakeholders, with the animal showing frequent yawning and dullness in attitude. All the interviewees reportedly agreed that their equines became agitated, impatient when ridden and demonstrated a lack of concentration; When flying insects were around, their equines showed signs of stress, with repeated head shaking. The secondary implications of IBH and Pruritus can cause more problems and all the interviewees had expressed several instances where they had experienced some form of

secondary problems, stating once an outbreak had occurred itching is unavoidable, thus causing secondary symptoms of fungal and bacterial infections. The secondary problems were treated with steroids and antibiotics by the interviewees, however, stating the dosages may need to be increased on a yearly basis, possibly increasing the risk of problems such as laminitis and colic. It has been suggested that various stresses can be a factor, such as moving to a new location, sickness, or severe injury can be a factor when mature animals develop Sweet Itch. (Moray Coast Vet Group 2018).

Participant knowledge on how to manage and treat the condition was varied depending on the severity of the condition. Of the 6 equine owner participants, not including the vet, only one had done in depth research to the management of IBH and pruritus and had successfully managed the condition. The remaining participants were consistent in their management and had done some research into treatments to help contain the condition once an outbreak had occurred. After evaluating existing treatments available on the market for pruritus, it was clear that the management strategies whether appropriate or not had to fit into the routine of the participant; all participants worked and said they would monitor their equines more if they could but were hindered due to work constraints, meaning equines were out at times of day when the midges seemed to swarm more. Although initial awareness and knowledge of IBH was generally high, when discussing the aetiology of IBH and pruritus in more detail, knowledge was varied.

It was also recorded that some of the participants did not acknowledge the swarming of the midges had changed their spawning pattern compared to previous years. Culicoides midges are also recognized as poor fliers, making equines less exposed to midge bites in windy, open areas, however this was only mentioned once across the interviews, suggesting that it is not commonly known amongst equine stakeholders. These findings suggest that although scientific research is available on the Culicoides, it is for the most part not being accessed or utilized by equine owners to guide their management strategies for IBH and pruritus. This is perhaps surprising, considering that most participants had personal experience of IBH in equines either owning or working with them. This suggests a gap in specific knowledge in relation to the *Culicoides* midge that needs to be addressed; to ensure that equine stakeholder knowledge of aetiology of IBH is better understood to allow for more effective prevention and management of the condition.

Although the circumstances of the participants were different, with significant differences in the variables such as breed, type, age and environment of the equine, patterns of treatment, spend and veterinary intervention did emerge. The south of the country spending more on

horse blankets treatment and vet care. The north of the country had the lowest spend on treatment, horse blankets and vet care. All the participants interviewed used several food supplements to combat the condition, often resorting to human medicines in the form of antihistamines and herb additives and also due to frustration of the condition becoming worse over the season two of the participants had made their own home-made supplements combining existing products.

The main frustration was the lack of advancement in treatment or new textile technologies for horse blankets to combat the condition. The interviews allowed for a naturalistic approach and benefited from not being completely pre-determined, this enabled the participants to express their concerns freely and share their opinions on the quality and effectiveness of the protective horse blankets and treatments they were using. Current literature on smart textile advances show there is a real possibility to develop a medical textile to combat IBH.

5.1.1 Survey

To accomplish a detailed account of the health and wellbeing of equines from the participants an on-line survey within the equestrian field provided a base line with which to compare the more detailed information from the interviewees. The survey followed the same categories as in the previous interviews; a broad line of questions to record experience, general equine health, diet, breed, gender, location, treatment approach, spend and environmental circumstances. Opportunity was given to report any information in the survey prompts relative to the condition that may have been missed. Recognised survey standards ensured the same general areas of information were collected from each participant. The results from this process showed in general, there appeared to be a lack of specific knowledge across most participants that IBH is caused by a hypersensitivity reaction to the saliva of the Culicoides biting midge. Some participants did recognize that the Culicoides midge is likely to be more present in areas with water present, and that they are more active during dawn and dusk (Rendal, 2014).

The on-line survey revealed a bias in women responding to the survey, therefore, either men own less equines than women, or do not consider the condition IBH or pruritus as a problem and are less likely to respond to an on-line survey. Male equine owners are more likely to be professional competitors and less likely to own an equine as a pet, male equine ownership and their opinions on IBH and pruritus will require further research. The survey results showed a bias in spending on horse blankets and treatment in the south, however, the environment most affected with the midge and IBH in equines was recorded to be in the east

of the UK and middle of the country. This suggests that the demographics of the peak district area has a more inviting environment for the midge, however, the equine owners in the south of the country have more disposable income. There was 100% consensus that if a new textile horse blanket were to be developed that all stakeholders would try it, the vet agreed it would be relevant and his practice would promote its use.

5.1.2 Management

There was a clear difference in how the participants treated and managed their equines condition of IBH and pruritus based on their previous level of experience with the condition. Comprehensively, the main treatment process was that of a protective horse blanket, second treatment strategies were to use fly sprays, creams, lotions, feed supplements were used but as the results show only by a small percentage of the stakeholders, seemingly with the horses that had quite severe IBH. This study showed the many variations of commercial treatments available for combating IBH and pruritus, although, participants of this study had differing opinions on what was best to treat an equine suffering with IBH. Participants seemed to accept the condition as part of daily life and were resigned to the knowledge that nothing would change in their management strategies without advancement in technologies to find new treatment methods. However, with the new findings presented by (Caro et al., 2014) on the functionality of the zebra strip as a deterrent to the biting midge landing on the host, a new batch of fly horse blankets have been brought to market in 2019 with zebra print. The equestrian industry is ready to progress with new technologies.

5.1.3 Textiles

Survey research provided information on existing treatments and materials used to protect the equine, a greater understanding for the need of a newly developed horse blanket to protect and treat the condition was established. Investigation into several different materials to assess their durability and functionality have been explored to establish the most effective baseline to create future samples. The trans-dermal medication delivery framework is a method that gives horse blanket absorption directly to the skin. The framework has numerous advantage points over customary intravenous and oral administration routs, it is accessible outside medical establishments, which takes some of the financial burden off the stakeholders and allows for therapeutic horse blankets to be delivered at a controlled ratio while their horse is happily grazing in their field. Research carried out by Takashima, (2019) supports this theory, adapting the processes could provide a solution particularly when applying existing natural medicines to a textile, and create a new method of treatment for IBH and pruritus.

There are challenges to this approach, direct delivery of medicines to the skin of the equine and durability of the horse blanket will need to be established; the skin barrier can be difficult to access; horse blanket formulations and dosage amounts will also need to be established. Information gathered from this research will contribute to our understanding of host-parasite interactions and further development of smart textiles using micro-encapsulation and other technologies. As discussed in the literature review, new textile processes are used in many fields for delivering and target-carrying medicines and research by Janarthanan and Kumar, (2017) into plant-based possibilities for treatment support the possibilities for new ways to treat IBH.

The current chemical use for equines on the market are a mixture of treatment for human and animal consumption There are many food supplements for the control of IBH, but most again are still for human consumption turmeric, flaxseed, Aloe Vera are the most common (Horse and Hound 2019) (B). There are of course veterinarian treatment medical treatments that include vaccinations to suppress the equine's immune system IL5 is one of these used as a master regulator of white blood cells which control the role of allergic reactions in equines (RCVS 2019). Medical textiles and the advancement of research within the human sphere could provide a solution using manipulations of existing material, textiles and medical technologies. There is a multitude of chemical repellents and insecticides on the market to repel the midge from biting humans and to reduce the rate of the midge population (Robin et al 2014). The World Health Organization are leaders in chemical repellents to deter biting flying insects, but these are still predominantly for human consumption and farming and agriculture (World Health Organisation 2019). There is a clear gap when it comes to any adaptation or application of chemical repellents or medicinal textiles into a suitable medical textile.

There is much to be considered when going forward with development of a new horse blanket to treat IBH and pruritus, the experience of the participant needs to be considered, the education and willingness to understand the new possibilities that a smart textile protective horse blanket could provide. Cost and availability must also be considered. The demographics of the stakeholders is important as the condition and what is known in one area, for example the UK, is not going to be the same as Europe or the US or the middle east as the climate and the conditions and education will differ dramatically and will have different results. On reflection, when this research was started a wide scope of parameters were looked at on the condition IBH and pruritus, however, it is possible based on the results that the parameters of the survey and interviews did not cover a wide enough demographic.

Development of a smart textile to treat all forms of pruritus would need to be based on a wider scale of information to ensure a fit for purpose product.

6.0 CHAPTER SIX CONCLUSION

The recognition of issues caused by IBH and pruritus amongst the participants was high, and a pattern of similar emotional and financial distress was recorded through the face to face interviews and the survey, however, the demographics of stakeholder spend was varied. All participants used a combination of the same available treatments and showed frustration at the lack of advancement in methods of treatment. This research has provided a qualitative and quantitative approach on the subject and provided a critical evaluation and understanding of the key issues equine stakeholders felt associated with IBH and pruritus. The findings from this study provide a practical starting point for the investigation of the impact of IBH and pruritus in the field. Following the same themes quantitative results show a recognisable comparison to the information gathered from the interviewees; but any conclusions drawn should be made with caution due to the small sample size and limited geographical area of research.

Based on the themes explored within this study the same recurring factors arose to the treatment and welfare of the equine. The treatment focused on fly sprays and protective horse blankets as a course of action, however, it was evidenced that it was often left too late before horse blankets were applied, usually weeks after the first out-break of swarms, thus already triggering the reaction to the saliva in the midge leaving only management as a way forward. This could be due to the participants not realizing the changes in climate and expecting the midges to stay to the same seasonal pattern. Results showed that other treatments, insecticides and Benzyl Benzoate when used were not used with consistency, according to the interviewees, they reported to switch treatments in trying to find the best one. Due to the inconsistency of using various treatment regimens it is not possible to ascertain which treatment best treats the condition.

The study showed that it was not always possible for the stakeholders to choose the environment their horse was kept in, and the results show a clear distinction with keeping horses near wet over grown land and near streams and rivers as opposed to high windy dry land, the horses kept near wet land or rivers and streams showed more intensity to the condition. All the stakeholders tried to manage IBH with horse blankets, fly sprays and insecticides, but also with food supplements to try make the skin less reactive. There is no

guidance on how much supplement to give on food additives that are homemade, therefore, the combinations and amounts given could cause secondary problems causing ulcers or colic and are often undetected until too late. The information gathered from the interviews evidenced there is a plethora of herbal supplements given to their equines, and all believed in the prospect of success of treatment. However, there is no scientific evidence to back the effectiveness of the results. Commercially available feed supplements to suppress IBH specific for horses have undergone stringent testing and market research with results showing their effectiveness, however the market is saturated with different products to choose from and according to the interviewees; a lot of confusion when choosing the right product was experienced.

Location of equines suffering from IBH and pruritus were shown to be predominately in the middle of the country, however this is due to the sample size of the survey and the location on which the research was based. Responses from survey participants show the problem of IBH to be nationwide. The location graph shows the heavy breed most affected by the condition and the highest number of heavy breed owners were in the east of the country, with 21 participants responding to the survey, 19 from the south, 8 from the north and only 1from the west of the country. There is no evidence to explain the phenomenon of why the heavy breed are more affected, it is suggested that the coarseness of the coat hair allows for easier penetration by the vector. Overall, responding participants had over 30 years' experience and said that they did not think the condition had worsened over time. However, this also coincided with the spend of the stakeholders who took part; the highest spending was noticed from the South of the UK, followed by the Eastern region where costs associated to horse blankets, treatment and veterinary care was high. The Northern region indicated low level of costs for treating the condition. Implying, that if more money is available and spent on treatment and intervention, stakeholders are less likely to see a difference or change in the condition.

Recent news of a new vaccine researched by Evax, for a vaccine to combat IBH is exciting and has the hopes of the equine industry for success in treating IBH and pruritus. However, based on the research done by Evax, stating each individual equine has its own unique immune system and antibody reactions to IBH, each case will respond differently to different treatments. Taking this into consideration, a trans-dermal medicated horse blanket may not be appropriate for all equines. The extensive research in new textile technology for the delivery of medicines for human health has provided a starting point for any further

development of protective horse blankets for the equestrian industry. This hypothesis is yet to be extensively explored for the suitability and commercial practicalities within the industry as a treatment method for the condition and any advancement in horse blanket development for pruritic skin conditions in equines.

Recent introduction of antimicrobial applications in commercial products for the equestrian industry have been introduced to reduce the transmissions of infection (Takashima, 2019). There are many trans-dermal applications for wound care for use in the medical field for human consumption; these include, prescription patch delivery, medical additives, cosmetics, and materials for medical devices and diagnostic agents. Using polymer synthesis and coating materials adhesives resins that also provide treatment for human consumption. Adapting these processes could provide a solution particularly when applying existing natural medicines to a textile, and create a new method of treatment for IBH and pruritus (Takashima, 2019) The new textile would have to endure environmental changes conducive with equine life, heat, humidity, rain, and if stabled exposure to faeces and urine.

Significant developments in smart textiles promoting wound healing and slow release technologies have provided a base line in which to pursue multi medicinal release systems to treat IBH and pruritus. Further research techniques and methods need to be explored evaluating microencapsulation, polymerisation and bi- component polymers, antimicrobial finishing's, and molecular change in materials to determine the possibilities of combining the technologies. This study has evaluated existing data in the field of textiles and the equestrian industry relevant to the condition and treatment. However, microencapsulation in textiles is still in its infancy in development for equine health and could prove challenging in the development for a new horse blanket design, there is no current smart textile to treat the IBH in equines and to date no recorded of any testing of such smart materials on equines. Further research is required on equine stakeholders' perceptions and opinions on IBH and pruritus so that more generalizable conclusions can be drawn.

Microencapsulation techniques could benefit the advancement for the treatment of IBH and pruritus by developing multipurpose textile delivery system following microencapsulation, polymerisation, and antimicrobial technologies. These processes could be used to create a horse blanket that will provide a barrier to bacterial infections created from the open sores, agents to stop the itching and natural antibiotic properties. Blending cotton and polyester in an appropriate ratio would produce a textile that could be used to develop a new design in equine wear horse blankets for the treatment of IBH and provide a universal smart textile

horse blanket if proved to work effectively. This would also eliminate the constraints of time management involved in treating the condition and the cost implications faced by the stakeholders. Further research into textiles with the capabilities to deliver a trans-dermal delivery system in a wearable form for equines is needed. On reflection, this study shows that textile technologies within the equestrian industry are making significant advances and is a step closer in the possibilities to develop a new trans-dermal medical textile for the treatment of IBH and pruritus.

The participants clear awareness of the serious welfare implications that can result from the condition reinforces the importance of effective management of IBH and pruritus from an equine welfare perspective, and evidence a need for a better treatment strategy. An appreciation of how relative and important the current state of health and wellbeing for the equine in this study were made clear by all the stakeholders and the lack of innovation to treat the condition was apparent. Advanced progress on smart textiles show the possibilities of developing a new protective textile horse blanket.

Advanced research carried out by Knottenbelt (2012), into the immune systems of equines show the chemical reactions in equine's caused by the biting midge. The reaction of ineffective immunoglobin has been researched to be the cause of an outbreak of IBH and pruritus in equine's as referenced by Rendal (2014). Current research undertaken by Lomas, and Robinson, (2018) Show the most current research to date is as relevant as previous research and yet no comprehensive advancement in treatment or new design in horse blanket has yet to be developed .

The cause of the condition has not changed, and it is still relevant that within six hours of a bite from the midge a reaction is caused (Wagner 2015). Research shows an earlier spawning of the vectors due to a change in the climate with evidence that spring has now started six days earlier than previously causing outbreaks of midges. Research undertaken by the Woodland Trust show that spring is occurring six days earlier causing catastrophic problems with wildlife. As this is not a factor that the layman would pick up on the late administering of the current protective horse blanket is understandable (Woodland Trust 2019).

7.0 CHAPTER SEVEN: Further Research and Treatment Methods

IBH is not a topic that is discussed openly within the equine community, some participants felt they had to hide the fact that their equine had a problem with sweet itch and that it was a taboo subject. Treatment methods were often not openly discussed and when asked if a new equine horse blanket would be something that they thought relevant, each participant agreed it would be something they would purchase and looked forward to. Further research will explore a more direct delivery of treatment, analysing appropriate textiles and methods of micro-encapsulation, spray drying and relatively new techniques of polymerization and ceramic and silver blending processes. Investigation into the use of medicines in a horse blanket that is breathable on the interior with a coated waterproof exterior and a trans-dermal medicated property; assessing different textiles for their durability and functionality, will be explored to establish the most effective baseline to create samples.

Sample prototypes will be tested at Manchester Metropolitan University laboratory facilities under a controlled clinical trial basis. With collaboration and guidance of Dan Harding, Veterinarian and Director of McMurtry and Harding. The trans-dermal sample horse blankets will be placed on four subjects (equines, ponies) and monitored daily in a controlled study. Data recorded will be the environment in which the subjects live, climate, age, breed, diet of the equine, general health, weight and condition, and all other variables relevant to the study. The hypostasis is that equines and ponies treated with a medicated horse blanket using a trans-dermal delivery system and other technologies, will show improvement in their condition of IBH and pruritus.

Recordings and examination of the infected skin areas and lesions will be taken daily by visual and photographic reports, and a daily recorded evaluation of the comfort of the subject. Comparisons will be made against equines treated using existing methods, with a control group treated with the same horse blanket, without the trans-dermal medication. The study through the methods mentioned above, aims to examine the possibilities and the potential production of a new design in equine horse blanket to target IBH and pruritus in the equine industry. Consultation and collaboration of Manchester Metropolitan University science department will provide advice and support in the production and analysis of the chemical or plant-based components. Following the development of ingredients using in-vitro studies at Manchester Metropolitan University and expertise from the textile institute a suitable textile structure embedded with medicines through micro-encapsulation or other technologies will be created.

Further research will explore the design of existing horse blankets and asses the possibilities of adaptation to include a cage like structure on the neck and wither and the rump area to alleviate pressure on any soars after excessive rubbing. These new textiles will include medicinal elements to include antibacterial, plant-based properties and existing natural fly repellents. The new design will explore new colour combinations and new mixtures of textiles to produce the most suitable, durable and comfortable horse blanket.

Through the methods mentioned above, this research aims to examine the possibilities and the potential production of a state-of-the-art equine horse blanket to target pruritus in the equine industry. The below diagram shows the elements that will be followed to produce the new trans-dermal horse blanket. As shown in the diagram the 4 main central elements will be the base line to build a fit for purpose horse blanket to combat IBH. Under diagram section 2.0/2.5, further research will combine the different textile technologies with different medicinal applications and rigorously tested under laboratory conditions before applying to specific selected equines for conformation of any improvement of the condition

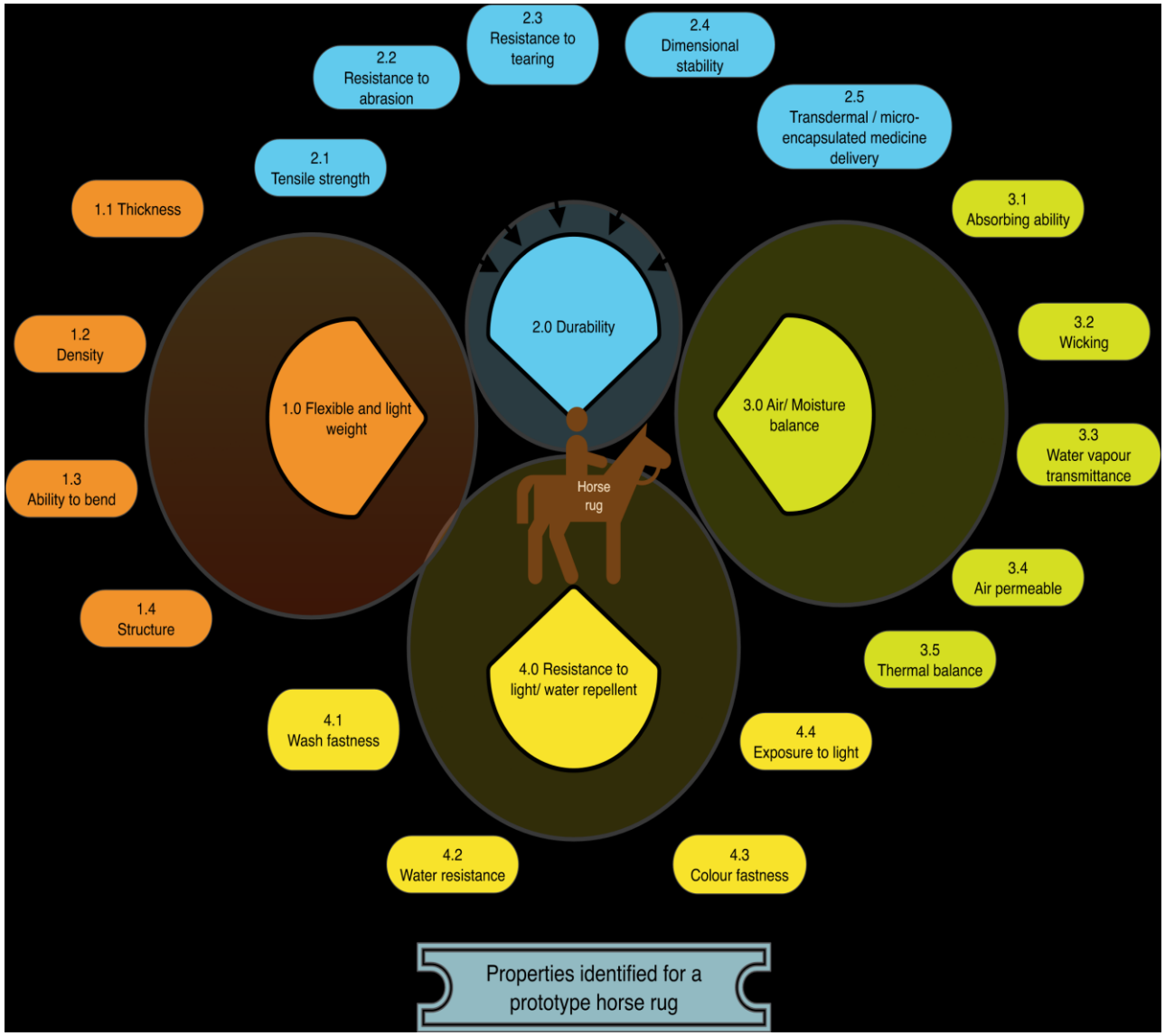

Figure 31. New horse blanket design template

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Appendix 1

Manchester Metropolitan University

Faculty of Arts and Humanities
Research and Knowledge Exchange

Manchester Metropolitan University, Room 123,
Geoffrey Manton Building,
Rosamund Street West,
Off Oxford Road,
Manchester, M15 6LL, UK

+44 (0)161 247 6673

Dr Prabhuraj Venkatraman
Manchester Fashion Institute

29 October 2018

Dear Dr Venkatraman,

Application for Ethical Approval: Tanya PERKINS

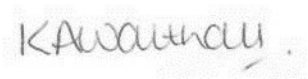
Project Title: The Development of a Trans-Dermal Textile to Combat Pruritus (sweet itch) in the Equestrian Industry

1 Ethics Reference Number: A&H1718-73

I am pleased to inform you that the above Ethical Application has been approved unconditionally.

I would be grateful if you could inform the other member(s) of the supervisory team.

Yours sincerely



Katherine Walthall
Research Group Officer

Tel: +44 (0)161 247 6673 Email:
k.walthall@mmu.ac.uk

Appendix 1

Consent Form

Research investigator: Tanya Perkins

Research Participants know as: Interview 1, Interview 2, Interview 3, Interview 4, Interview 5, Interview 6, and Interview 7.

The interviews will occur once a month, from May through October, at a time agreed. There are no anticipated risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time.

Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research undertaken from UK institutions require that interviewees explicitly agree to being interviewed and how the information contained in their interview will be used. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information sheet and then sign this form to certify that you approve the following?

• The interview will be recorded, and photographic evidence will be taken of the subject (horses) and a transcript will be produced.

• You will be sent the transcript and given the opportunity to correct any factual errors

• The transcript of the interview will be analysed by Tanya Perkins as research investigator

• Access to the interview transcript will be limited to Tanya Perkins and academic colleagues and researchers with whom she might collaborate as part of the research process

• Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be made anonymous so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed.

• The actual recording will be destroyed or returned to you.

Singed: Researcher

Singed: Participant

Appendix 1

Faculty of Arts and Humanities

Research and Knowledge Exchange

+44 (0)161 247 6673

Participation Information Sheet 1

Study Title **Development of Smart Trans-Dermal Textile to Combat the Condition Pruritus (sweet itch) for the Equestrian Industry**

Invitation to participate

I would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Ask questions if anything you read is not clear or would like more information. Take time to decide whether to take part. All information will remain anonymous, confidential and be stored on a password protected database. Pseudonymization information will be used in the researchers (Tanya Perkins) project and will be used in any further study and subsequent Master's Research thesis. Results from this study may also be published in relevant publications, presented at research conferences and shared with relevant stake holders.

Purpose of the study

The purpose of the study is to gain current knowledge of the condition sweet itch in horses, ponies, donkeys, and mules; I use the term "Horse" throughout the survey; however, this refers to all equids including horse, pony, donkey, and mule. The study will collect information on current treatments being used. Information on the effects of the condition on the HPDM and the owners to include finances and emotional distress if any; your thoughts and experiences are vital to this research and I greatly appreciate you taking the time to participate. The results from this research will be to determine if there is a specific method of treatment most effective and to produce a new trans-dermal textile to deliver existing treatments. We have checked that the processing is necessary for the relevant purpose and are satisfied that there is no other reasonable way to achieve that purpose as under new GDPR law article 6, 25th May 2018.

Invitation

Faculty of Arts and Humanities

Research and Knowledge Exchange

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You have been invited to join this study based on your experience with HPDM ownership with the condition sweet itch.

Taking part

- You will be required to have a face to face interview lasting approximately 40 minutes (November 2018), to assess the progress of the treatment's used and the progression of the condition
- This can take place in the area your horse is kept in, your home, or an open public space
- You will be asked a series of questions about your HPDM and his/her condition
- Consent to take photographs of the HPDM and permission to publish the pictures within the Research Thesis at Manchester Metropolitan University if required
- There are no expenses or payments involved
- No discomfort, inconvenience or risks are anticipated, but if at any time you feel distress at the conversational topic the interview will be concluded
- This is a research study undertaken by myself Tanya Perkins 07595650773 tanya.perkins@stu.mmu.ac.co.uk at Manchester metropolitan University Benefits

We cannot promise the study will help you but the information we get from the study will help to increase the understanding of Pruritus in equines, specifically Sweet Itch and may lead to possible new methods of treatments

If you have concerns or would like to make a complaint

If you have a concern about any aspect of this study, you should ask to speak to the researcher or supervisor of the researcher, who will do their best to answer your questions researcher contact (07595650773) or Dr P Venkatraman senior supervisor at Manchester Metropolitan University (0161 2476581)

If you remain unhappy and wish to complain formally you can do this through Manchester Metropolitan University complaints procedure complaintsappeals@mmu.ac.uk Tel: 0161 247 1095

Confidentiality of Data

Interview data will be recorded in writing and photography of the subjects (horses) Interview material and questionnaires will be kept anonymous. All information which is collected about you and your horse during the course of the research will be kept strictly confidential, and any information about you which leaves the university will have your name and address removed so that you cannot be recognised. All interview materials will be returned to you after the completion of the study or will be destroyed by the researcher at your request. If you withdraw from the study, we will destroy all your identifiable samples/ tape recorded interviews, but we will need to use the data collected up to your withdrawal.

General Statements

I confirm that I have read the information sheet dated (..... .....) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

I understand that the information collected about me will be used to support other research in the future and may be shared anonymously with other researchers.

Singed …….

Appendices 2

Ethics Approval Number: A&H1718-73

Veterinary Interview, Opinion and Answers

Interviewee 7

McMurtry and Harding Veterinary Practice

Clinical Director/Vet

The questions put forward to the vet are more clinical in nature, the purpose in this questioning was to ascertain a professional perspective and the questions and answers are listed.

Question 1.

What do you consider the most common symptoms within the sweet itch range?

'Pruritus, hair loss and pyoderma which is skin infection'.

Question 2.

What characteristics do you most see in a horse that you feel shows general signs of sweet itch?

How do you classify these?

Equids showing signs of with mane and tail itching. Hair loss in these areas, bald patches on the face and ears where there has been rubbing.

Question 3.

What time of year do you consider most prevalent for the onset of the symptoms?

Early spring, but cases are lasting longer because the weather is milder and wetter in the winter months.

Do you think all cases of IBH follow the time of year pattern?

Yes

Question 4.

Or do you think due to current climate changes that there is no specific start or finish time for the subjects to be affected?

I think that because the climate has been milder in the winter months the midges are more persistent and thus it takes longer the symptoms of sweet itch to go.

Question 5.

On a daily/weekly basis how many cases do you see?

We don't see many cases that we are called out for. Most of our clients manage their horses sweet itch quite well

Question 6.

How many horses do you see for something else but that show signs of sweet itch?

Question 7.

How many do you see on a weekly/monthly basis to treat a severe secondary injury caused by sweet itch?

Question 8.

Do you see many successful attempts by horse owners containing/treating sweet itch?

Well the people that don't treat and use medication to contain sweet itch, we don't see! These people don't usually call on our services. I imagine there are a lot of untreated cases. We as a practice see a reasonable amount of cases of horse owners with sweet itch, but of course these are the people that care about their animals so are doing their best to treat them anyway.

Question 9.

If not, what are some of the factors you feel are missed or neglected by owners?

Across the board all aspects of the onset of sweet itch are missed and on average people allow it to progress too far before intervention.

Question 10.

Do you think the reasons for this are financial/time/lack of knowledge?

I would say it's more a lack of knowledge, particularly after a first attempt to treat the condition has failed, this becomes the biggest barrier because then more treatments are tried that may not be appropriate.

Question 11.

For those horse owners you see keeping horses with sweet itch in good order, what do you think are the contributions to this?

Prevention, physical barriers, horse blankets, money spent on topical treatments and knowledge of the condition.

Question 12.

Do you think as general horse owners we know enough about the condition/the causes/ and treatments?

It's too difficult to generalise, it's a full range of some people who really have the knowledge on the condition and some people who really have no idea.

Question 13.

Do you think IBH is a condition that should always be regarded as a veterinary condition that horse owners should see it as such. I mean, like a condition that should be advised by a vet. The same as a colic for example?

Answer

Horses with colic by comparison, it is expected that a vet will be called. Sweet itch is not as serious as colic and may be able to be managed without the vet being called. If the horse owner has enough knowledge, they are able to prevent and contained the condition without a vet being called. However, this flips from unnecessary to have a vet visit to out of control. By the time the vet is needed the condition is usually very bad.

Question 14.

Do you feel as a vet that you are given enough information on advancements in treatment of IBH and do you feel there is enough research on the condition?

Answer

I feel as a vet it's up to us to get the information; and the information is out there

Question 15.

Do you think sweet itch has become a condition that is not taken as seriously as it could be because there is no cure?

Answer

Most owners recognise the condition and do ask for help. Its accepted that there is no cure and that it is a condition that needs to be managed well. Most owners that are in my practice are above the average when it comes to knowledge on the condition and more than average ask for help.

Question 16.

Is there any way that sweet itch could be diagnosed before an outbreak? For example, a test of some kind, so the horse owner could be more prepared?

Answer

Question 17.

How many cases of IBH do you think are misdiagnosed as sweet itch by horse owners? When it is in fact a reaction to something else? i.e food/sweat/sun/grass etc

Answer

I think it is easy to use the term sweet itch inappropriately as sweet itch is a term generally used for everything when it comes to itchy skin.

Question 18.

Do you feel there is a need for a new way to treat IBH in horses? If so; what ideas do you have?

Answer

It could be relevant if it works; I think you need to think what the most relevant medicines would be to use in the microencapsulation process. Calamine is a good topical lotion for treating itching skin and insect bites or Aloe Vera is also very soothing. To have a horse

blanket with fly repellent maybe all you need! Antibiotics in the horse blanket would send you down a whole different path as there would be different governing bodies you would need to get approval from, the (VMD) Veterinary Medicines Directorate, and there would be concerns as to the appropriate use of antibiotics without a proper diagnosis for need. Benzyl Benzoate is not medicine that would need approval from the VMD and has been the backbone of treatment for skin conditions for a long time.

Question 19.

Do you think a medicated horse blanket using microencapsulation technologies would be relevant for this condition?

Answer

Yes

Question 20.

How well received do you think a horse blanket of this type would be? And do you think it would be well received by all the stake holders/vets/insurance companies? And if not; why?

Answer

I think a horse blanket of this kind as a treatment would be very well received and I think on a commercial level you would have a wider audience than compared to just vet recommendation. As vets we are governed by a several different bodies, the VMD, Veterinary Medicines Directorate who oversee animal health and welfare and ensure the safety, quality and efficiency of veterinary medicine. The RCVS, Royal College of Veterinary Surgeons are the regulatory body governing vets. We are governed by CASCADE, cascade is when a veterinary medicine is used in another species or is used to treat another disease, so there will be a lot of things to take into consideration when deciding on what medicinal elements you want in your horse blanket.

Question 21.

Do you think if the horse blanket is proven to be effective that it should be available through insurance claims?

And only through insurance claims?

Answer

Yes, it could be available through insurance companies, but it is the insurance companies that decide what they will allow to be claimed for through insurance

Question 22.

Would you be happy to continue to support and answer any questions as this research develops?

Answer

Yes, it's very interesting; IBH is a relatively simple problem that is exceptionally difficult to resolve.

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Questionnaire Interviewee One.

Age: Of Participant	44
Gender: Of Participant	Female
Do you live in the UK	Yes
How many years' experience in horse ownership?	5 years.as an owner.
Classify Horse/Pony/Donkey/ Gender	Mare
Classify Horse/Pony/Donkey/ Breed	Irish Draft X.
Classify Horse/pony/Donkey/ Type	Good doer
Classify Horse/Pony/Donkey/ Age	8
When was the itching first was noticed?	1-2 years old
Do you think the itching was learned behaviour?	No but maybe now is habit
Please specify	

How are your horses kept in the summer months?

Option one: stabled 24/7

Option two: turned out 24/7

Option three: stabled 24/ with limited turn out

Option Four: stabled at night Yes

Option Five: stabled in the day

How do you manage your horse sweet itch?

Option one: restricted turn out

Option two: horse blankets Yes

Option three: fly spray/creams Yes

Option four: Other Specify

What secondary conditions have resulted from your horse's sweet itch?

Option one: Open soars Sometimes on her tail

Option two: Infection

Option three: Laminitis

Option four: Colic

Option five: Dietary problems

Other Specify ……

How much money do you spend on the management of the condition annually?

£10-£100

£10-£100

£100-£200 £100-£200

£200-£500

£500+

Does your horse's sweet itch effect what you do with your horse? Specify

No

What treatment was given by your vet (if any) Tick all that apply

Options:

Lotion

Creams

Supplements

Horse blankets

Antibiotics

Antihistamines

Steroids

Home Remedies (Please Specify) Anti itch shampoo

Interview One: Statement

Horse: Nuala

See Figure 8, Page 18

I have known my horse Nuala since she was born. Her mother Bridget is owned by my friend who purchased her from a horse dealer in Cheshire. She was told that she had come from a sale in Ireland. Bridget has an Irish passport stating that she is a full Irish Draught. Unknowingly, when my friend purchased Bridget she was in foal and Nuala is that foal. So, we do not know anything about Nuala's sire. Nuala is smaller and a little bit finer than an average Irish Draught. She was born on a farm in Stanton near Ashbourne and was kept with her mother and one other mare that was unrelated. On the farm there was also cows and sheep, but grazing was always kept separate from the other livestock. The horses were always strip grazed with the electric fence being moved every day to give them a new patch of grass. Nuala was well handled from being a foal and has a very good temperament but can be very 'marish' with other horses when out hacking – ears back and will threaten to or kick when others get too close. However, she is safe and sensible to ride.

I bought Nuala when she was 3.5 years old – she had been put in Rambo Sweet Itch horse blankets for a year or so previous to this as she had become a very itchy horse, but I don't know how bad this was or if any other treatment was given. She also developed a lot of sarcoids, mainly along the midline of the belly and the inner side of the rear legs at the top, with one on the chest and one on the neck. After taking ownership of Nuala I did treat her sarcoids, initially with Liverpool cream and have since used the cream the owners can apply (can't remember the name) and have had some banded. At the moment she doesn't have any actively growing sarcoids and has responded well to all the treatments. Because I was told she had Sweet Itch when I bought her and also because of the sarcoids, I have always kept her in horse blankets for protection in the summer. She seems to be a very itchy horse anyway, or itching is now a habit with her as she will still itch in the winter when there are no midges or flies.

She mainly itches her tail and will rub along the wall of the stable from side to side. However, if a horse blanket is kept on her in the stable, she seems to do this less. I will wash her tail

quite frequently, at least once a week in the summer, and I use Nettex Summer Freedom Salve (was previously called Itch Stop Salve) on her tail and sometimes on her mane. This does seem to help and soothe the itching – I have never let it get to a point where she has become bald or drawn blood from the itching.

Question One: Does your horse have IBH or Pruritus? What do you know about the condition?

Question Two: Treatment Current/Food Supplements

> 'I feed her garlic as I was told that that helps to deter flies and midges from biting because it makes their blood smell'.
>
> (Interviewee 1, hobbyist)

Question Three: What environment is you horse kept in?

> "Because I was told she had sweet itch when I bought her, I have always kept her in horse blanket's for protection in the summer, she just seems to be a very itchy equine anyway, I think it's the habit she is kept in, and she still itches in the winter". 'They're covered up 24/7 and are never given a chance to actually start to rub, because I do think it's learnt behaviour

> 'My equine she gets so itchy, and so used to the fact that even if you are soothing it (the itch) she carries on itching because it's sort of habitual. My girl, Nula, itches all the time even in the winter and rubs her mane and tail off when there are no midges. It's really weird to see and leaves me at a loss of what I can do for her. I can't believe that there is no better solution, especially in my job where I sell products to vets, that there is nothing that anyone has come up with to combat this horrid skin complaint'.
>
> (Interviewee 1, hobbyist)

Question Four: What are the financial implications? Would you buy a horse knowingly with IBH or Pruritus?

‘No, I definitely would not again, because it stops you doing so many things. They never look good or well and the time and money that’s involved makes it not fun at all, and the point is that it’s meant to be fun. Constantly look scruffy, and the management time that is involved

(Interviewee 1, hobbyist owner)

Question Five: What horse blankets are you currently using? What horse blankets/treatment would you like to see in the future?

‘During the summer months she has to be in a fly horse blanket, but she is actually in a fly horse blanket for probably nine months of the year’.

(Interviewee 1, hobbyist)

‘I don’t think that anything on the market is that effective. Nothing I use on Nula works or stops her from itching. We all know what causes it, but no one knows how to stop it, which I find really hard to believe in this day and age. Nothing stops her from itching her mane and tail out’.

(Interviewee 1, hobbyist)

Ethics Approval Number: A&H1718-73

Questionnaire: Interviewee Two

Interview Transcription

Age: Of Participant	24
Gender: Of Participant	Female
Do you live in the UK	Yes
How many years' experience in horse ownership?	14 years.as an owner.
Classify Horse/Pony/Donkey/ Gender	Mare
Classify Horse/Pony/Donkey/ Breed	Welsh X TB
Classify Horse/pony/Donkey/ Type	Difficult to keep weight on
Classify Horse/Pony/Donkey/ Age	4
When was the itching first was noticed?	12 months old
Do you think the itching was learned behaviour?	No

Please specify

How are your horses kept in the summer months?

Option one: stabled 24/7	
Option two: turned out 24/7	
Option three: stabled 24/ with limited turn out	Yes
Option Four: stabled at night	Yes
Option Five: stabled in the day	Yes

How do you manage your horse sweet itch?

Option one: restricted turn out	Yes
Option two: horse blankets	Yes

Option three: fly spray/creams Yes

Option four: Other Specify

What secondary conditions have resulted from your horse's sweet itch?

Option one: Open soars Yes

Option two: Infection Yes

Option three: Laminitis

Option four: Colic

Option five: Dietary problems Yes

Other Specify

How much money do you spend on the management of the condition annually?

£10-£100

£10-£100

£100-£200

£200-£500

£500+ £500+

Does your horse's sweet itch effect what you do with your horse? Specify

Yes, I can't rider her or train her at all as she is so uncomfortable.

What treatment was given by your vet (if any) Tick all that apply

Options:

Lotion

Creams E45 skin cream

Supplements Soy Oil/Seaweed

Horse blankets Fly Horse blankets

Antibiotics Yes

Antihistamines Yes

Steroids Yes

Home Remedies (Please Specify)

Interview Two Statement

Horse: Tink

See Figure 2, 3, 4, Page 14

A young lady in her twenties hobbyist horse owner with horse kept at a local DIY livery yard in the Midlands UK:

Horse; Mare four years old; Breed mixed welsh x TB skewbald.

Participant: Female aged 24 years, grew up on a dairy farm and has owned horse and ponies from the age of four.

My young mare was a rescue project when she was a foal, she was rescued by a friend and if I had not taken her, she was to be shot I was given her for my 15th birthday. I got Tink when she was 12 months old, she was in a very sorry state. She was as thin as a hat rack, riddled with worms, matted hair from head to toe and very angry looking bare skin on her legs. I thought it was caused by the sun because she has pink skin; I didn't know that it could be caused by a fly bite. I had the vet to her, and they said it could be a mixture of things, they said it could be caused by fly's and midges, they also said it could be the sun. We had her checked by several different vets who were at a loss to the cause of the condition. Blood lest were done to check her liver and it was suggested it could be a reaction to the sun or it could be eczema. Either way the open sores attract the fly's and the midges, and she is in constant discomfort, I am at a loss as to what to do. I have been using a mixture of different creams and sprays as well as prescribed antibiotics and steroids, nothing works. Every day I go to the yard to care for her, it is heart breaking and I end up crying every day I see her. She is only four and if I cannot figure out what the problem is, I may have to have her put down. It has got worse every year for the last three years, I really don't know what to do and the vets don't know what to do, so what should I do?

I asked the participant what she thought to a horse blanket that was medicated for the whole body; and in this case that also covered the legs with medicines that housed antibiotics, anti-itch and fly repellent. The participant responded in tears and stated that she would try anything and asked if I had such a horse blanket that she could put on with immediate effect.

Question One: Does your horse have IBH or Pruritus? What do you know about the condition?

> ‘She had very angry looking bare skin on her legs. I thought it was caused by the sun because she has pink skin.’ ‘I didn’t know that it could be caused by a fly bite. I had the vet to her, and they said it could be a mixture of things, they said it could be caused by fly’s and midges, they also said it could be the sun. We had her checked by several different vets who were at a loss to the cause of the condition. Blood test were done to check her liver and it was suggested it could be a reaction to the sun or it could be eczema. Either way the open soars attract the fly’s and the midges, she is in constant discomfort’.
>
> (Interviewee 2, hobbyist owner)

Question Two: Treatment Current/Food Supplements

Question Three: What environment is you horse kept in?
Question Four: What are the financial implications? Would you buy a horse knowingly with IBH or Pruritus?

Question Five: What horse blankets are you currently using? What horse blankets/treatment would you like to see in the future?

> *‘She has a fly horse blanket on at all times, even in the winter under her winter horse blanket, and cream is applied every day of the year’.*
>
> (Interviewee 2, hobbyist owner)

> *‘I have used all the possible treatments out there, fly horse blankets, stabling, and applying lotions daily. If there was ever a sweet itch vaccination, then I would definitely give it a try, or following this research, if there is a horse blanket produced from this research, I would be first in line to try it’.*
>
> (Interviwee 2, hobbyist owner)

Ethics Approval Number: A&H1718-73

Questionnaire Interviewee Three:

Interview Transcription

Age: Of Participant	31
Gender: Of Participant	Female
Do you live in the UK	Yes
How many years' experience in horse ownership?	25 years.as an owner.
Classify Horse/Pony/Donkey/ Gender	Gelding
Classify Horse/Pony/Donkey/ Breed	Irish Draft
Classify Horse/pony/Donkey/ Type	Good doer
Classify Horse/Pony/Donkey/ Age	10
When was the itching first was noticed?	1 years old
Do you think the itching was learned behaviour?	No

Please specify

How are your horses kept in the summer months?

Option one: stabled 24/7

Option two: turned out 24/7 Yes

Option three: stabled 24/ with limited turn out

Option Four: stabled at night

Option Five: stabled in the day

How do you manage your horse sweet itch?

Option one: restricted turn out

Option two: horse blankets Yes

Option three: fly spray/creams Yes

Option four: Other Specify

What secondary conditions have resulted from your horse's sweet itch?

Option one: Open soars Yes sometimes

Option two: Infection

Option three: Laminitis

Option four: Colic Yes

Option five: Dietary problems

Other Specify ……

How much money do you spend on the management of the condition annually?

£10-£100

£10-£100

£100-£200

£200-£500

£500+ £500+

Does your horse's sweet itch effect what you do with your horse? Specify

No…….

……...

What treatment was given by your vet (if any) Tick all that apply

Options:

Lotion

Creams

Supplements

Horse blankets Yes

Antibiotics	Yes
Antihistamines	Yes
Steroids	Yes
Home Remedies (Please Specify)	Yes

Interview Three: Statement

Horse: Ozz

A livery yard owner and high-level competition rider with over twenty-five years' experience, Midlands UK:

Participant; Female age 31 years old. Grew up on a beef and sheep farm, owned several horses and ponies, competed to cci one* level, revered in her position as a horse owner a person that breeds and breaks young stock and has a reputation in rehabilitation and rescue of problem horses.

Horse, Gelding Ten years old; Homebred 17hh Irish Draft

Ozzy was bred and born at home and was always an itchy youngster/foal until he was about five years old, lots of youngsters are just itchy, but at five years he began to break the skin and became obsessive about itching certain areas, at this point I bought a cheap and cheerful fly horse blanket and washed his tail and mane regularly. He ruined every horse blanket I put on him from the constant itching including a boet horse blanket costing over £400 and considered the best on the market; he constantly got sweat up because the boet horse blanket is so heavy which made him itch even more. Ozzy continued to itch and break his skin along his back, neck, head and tail. Ozzy then suffered an injury which took over a year to recover from during this time his itching got much worse and was sometimes going through two horse blankets a day, this gives you an idea of how crazy he got with his itching. I tried all sorts of potions like "ditch the itch" fly spray fly cream, homemade potions, human anti histamine's, nothing worked. It got to the point that he would itch so much he would rip his horse blankets right off himself the he would get so wound up that the flies were on him he would colic. In one week, he had colic every other day which resulted in a vet call every other day. As he recovered from his injury, I noticed that his itching seemed less intense, but I did notice that at certain times of the day it got worse. He was at his worst in the evenings between 3.30 and 9.00, this seemed to be the time the midges would come out to bite. I noticed that although the midges were out in the morning early, they were more swarms and intense in the evening, ozz only seemed to get bothered by midges though.

I have had to get very creative to try to manage ozzys itching

Question One: Does your horse have IBH or Pruritus? What do you know about the condition?

Question Two: Treatment Current/Food Supplements

> *'You've got to work your whole routine around how you are going to manage treatment; this affects me as I have a large livery yard to run and I compete at competitions. It's a lot to ask my staff who already have a massive amount to do, to then trek across several fields three times a day to check he's not going bonkers with the midges or to make sure his horse blanket is on"*
>
> (Interviewee 3, competition owner, livery yard owner)

> *I have had to become very creative to try to manage Ozzy's itching, Ozzy was born and bred at home, his mum had sweet itch and I did notice that very early he started to copy her. I have kept a very close eye on his behaviour and have tried many different approaches. I have spent thousands of pounds in trying to make him more comfortable and have moved him to every different part of my land to try and combat the midges. He was sometimes going through two horse blankets a day because he would itch so much, he would simply destroy his horse blankets. This gives you an idea of how crazy he got with his itching. I tried all sorts of potions like, "ditch the itch", fly spray, creams, homemade potions, human anti histamines, nothing worked. It got to the point that he would itch so much he would rip his horse blankets right off himself then he would get so crazy when that the flies were on him, he would colic. In one week, he had colic every other day which resulted in a vet call every other day'*
>
> (Interviewee 3, competition owner, livery yard owner)

To help relieve the symptoms of ozzys IBH, I give him antihistamines, my vet said it was ok to give him up to 8 tablets a day and would not be harmful to him I don't know if it helped at all and it defiantly didn't cure it'.

(Interviewee 3, competition owner, livery yard owner)

Question Three: What environment is you horse kept in?

All my horse are kept in a mixture of high ground, low ground, wet and dry. I own a lot of land and its mixed. I tend to put the hardier ones on the more challenging land

Question Four: What are the financial implications? Would you buy a horse knowingly with IBH or Pruritus?

'It's tricky because I tend to buy them at a young age and as I have said earlier it doesn't come through until they are older so it would put me off, but at the same time if the animal was good enough, I know I could manage it.'

(Interviewee 3, competition owner, livery yard owner)

'I have spent thousands of pounds on horse blankets, vet bills and home remedies, I am too invested now, if I felt like I couldn't continue I would have him put to sleep')

(Interviewee 3 competition owner, livery yard owner)

'There is the cost of extra horse blankets which are very likely to need replacing frequently due to rips from the equine itching. If their sweet itch is so bad then you have to stable them, this incurs extra cost in bedding and feed. Stabling the equine, there is the cost of hay and bedding'.

'I had to get the vet to give ozzy a course of injections that did help short-term, but financially it was crippling.'

(Interviewee 3, competition owner, livery yard)

Question Five: What horse blankets are you currently using? What horse blankets/treatment would you like to see in the future?

'Routine-wise, it's quite hard when it's red hot to ask an equine to wear a fly horse blanket. It's probably actually easier to have them out during the night when it's cooler and have them in during the day, the best scenario is to make sure you get the fly horse blankets on before the midges start to hatch, so if my equines go out in February and its mild enough for them not to have a winter horse blanket on, their fly horse blanket goes on instead

(Interviewee 3, competition owner, livery yard)

'Lots of youngster are itchy, but at five years old he began to break his skin and became obsessive about itching, I washed his mane and tail regularly, he ruined every horse blanket I put on him including a boett horse blanket costing over £400. I knew the midges came out at night the worst on my land between 3.30 and 9.00pm. I noticed that, although the midges were out in the morning early, there were more swarms and were more intense in the evenings'

(Interviewee 3, competition owner livery yard owner)

'ozzys sweet itch caused him to colic every other day his sweet itch was so bad, because he was colicing so badly he then got another injury'.

(Interviewee 3, Competition owner, livery yard owner)

'*I had a Shetland that was a companion pony for all my youngsters, he had terrible sweet itch, he had a tiny boet horse blanket that he constantly destroyed. He suffered terribly and his skin was always bald and infected. I used to use Benzol Benzoate on him which helped. In the end he died, and I do think it's because of the stress of the constant itching.*

(Interviewee 3, competition owner, livery yard owner)

'I have had ponies and equines go over electric fences, jump them or through it to rub, I have experienced that first-hand,

its heart breaking, but what do you do? My home bred, ozzy is like my child, I would never put him down unless he was so miserable that I had no choice. It cost me fortunes, but I don't care. I wait for a better way to treat this condition and believe that it will come soon'.

(Interviewee 3, competition owner, livery yard owner)

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Questionnaire Interviewee Four:

Interview Transcription	
Age: Of Participant	41
Gender: Of Participant	Female
Do you live in the UK	Yes
How many years' experience in horse ownership?	12 years.as an owner.
Classify Horse/Pony/Donkey/ Gender	Gelding
Classify Horse/Pony/Donkey/ Breed	Welsh cob x warmblood
Classify Horse/pony/Donkey/ Type	Hunter
Classify Horse/Pony/Donkey/ Age	22
When was the itching first was noticed?	10 years plus
Do you think the itching was learned behaviour?	Don't know
Please specify	
How are your horses kept in the summer months?	
Option one: stabled 24/7	
Option two: turned out 24/7	
Option three: stabled 24/ with limited turn out	
Option Four: stabled at night	Yes
Option Five: stabled in the day	Yes

How do you manage your horse sweet itch?

Option one: restricted turn out Yes

Option two: horse blankets Yes

Option three: fly spray/creams Yes

Option four: Other Specify Yes

What secondary conditions have resulted from your horse's sweet itch?

Option one: Open soar Yes

Option two: Infection

Option three: Laminitis

Option four: Colic

Option five: Dietary problems

Other Specify ……

How much money do you spend on the management of the condition annually?

£10-£100 £10-£100

£10-£100

£100-£200

£200-£500

£500+

Does your horse's sweet itch effect what you do with your horse? Specify

Not really unless soars are in the girth area and if that is the case I don't hack.

What treatment was given by your vet (if any) Tick all that apply

Options:

Lotion

Creams

Supplements

Horse blankets

Antibiotics

Antihistamines

Steroids

Home Remedies (Please Specify)

Interview Four: Statment

A hobbyist horse owner and long-time horse rider.

I have owned Rhino for 3 years and had him on loan for 2 1/2 years previously to that.

He is a 22-year-old happy hacker who used to hunt and show jump with his previous owner, Bridget. I've known of Rhino for a few years before I had him on loan but not very well. Before I had him, I knew he was sweet itchy but not to what extent.

He is not full blown sweet itchy but does have it in a milder form. He wears a Rambo sweet itch horse blanket 24/7 from march to October apart from when we ride.

I use fly spray and cream on him daily march to September. Twice daily when flies are bad.

On advice from a friend he has 8 antihistamines (citirezine) daily during these months.

If he has any open sores, I use sudocrem to help them heal quickly and cleanly. However, if he gets into a habit of scratching it can take days to stop the cycle. We discovered by accident this summer if leaving a fly mask on overnight helps, as it's almost like security blanket!

We tend to ride early, especially during the summer, to avoid to many flies and midges usually plastered in spray to keep them at bay! Also, I try to make sure he is in before the midges appear in the evening.

I have found over the 5 or so years of having Rhino that management is the best prevention. I keep him in a routine all year round as he becomes itchy when he is stressed. I keep stocked up with antihistamines and fly spray!

Question One: Does your horse have IBH or Pruritus? What do you know about the condition?

Yes, he does, I have owned horses for a long time and aware of sweet itch and what causes it, midges. Rhino

suffers terribly from it, it cost me a fortune. Year round I must treat him

(Interviewee 4, hobbyist)

Question Two: Treatment Current/Food Supplements

'During the summer I give him human antihistamines (citirezine) on advice from a friend I also douse him in fly spray on his body and on his horse blanket when it's on. I also hog his mane'.

(Interviewee 4, hobbyist)

Question Three: What environment is you horse kept in?

Question Four: What are the financial implications? Would you buy a horse knowingly with IBH or Pruritus?

'It would depend on where I keep my equine; If I didn't have my equine where I do now, I would have to reconsider what I would do. My equine has sweet itch, but I can manage it quite well where I keep him').

(Interviewee 4, hobbyist owner)

Question Five: What horse blankets are you currently using? What horse blankets/treatment would you like to see in the future?

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Questionnaire Interviewee Five

Interview Transcription

Age: Of Participant	63
Gender: Of Participant	Female
Do you live in the UK	Yes
How many years' experience in horse ownership?	57 years.as an owner.
Classify Horse/Pony/Donkey/ Gender	Gelding

Classify Horse/Pony/Donkey/ Breed	Sport Horse x warmblood
Classify Horse/pony/Donkey/ Type	Hunter
Classify Horse/Pony/Donkey/ Age	15
When was the itching first was noticed?	10 years plus
Do you think the itching was learned behaviour?	No
Please specify	
How are your horses kept in the summer months?	
0	
Option one: stabled 24/7	
Option two: turned out 24/7	
Option three: stabled 24/ with limited turn out	
Option Four: stabled at night	Yes
Option Five: stabled in the day	Yes

How do you manage your horse sweet itch?

Option one: restricted turn out	Yes
Option two: horse blankets	Yes
Option three: fly spray/creams	Yes
Option four: Other Specify	Yes

What secondary conditions have resulted from your horse's sweet itch?

Option one: Open soar	Yes
Option two: Infection	
Option three: Laminitis	Yes
Option four: Colic	Yes

Option five: Dietary problems Yes

Other Specify ……

How much money do you spend on the management of the condition annually?

£10-£100

£10-£100

£100-£200

£200-£500

£500+ £500 +

Does your horse's sweet itch effect what you do with your horse? Specify

Not really unless soars are in the girth area and if that is the case I don't hack.

What treatment was given by your vet (if any) Tick all that apply

Options: All

Lotion

Creams

Supplements

Horse blankets

Antibiotics

Antihistamines

Steroids

Home Remedies (Please Specify)

Interview Five: Statement

A hobbyist horse owner and long-time horse rider.

I have owned Norman for 7 years and had him on loan for 2 1/2 years previously to that.

He is a 15-year-old happy hacker who used to hunt and show jump with his previous owner, Before I had him, I knew he was sweet itchy but not to what extent.

He is not full blown sweet itchy but does have it in a milder form. He wears a Rambo sweet itch horse blanket 24/7 from march to October apart from when we ride.

I use fly spray and cream on him daily march to September. Twice daily when flies are bad.

On advice from my vet who is my sister and is a homeopathic vet, I give him dandelion stalks from my garden, and he has 8 antihistamines (citirezine) daily during these months.

If he has any open sores, I use sudocrem to help them heal quickly and cleanly. However, if he gets into a habit of scratching it can take days to stop the cycle. I ride in the evening after work.

Question One: Does your horse have IBH or Pruritus? What do you know about the condition?

I am very experienced with the condition and have at one time or another always owned a horse with the condition (Interviewee 5, hobbyist)

Question Two: Treatment Current/Food Supplements

I use garlic and turmeric; I also use herbal plants from my garden

Interviewee 5, hobbyist)

Question Three: What environment is you horse kept in?

All my horses are kept at home on very high dry and windy land, I don't really have a problem with midges, but the black flies are horrendous. My horses come in with a blanket of flies on them, they get under their horse blankets, they are disgusting

(Interviewee 5, hobbyist)

Question Four: What are the financial implications? Would you buy a horse knowingly with IBH or Pruritus?

No

(Interview 5, hobbyist)

Question Five: What horse blankets are you currently using? What horse blankets/treatment would you like to see in the future?

A horse blanket that works!

(Interviewee 5, hobbyist)

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Questionnaire: Interviewee Six

Interview Transcription

Age: Of Participant	53
Gender: Of Participant	Female
Do you live in the UK	Yes
How many years' experience in horse ownership?	43 years.as an owner.
Classify Horse/Pony/Donkey/ Gender	Gelding
Classify Horse/Pony/Donkey/ Breed	Thoroughbred
Classify Horse/pony/Donkey/ Type	X Racehorse
Classify Horse/Pony/Donkey/ Age	11
When was the itching first was noticed?	After Purchase
Do you think the itching was learned behaviour?	No
Please specify	
How are your horses kept in the summer months?	Horse blankets and stabled

0

Option one: stabled 24/7

Option two: turned out 24/7

Option three: stabled 24/ with limited turn out

Option Four: stabled at night Yes

Option Five: stabled in the day Yes

How do you manage your horse sweet itch?

Option one: restricted turn out Yes

Option two: horse blankets Yes

Option three: fly spray/creams Yes

Option four: Other Specify Yes

What secondary conditions have resulted from your horse's sweet itch?

Option one: Open soar Yes

Option two: Infection Yes

Option three: Laminitis

Option four: Colic Yes

Option five: Dietary problems

Other Specify ……

How much money do you spend on the management of the condition annually?

£10-£100

£10-£100

£100-£200

£200-£500

£500+ £500 +

Does your horse's sweet itch effect what you do with your horse? Specify

Yes, his welts cover his entire body, so I can't put a saddle on him, as soon as I get one episode cleared up, he gets bitten again and the whole process starts again.

What treatment was given by your vet (if any) Tick all that apply

Options:

Lotion

Creams

Supplements

Horse blankets

Antibiotics

Antihistamines

Steroids

Home Remedies (Please Specify) All of the above and green sulphur

Interview Six:

A hobbyist horse owner and professional flat racing jockey

I have owned Alfie for 3 years

He is an 11 -year-old retired x racehorse I had only had him a few months then he came in from the field with a few fly bites on him. I didn't think anything of it, fed him and left him for the night. I came back in the morning and have never in my whole career seen anything like it. He was covered from head to toe in giant welts that had already started to burst with blood and puss. It was soul destroying and heart-breaking, so now he wears a premier equine sweet itch horse blanket 24/7 all the time apart from when we ride.

I use fly spray and cream on him daily every day. Twice daily when flies are bad.

On advice from a friend he has 8 antihistamines (citirezine) daily.

If he has any open sores, I use sudocrem and then green sulphur at nigh to help dry out the puss and to help them heal quickly and cleanly. However, if he gets into a habit of scratching it can take days to stop the cycle.

We tend to ride early, when I can

Question One: Does your horse have IBH or Pruritus? What do you know about the condition?

'I knew that midges caused a reaction in equines, but I wasn't quite sure how or why. I did know that there

are other skin conditions caused for other reason, the equines on the track have all sorts of skin complaints. It seems that once they are affected, they always seem susceptible, and there's nothing you can do about it really. I am retired now and have an equine for a hobby, he's very itchy and because I am now in an environment where the sole care of him is my responsibility, I have learned a lot more about the possible causes. I buy special horse blankets to protect him that cost a lot of money, but if he even manages to keep them on for more than 48 hours, they don't really protect him and definitely don't treat his broken skin'

(Interviewee 6, retired jockey)

Question Two: Treatment Current/Food Supplements

'If the case is severe then, yes, the track vet would come and give steroid injections, this had to monitored very carefully though as some of the substances couldn't be used too close to race day'.

(Interviewee 6, retired jockey)

Question Three: What environment is you horse kept in?

Question Four: What are the financial implications? Would you buy a horse knowingly with IBH or Pruritus?

'no, because of the time and money involved in an equine with sweet itch.' 'There is the cost of extra horse blankets which are very likely to need replacing frequently due to rips from the equine itching. If stabling the equine, there is the cost of hay and bedding. And then there is the cost of the vets for the cost of steroids,

antihistamines and benzyl, which will possibly be needed on a long-term basis.'

(Interviewee 6, retired jockey)

'I think definitely it impacts their welfare, it's very difficult to detach yourself from the situation when you have an equine with a bad skin condition because you have become already too invested. But if you were to take a step back you would probably understand that the equine is not happy and that you don't really have the money to treat it; really if it's that bad you should just have the equine put down'.

(Interviewee 6, retired jockey)

Question Five: What horse blankets are you currently using? What horse blankets/treatment would you like to see in the future?

'Obviously it takes more time, on the track these equines must be washed before they train, then after they train then before they race and after, its very time consuming and the equines are very uncomfortable especially because they get so hot. It would be brilliant if there was such a horse blanket that could protect and treat.

(Interviewee 6, retired jockey)

'I think once they have it, it will always come back there is no way really of stopping it.'

(Interviewee 6, retired jockey)

Appendix 3

Horse owners survey on sweet itch

Start of Block: Sweet Itch survey/ this is for all equines, horse, pony, donkey, mule

Q1 What breed is your equine? What type is your equine? (eg, heavy/light)

_____

Q2 Where do you live?

○ Town, county _____

Q3 What is your date of birth?

○ Enter as dd/mm/yyyy _____

Q4 Are you male or female?

○ Male

○ Female

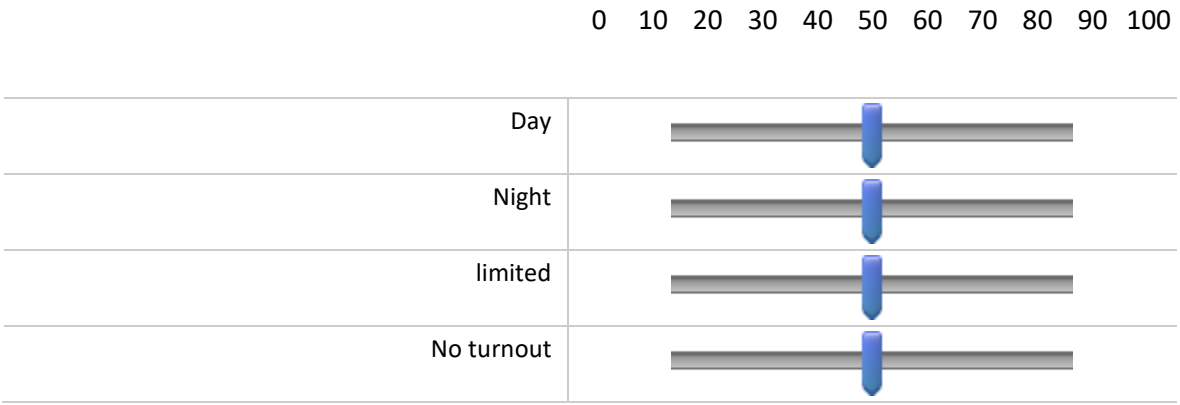
Q5 How many years of experience do you have?

○ 0-15 years

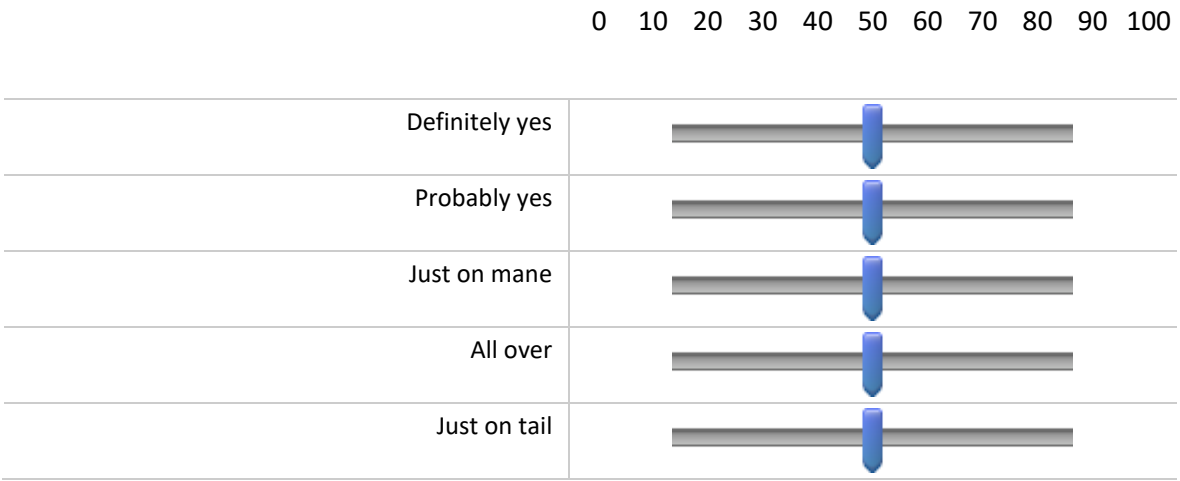
○ 15-30 years

○ 30 more years

Q6 Is your equine kept outside in the summer daytime? What % of time?



Q7 Does your equine have sweet itch? (0 = Mild, 100= Severe)



Q8 How do you manage sweet itch ?

- [ ] Fly Rug
- [ ] Vet Treatment
- [ ] Home remedies
- [ ] Other treatments used, please specify below

_____

Q9 What products do you use?

- ○ Steroids
- ○ Antihistamines
- ○ Fly spray/cream
- ○ Other _____

Q10 How much money do you spend annually on treatment and rugs?

- ○ £0-100
- ○ £100-200
- ○ £200-300
- ○ £300-400
- ○ £500 +

Q11 What secondary problems have occurred as a result of the condition, if any? (0 = mild, 100 = severe)

0 10 20 30 40 50 60 70 80 90 100

Open sores/infections	
Colic	
Dietary problems	

Q12 Have you had to have your equine euthanized due to the severity of sweet itch?

- [ ] Yes
- [ ] Yes, due to secondary problems
- [ ] No

Q13 Are you concerned with current treatment?

- ○ Yes
- ○ Maybe
- ○ No

Q14 If you are concerned with the treatment highlight the major areas here

- ○ Comments here _____

Q15 Does your equine's sweet itch condition affect what you do?

- ○ Yes
- ○ Maybe
- ○ No

Q16 What environment is your equine kept in? Tick all that apply.

- ○ High ground
- ○ Wet ground
- ○ High vegetation
- ○ Open ground
- ○ Combination of all of the above

Q17 Does the condition worsen each year?

- ○ Yes
- ○ Maybe
- ○ No

Q18 Do you have to change your treatment every year to contain the condition?

- ○ Yes
- ○ No

Q19 Do you think that the midges are swarming for longer periods at sunrise and sunset?

- ○ Yes
- ○ No

Q20 Do you think that the midges are thriving for longer in the year.

- ○ Yes
- ○ No

Q21 Do you think there has been progress in the treatment for sweet itch?

- ○ Yes
- ○ No

Q22 What do you consider the best treatment for sweet itch?

_____

Q23 Which sweet itch rug do you consider the best?

_____

Q24 Did you know your equine had sweet itch before purchase?

- ○ Yes
- ○ No

Q25 Would you have purchased your equine if you had known that he/she had sweet itch?

- ○ Yes
- ○ Maybe
- ○ No

Q26 Please enter your email address if you would like to be entered into the prize draw for a £25 Amazon voucher

_____

End of Block: Sweet Itch survey/ this is for all equines, horse, pony, donkey, mule