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Investigation of Myofascial Trigger Points in Equine Pectoral Muscles and Girth-Aversion Behavior

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ABSTRACT

Horses displaying aversion to fastening of the girth may be expressing pain from myofascial trigger points (MTrPs). The location of MTrPs in the pectoral region of horses has not been previously described. The objectives of this study were as follows: (1) to locate and map MTrPs in the transverse and ascending pectoral muscles; (2) to score the severity of the MTrPs by behavioral reaction to palpation; and (3) to look for associations between these findings and girth-aversion behavior. Thirty-eight horses were recruited in a cross-sectional clinical study. Taut bands were identified on palpation of horses undergoing physiotherapy assessment and then scored for behavioral reaction to palpation as normal (0), mild (1), moderate (2), or severe (3) and mapped. Owner-reported history of girth-aversion behavior was compared with the severity score using chi-squared analysis. Myofascial trigger points were identified in all horses (average severity: mild n = 6, moderate n = 24, and severe n = 8) with the most common regions of ascending pectoral muscles being the axillary and along the region usually covered by the girth. Horses with an owner-reported history of girth-aversion behavior (n = 13) had higher severity scores than horses without a history of girth-aversion behavior (n = 25; $P = .014$). Knowledge of the presence and location of MTrPs could assist in the development of prevention and management strategies to improve comfort, optimize performance, and reduce girth-aversion behavior.

1. Introduction

Girth-aversion behavior or “girthiness” is an adverse behavioral response to the girth being fastened. It may manifest as biting, flattening the ears, blowing out, swishing the tail, moving away, and other general signs of discomfort or avoidance. Girth aversion has been proposed to arise from (1) failure of the cutaneous trunci reflex (which is conveyed along nociceptive fibers) to habituate to persistent stimulation or (2) in response to pain caused by compression of the muscles beneath the saddle and girth [1]. Clinically, some horses display girth-aversion behaviors during treatment of myofascial trigger points (MTrPs) in the pectoral muscles and subsequently improve as the MTrPs are released. It has been hypothesized that horses displaying girth-aversion behavior are expressing pain from MTrPs.

An MTrP is a harder-than-normal bundle of contracted muscle fibers and inflammatory mediators [2]. Various mechanical and nervous system stresses, such as compression, poor posture, and eccentric muscle loads, are proposed catalysts [3]. The two crucial events for MTrPs to form are sensitization of nociceptors and excessive

Ethical animal research statement: All horses were assessed and treated as part of routine clinical practice and as per the regulations for the Department of Agriculture and Food, Western Australia, the data collection was considered incidental and did not require separate ethical approval.

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endplate action potentials [4]. When combined in the same location, they produce the four key characteristics of an MTrP, described in humans as: a taut band, painful/tender area, referred pain, and local twitch response [3]. Spontaneous electrical activity (SEA) (a by-product of excessive endplate action potentials) is detectable via needle electromyography at active MTrP sites [3]. Spontaneous electrical activity is only found in active MTrPs (not latent MTrPs) and in humans is highly correlated with reported pain intensity and pressure-pain threshold [5].

Myofascial trigger points in animals are comparable to MTrPs in humans. Although referred pain is difficult to evaluate in animals, the taut band, local twitch response, and behavior attributed to pain on palpation have been described in horses [6], dogs [7,8], rabbits, and rats [3,9]. Spontaneous electrical activity has been recorded in equine cleidobrachialis muscle at sites determined by palpation to be MTrPs compared to no SEA at control sites [6]. The SEA recorded in horses has the same characteristics as those reported for rabbits, rats, and humans [3,6]. Fascia runs through and surrounds muscles; however, little is documented on the fascial component of myofascial trigger points. Horses have thick extensive fascia, the relevance of this to MTrPs, and the present study is unknown.

Human studies have determined that MTrPs have tiny loci, 1.6 ± 1.1 mm^2 [10], with a slightly larger surrounding area that produces a pain response. Intertester precision for locating MTrPs in humans was found to be 6.5–7.6 mm or approximately the width of the fingertip [11]. The more severe the MTrP the more reliable it was to locate [11]. Human studies are in agreement that pain response and pain referral are the most reliable findings [3,12,13]. Local twitch response is the least consistent finding, yet Hong and Simons [3] suggest that it is useful to confirm diagnosis as it is often elicited during treatment. Human studies found that protocols closer to normal clinical practice produced greater agreement suggesting summation of visual observation, palpation, and subject expression of pain are superior to palpation alone [11,13].

Palpation of active MTrPs elicits pain. Animals communicate pain through their behavior. Orthopedic pain in horses scored by behavioral response to palpation was found to be specific, sensitive, and reproducible [14]. Pain response on palpation (scored 0–5) in horses with suspected sacroiliac joint pain was significantly correlated with pressure algometry measurements of mechanical nociceptive thresholds [15]. Palpation was also strongly correlated with suspected severity of sacroiliac dysfunction [15]. Pain score on palpation (0–3) was a reliable outcome measure between three physiotherapists comparing palpation and algometry in horses [16].

Transverse and ascending pectoral muscles were chosen to be assessed in this study as they lie beneath the region covered by the girth. The transverse pectoral muscle originates on the sternum between the first and sixth costal cartilages, travelling to the medial humerus and antebrachial fascia; the ascending (profound) pectoral muscle has attachments to the sternum between the fourth and ninth costal cartilages, xiphoid process, and abdominal tunic and inserts onto the craniomedial aspect of the humerus where it blends with tendons of biceps brachii, coracobrachialis, and supraspinatus [17–19]. The pectoral muscles help hold the thoracic limb onto the trunk, transferring and damping ground reaction force [17]. They decelerate and stabilize the limb in late swing, controlling limb placement. During stance, they support the trunk, bringing it forward over the limb which facilitates spinal flexion required for "good posture" and hindlimb protraction [20].

Overall knowledge of MTrPs in horses is lacking. Physically, MTrPs interfere with muscle lengthening and strength, whereas pain mechanisms inhibit muscle performance and motor control [21,22]. Myofascial trigger points are considered to be pain producing, so if present in the pectoral muscles could contribute to aversive behaviors when the girth is fastened. Knowledge of the presence and location of MTrPs could assist in the development of prevention and management strategies to improve comfort, optimize performance, and reduce girth-aversion behavior. Therefore, the purpose of this study was to (1) locate and map where MTrPs commonly occur in the pectoral muscles, (2) score the severity of the MTrPs by behavioral reaction to palpation, and (3) look for associations between these findings and girth-aversion behavior.

2. Materials and Methods

For this cross-sectional clinical study, 43 horses underwent clinical examination as part of their initial physiotherapy consultation between November 1, 2014, and January 31, 2015. All assessment and data collection were performed by one qualified veterinary physiotherapist (A.G.B.).

2.1. Inclusion and Exclusion Criteria

Horses were low-level performance horses in Western Australia, mares or geldings between 12 and 18hh in height, 4 years and over, and currently undergoing regular ridden exercise.

Horses were excluded if they: were stallions, mares in foal, were too anxious to stand square for about 10 minutes, were unridden horses (harness, young, or retired), were undergoing high-level discipline-specific competition, were in poor health including recent colic, had undergone previous abdominal surgery, had previous trauma to the pectoral muscles resulting in scar tissue, were currently taking anti-inflammatory or analgesic medication, or were receiving physiotherapy treatment in the last week (or regularly) that included soft tissue release through the pectoral muscles. Five horses were excluded: one retired, one unbroken, one stallion, one with previous stake injury in the pectoral region, and one had pitting edema in the ascending pectoral region. This left 38 study participants. One horse was receiving phenylbutazone at initial assessment so pectoral muscle assessment was delayed until follow-up consultation 1 week later, by which time the horse had been medication free for 5 days.

2.2. Assessment Procedure

Details for age, gender, breed, discipline, height, saddle type, and girth type were taken from the case history section of the standard physiotherapy assessment form as used by author AB's practice. Questions relating to girth-aversion behaviors, side of fastening the girth, and frequency of stretching the forelimb forward after fastening the girth were piloted on two owners, refined, retested, and added to the assessment form (see Supplementary Information Item 1 for questions). Questions relating to exclusion criteria were added and recorded in the case history. Owners were questioned on girth-aversion behavior before physical assessment.

Horses received physiotherapy assessment and treatment in a routine professional manner, except for the following variations from usual practices which were implemented to standardize data collection. It was checked that horses had been rested for at least 1 hour before assessment (e.g., not ridden, lunged, or groomed), and their coat was dry. Most horses were seen at the client's home, but as far as possible, a quiet calm environment was used to stand the horse square on a firm level surface. The horses were familiarized with palpation along the neck and shoulder as part of standard physical assessment before palpating the pectoral muscles.

The pectoral muscles were palpated with a flat hand and the pads of the fingers in a mediolateral direction over the cranial portion of the muscle, then in a craniocaudal direction over the caudal portion of the muscle, and finally scooping into the axilla. The presence or absence of taut bands was recorded with a 1 or a 0 onto a reference map divided into cells. To confirm if an MTrP was present and to gauge its severity, direct pressure was applied to each of the identified taut bands. The local and behavioral response to palpation was observed and scored 0–3: normal, mild, moderate, or severe (see Supplementary Information Item 2 for full scoring details). Four horses were used for practice of palpation of the pectoral muscles and to pilot the reference map and scoring method; the map was repeatedly refined and retested for ease of use and consistency across and within the four horses. If the horse moved, the measurement was repeated. A few seconds were allowed in between applying pressure to each taut band and a scratch on the neck if necessary to return the ears/facial expression to neutral. The side of the horse assessed first was randomized by flipping a coin.

2.3. Data Analysis

Data was coded, entered into excel, and double checked, before being transferred to Minitab17 and checked for errors. Descriptive statistical summaries, girth-aversion behavior scores, and mean trigger point severity scores were produced.

2.4. Girth-Aversion Behavior Scores

Owners were questioned on the presence of 10 behaviors they may have observed while fastening their horse's girth: turning head to look at girth area, cribbing/mouthing/nibbling, attempting to bite, pawing/stamping, kicking, breath holding/blowing out, flattening ears, swishing tail, moving away, and any other. Owners also reported how frequently these behaviors were displayed. The sum of the behaviors was multiplied by the frequency of the behavior (never = 0, rarely = 1, sometimes = 2, often = 3, and always = 4, see Supplementary Information Item 1) to produce a girth-aversion behavior score. Horses scoring 10 or more were classified as girth averse and <10 nongirth averse.

2.5. Mean Trigger Point Severity Scores

The sum of severity scores was divided by the number of MTrPs to produce a mean trigger point severity score for each horse. Based on these scores, the horses were categorized into severity levels, scores of 0–1 represent mild, >1–2 moderate, and >2–3 severe. The number of MTrPs and the mean severity for each cell was calculated for the total and girth-averse and non–girth-averse subgroups of horses and mapped. The "Pectoral Map Generator" (Pectoral Map Generator software written by Ben Chandler, Doodlakine, Australia) program was used to convert rows of numbers from an excel spreadsheet into shading of the correlated cell on the image file of the pectoral map. The "Pectoral Map Generator" program was specially created for this project and is not commercially available.

2.6. Statistical Analysis

Chi-square for trend was used to test for a relationship between girth-aversion behavior scores and mean trigger point severity scores. Data were not normally distributed so Kruskal–Wallis and Spearman's correlation coefficient were used to test for relationships between girth-aversion behavior, severity, and demographic variables. Statistical significance was set at $P < .05$.

2.7. Study Power

Sample size was estimated using mild MTrPs to represent unexposed and moderate and severe MTrP categories combined to represent exposed (ratio 0.3, percentage girth aversion in unexposed group 1% and percentage girth aversion in exposed group 50%). To attain power of 80% and a 95% two-tailed confidence interval (CI), 33 horses were required (EpiInfo7 cross-sectional calculator).

3. Results

3.1. Descriptive Data

The sample consisted of 13 mares and 25 geldings, aged 4–23 years (median, 10; 95% CI: 7.58–13 years), with a median height of 157 cm (95% CI: 153–162 cm). Data for breed, discipline, type of saddle used, length of girth used, side of fastening girth, and frequency of stretching the leg forward after fastening the girth are given in Tables 1 and 2. There was a weak positive correlation (Spearman's rho = 0.33, $P = .043$) between age and girth-aversion behavior scores. There was a weak negative correlation (Spearman's rho = −0.32, $P = .048$) between height and the number of MTrPs. There was a statistically significant difference between the number of MTrPs based on discipline (Kruskal–Wallis $P = .003$); horses in the disciplines of dressage and pony club had more MTrPs than other disciplines. All other combinations of descriptive variables and outcome

Table 1
Description of breed and discipline in 38 horses, count (percentage).

Breed	Count (percentage)	Discipline	Count (percentage)
Thoroughbred	13 (34.21)	Pony club	12 (31.58)
Arab/cross	5 (13.16)	Pleasure	12 (31.58)
Welsh/cross	5 (13.16)	Dressage	5 (13.16)
Quarter Horse cross	3 (7.89)	Eventing	5 (13.16)
Mixed breed	3 (7.89)	Show jumping	2 (5.26)
Australian Stock Horse	3 (7.89)	Camp drafting	2 (5.26)
Riding pony	2 (5.26)		
Cleveland Bay × Thoroughbred	2 (5.26)		
Thoroughbred × Quarter Horse	1 (2.63)		
Warmblood × Thoroughbred	1 (2.63)		

variables were either not statistically significant or invalid due to small sample size per category (e.g., only one subject with the girth fastened on the right side in the girth-averse category).

3.2. Common Locations of MTrPs—Combined Frequency and Severity

Ninety-five percent of horses had MTrPs in the axillary portion of ascending pectoral muscle on the right and 92% on the left, with a mean severity of severe (Fig. 1). Eighty-seven percent of horses had MTrPs to the right of the sternum in the girth region with a mean classification of severe. High percentages of MTrPs occurred along the girth line and toward the margins of muscles, with a mean classification of moderate. Higher frequencies were positively associated with higher severity; Spearman's rho = 0.995, $P = <0.01$.

3.3. Owner-Reported Girth-Aversion Behavior While Girth Being Fastened

The most common girth-aversion behavior associated with fastening the girth was looking at the girth which was reported in 19 horses (50%). This was followed by blowing out or holding of breath 16 (42.11%), then cribbing 15 (39.47%), tail swishing 12 (31.58%), flattening the ears 11 (28.95%), and moving away 11 (28.95%). Attempting to bite was less common 8 (21.05%), whereas other behaviors were reported in 6 (15.79%) of the horses (qualitatively described by the owners as; tossing the head, sighing, and "grumpy face"). The least frequent behaviors were pawing or kicking both 2 (5.26%). Fourteen (36.84%) of the horses always displayed some of these behaviors, 9 (23.68%) often, 10 (26.32%) sometimes, 1 (2.63%) rarely, and 4 (10.53%) never displayed any aversive behaviors during girthing.

3.4. Girth-Aversion Behavior Scores

Girth-aversion behavior scores ranged from 0 to 28 (median, 6; 95% CI: 4–8.84). Thirteen horses (34.21%) received a score of 10 or more and were classified as girth averse (median, 18; 95% CI: 12–24). Twenty-five horses (65.78%) scored <10 and were classified as nongirth averse (median, 4; 95% CI: 2.19–5.6).

3.5. Mean Trigger Point Severity Scores

Mean trigger point severity scores ranged from 1.0 to 2.95 (median, 1.54; 95% CI: 1.31–1.71). Six horses were categorized as mild (median, 1; 95% CI: 1–1), 24 horses were categorized as moderate (median, 1.53; 95% CI: 1.31–1.63), and 8 horses categorized as severe (median, 2.42; 95% CI: 2.16–2.68).

3.6. Girth Averse versus Nongirth Averse

When grouped together in MTrP severity categories (mild, moderate, or severe), there was a significant difference between horses classified as girth averse or nongirth averse, $P = .014$ (Table 3). There was also a significant difference in the mean severity of MTrPs between girth-averse and non–girth-averse horses, $P = .013$. Non–girth-averse horses had a mean severity of 1.45, whereas girth-averse horses had a mean severity of 1.89. For 70 of the 74 cells or 95% of the time, girth-averse horses scored a mean severity equal to or greater than non–girth-averse horses (Fig. 2). There was no difference in number of MTrPs between girth-averse and non–girth-averse horses, $P = .1$.

3.7. Randomization

Twenty-two horses (57.9%) were assessed first on the left side, and 16 horses (42.1%) were assessed first on the right side. There was no significant difference in number of MTrPs, $P = .10$, or severity of MTrPs, $P = .42$, between horses assessed first on the left or the right.

4. Discussion

Myofascial trigger points were located in all horses in this study with the most common site being the axillary

Table 2
Description of type of saddle, type of girth, side of fastening the girth, and frequency of stretching the forelimb forward after fastening the girth in 38 horses, count (percentage).

Type of Saddle		Type of Girth		Side of Fastening		Frequency of Stretching	
Dressage	12 (31.58)	Long	18 (47.37)	Both	18 (47.37)	Regularly	15 (39.47)
All purpose	12 (31.58)	Short	17 (44.74)	Left	16 (42.11)	Never	12 (31.58)
Jumping	6 (15.79)	Both	3 (7.89)	Right	4 (10.53)	Sometimes	11 (28.95)
More than one	5 (13.16)						
Other	3 (7.89)						

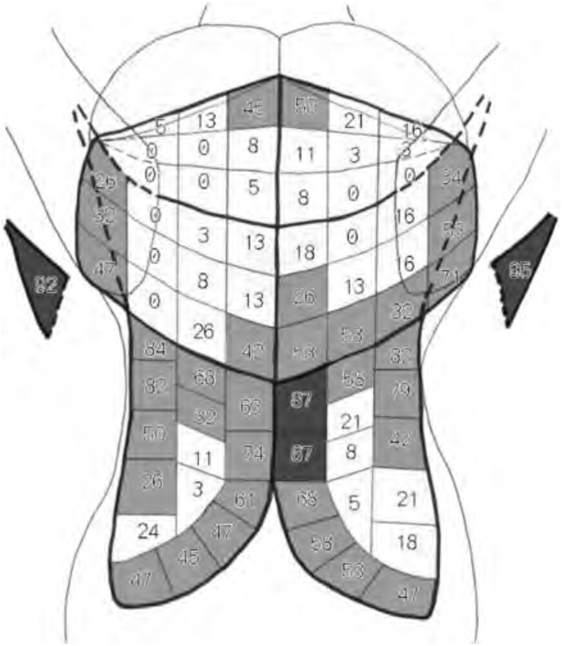

Fig. 1. Map of transverse and ascending pectoral muscles viewed ventrally (cranial at the top of the page, left forelimb toward the left of the page); frequency and severity of MTrPs in 38 horses. Shading = average severity, white: mild 0–1, light gray: moderate >1–2, and dark gray: severe >2–3. Overlaid numbers = percentage of horses with an MTrP for each cell. MTrPs, myofascial trigger points.

portion of the ascending pectoral muscle. The ascending pectoral muscle is a large muscle (~2.8 kg each [17]) that narrows down to a small insertion on the craniomedial aspect of the humerus. The muscle twists from trunk to limb; when combined with girth pressure and eccentric work, this may create a site of stress predisposed to MTrP development. The girth does not lie over the axillary portion of ascending pectoral muscle; however, the girth could have a tethering effect over the middle of the muscle, restricting lengthening of the muscle during forelimb protraction and therefore increasing stress toward the muscle insertion in the axilla. In the region between the forelimb and the trunk, several layers of fascia converge, contributing to an extensive web of attachments and sources of tension or dysfunction potentially affecting this region.

Myofascial trigger points were common to the right of the sternum; this may be related to laterality or the natural crookedness of horses. It has been suggested that passage through the birth canal distorts the ribcage at its widest point and leads to asymmetrical adaptations in the horse [23]. Mild asymmetry may place the sternum slightly off center and skew the pectoral muscles. Furthermore, many equine handling practices including mounting are one sided. This may be a factor contributing to asymmetrical distribution of MTrPs. It is English riding convention to fasten the girth on the left. This may pull the skin and pectoral muscle muscles toward the left, bunching and pinching them against the right side of the sternum. This action and compression may irritate the region sufficiently to induce MTrPs.

Table 3
Categorized of girth-aversion status and myofascial trigger point (MTrP) severity in 38 horses.

Girth-aversion status	Mild MTrP Severity	Moderate MTrP Severity	Severe MTrP Severity	Total
Nongirth averse	6	16	3	25
Girth averse	0	8	5	13
Total	6	24	8	38

The cutaneous trunci overlies the lateral edge of ascending pectoral muscle which was another common site for MTrPs. This is the thickest part of cutaneous trunci [1]—Essig et al [24] suggest stimulation produces a bigger twitch where the muscle is thicker. Stretching the forelimb forward may produce reflex relaxation of the cutaneous trunci and lessen irritation [1]; however, the present study found no statistical difference between owner-reported frequency of stretching and any of the outcome measures. The possible benefit of stretching would be better assessed with a treatment-based study. There is moderate evidence in humans that stretching effectively decreases pain associated with MTrPs [25,26].

There were a large number of MTrPs across the middle of ascending pectoral muscle and caudal edge of transverse pectoral muscle. This is the region the girth lies over so the relationship between girth design and MTrPs warrants further investigation. Girth-averse horses had higher severity of MTrPs in the region behind the elbow; this is similar to where Murray et al [20] recorded the highest pressure under normal girths. The pressures in this region peak during unilateral stance [20]. The pectoral muscles perform multiple functions during stance phase of gait which may be hampered by compression from a girth. Compression can restrict muscle lengthening and reduce blood flow producing localized ischemia [27,28]. The Fairfax girth, which is cut back around the elbow, was found to allow an increase in stride length, hock, and carpal flexion when compared to a normal girth [20]. These changes in limb movement may be partly due to decreased pressure on MTrPs. Investigation of long-term use of a cut back girth is warranted as it may decrease MTrP severity in these locations and in turn decrease girth-aversion behavior.

Girth-averse horses had higher mean MTrP severity scores. Myofascial trigger points produce signs of pain both spontaneously and when palpated. The presence of MTrPs in muscles in the girth area offers one explanation for aversive behavior on fastening the girth. Horse owners often attribute behavior to reasons other than pain, such as ill will [29]. Compared to veterinarians, owners are found to underestimate back pain [29] and lameness [30]. Nondisclosure of pain is a survival mechanism for prey animals; however, when horses are restrained, aggressive behavior is strongly associated with pain [31]. Girth-aversion behavior such as biting and kicking can be dangerous for handlers. Owners, handlers, and riders should be more aware that girth-aversion behavior may be associated with MTrPs, and therefore, horses may be expressing musculoskeletal pain and the source of pain should be identified and addressed.

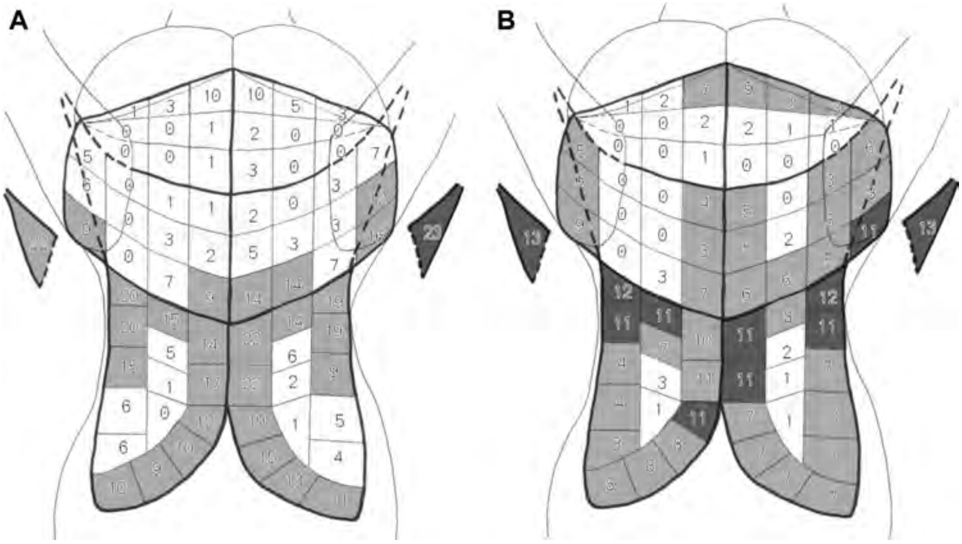

Fig. 2. Map of transverse and ascending pectoral muscles viewed ventrally (cranial at the top of the page, left forelimb toward the left of the page). Frequency and severity of MTrPs in (A) 25 non–girth-averse horses and (B) 13 girth-averse horses. Shading = average severity, white: mild 0–1, light gray: moderate >1–2, and dark gray: severe >2–3. Overlaid numbers = number of horses with an MTrP for each cell. MTrPs, myofascial trigger points.

Three horses in the severe category were categorized as not girth averse. Physical examination findings were gathered from one time point only, yet owners were asked to reflect over time how their horse on average behaves during girthing. It may be that the MTrP pain was acute, and therefore, the owners had not noticed a sustained display of girth-aversion behavior. Perhaps, these horses were expressing their MTrP discomfort whilst ridden rather than during girthing. Two horses with high girth-aversion scores had moderate severity scores. One had been gelded in the previous year and still displayed some stallion behaviors. The other had a previous history of poor saddle fit so the girth-aversion behavior may have become habitual although the anticipated pain no longer occurred with the better fitting saddle.

The weak positive correlation between age and girth-aversion behavior score suggests that older horses displayed more girth aversion, which may relate to cumulative painful experiences. The weak negative correlation between height and MTrPs is possibly a novel finding. The observed differences in frequency of MTrPs between disciplines may be due to the wide variety of workloads, tack, and training methods being used.

A potential limitation of this study was the sample size being too small to detect associations between some of the descriptive variables and outcome variables. Actual occurrence varied from the estimates (ratio 0.18, percentage girth aversion in unexposed group 0% and percentage girth aversion in exposed group 40.62%), suggesting 57 horses would have been required to achieve the same power. Cross-sectional studies sample data at one time point, so it cannot be said that MTrPs are causing girth-aversion behavior, just that both are present in these horses. There may be another factor causing both, for example, poor saddle fit, back pain, or gastric ulceration. There are many possible ways of assessing whether horses are girth averse. Questioning owners is vulnerable to recall bias. Horses tended to cluster toward non–girth-averse low scores or toward girth-averse higher scores that is if they attempted to bite they also tended to demonstrate other behaviors.

The strengths of this study were that the assessments were carried out under real clinical situations, so the generalizability of the results to practice is high. The lack of difference in number or severity of MTrPs based on the left or the right side being assessed first suggests there was no order effect and that the single assessor was able to maintain consistency. Multiple characteristics were examined to identify MTrPs, and the cells of the reference map were large enough to encompass several MTrPs.

Further research should investigate the function of the pectoral muscles during locomotion and posture. Larger samples and different study designs could examine possible contributing factors and their temporal relationships. For instance would a program of regular forelimb protraction stretching reduce the number and severity of MTrPs (and reduce girth-aversion behavior) and what is the effect of back pain, saddle or girth shape, and fit, lameness, or the presence of stomach ulcers?

4.1. Conclusion

Myofascial trigger points are very common in the axillary portion of ascending pectoral muscle, to the right of the sternum, through the girth region and toward the edges of muscles. Horses displaying girth-aversion behavior had more severe trigger points. This sample was too small to draw correlations between other possible contributing factors. Physically, MTrPs interfere with muscle lengthening and strength, whereas the pain from MTrPs also inhibits muscle performance and motor control. Knowledge of the presence and location of MTrPs could lead into the development of efficient management strategies and prevention, improving comfort for ridden horses, optimizing performance, and reducing girth-aversion behavior.

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Appendix

Supplementary Information Item 1: Girth-aversion behavior assessment form (Appendix 1)

1) When being girthed does your horse do any of the following: turn his head to look at the girth area, crib/mouth/nibble, attempt to bite, paws ground/stamps, kicks, holds breath/blows out, flattens ears, swishes tail, moves away, other

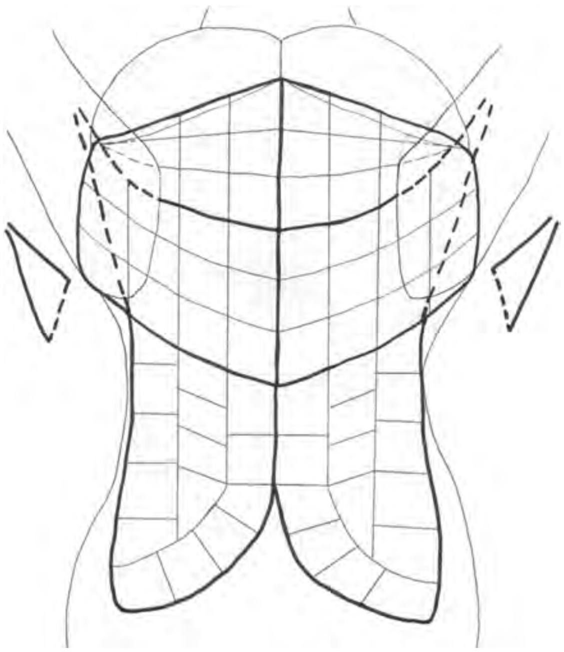
2) How often does your horse exhibit any of these behaviours: Never Rarely Sometimes Often Always

3) Do you fasten your girth on the left or the right? Left Right Both

4) Do you regularly stretch your horses leg forward after fastening the girth? No Sometimes Yes

5) Map taut bands no = 0, yes = 1, tear = 2

6) Behavioural response 0/1/2/3



Supplementary Information Item 2: Behavioral response to palpation scoring (Appendix 2)

Behavioral response to palpation to gauge severity of trigger point

(e.g., tenderness on palpation/hypersensitivity, pain (referred?), local twitch)

0 = normal: pain-free reaction to palpation/pressure sensation.

1 = mild: a few mild facial or behavioral indicators, ±local reaction.

2 = moderate: several moderate facial and behavioral indicators and a local muscle reaction.

3 = severe: severe facial, behavioral and local reaction, withdrawal, aggression.

Signs of pain/trigger point

Local reactions: local twitch, spasm, fasciculation, local movement–muscle contraction, withdrawal = sternal lift/reflex (small, medium, large).

Facial expressions: dilation of nares, breath holding, nose wrinkling, aggressive snorting.

Brief rapid caudal ear movement, sustained ears back, ears flattened/pinned.

Lips tightening, clenched jaw, teeth bearing, teeth grinding.

Rapidly turns eye toward, fixed stare/not blinking, rolls eye/looks out of top part of eye/eyes puckered slightly.

Behavioral responses: rigid stance, lift leg/rising hind-leg, stamping foreleg, restless, kicking.

Head jerk, head and neck very high, rearing.

Head turn, head and neck turn, neck low and snaking, biting.

Tail swishing, tail flattening, tail lashing.

Stepping away, swinging hind quarters, walking through handler/pulling on tie, plunging/escape/bolt.

Behavioral signs of a treatment effect/enjoyment: closing eyes, sticking top lip out, nuzzling, lowering head, deep breathing, leaning into palpation; will be assumed evidence for the presence of a MTrP and therefore scored a 1.

Scoring system developed with reference to:

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