THESIS LONDON COLLEGE OF ANIMAL OSTEOPATHY

Title: "Evaluation of the impact of osteopathic treatments in reducing anxiety in dogs and their potential integration into canine behavior modification programs"

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Abstract: This academic thesis examines the efficacy of osteopathic treatments in reducing canine anxiety and explores their integration into behavior modification programs. Relevant studies are reviewed, physiological mechanisms are discussed, and findings on the influence of osteopathic medicine on canine anxiety are presented. osteopathy on the autonomic nervous system and the HPA axis. It is concluded that osteopathy may be a valuable component in a multimodal approach to the treatment of anxiety in dogs.

Objective: The approach for this academic research thesis is based on the review of studies of osteopathic treatments that may be related to a reduction in anxiety in dogs, and on the other hand, on how this therapy could be integrated as part of canine behavior modification programs. There is a relationship between osteopathic techniques and a reduction in anxiety and changes in behavior.

Design and data sources: To identify relevant studies on the impact of osteopathic treatments on canine anxiety, it is important to use a variety of bibliographic databases and sources. Therefore, the review has been carried out in Google Scholar, which collects some specialized publications https://scholar.google.com/ and https://pubmed.ncbi.nlm.nih.gov/ as one of the most used scientific databases in the health and medical areas, which includes articles from peer-reviewed scientific journals. Another source of studies and articles specialized in veterinary and animal health that has been used for this study is Scopus (https://www.scopus.com/). Additional scientific sources for consultation have been And others; https://www.webofscience.com/ , https://www.cabdirect.org/ , https://www.ebscohost.com/

In the searches, a combination of Boolean terms has been used to maximize search efficiency;

- “Osteopathic treatment of animals”
- "osteopathy" AND "canine anxiety"
- “osteopathic manipulations AND anxiety”
- "osteopathic treatments" AND "canine behavior modification"

- "effects of osteopathy" AND "dogs"

Without forgetting the review of the references of the reviewed studies.

The following criteria were used to determine the inclusion and exclusion of studies.

Inclusion criteria;

- Studies evaluating the impact of osteopathic treatments on canine anxiety.
- Randomized controlled trials (RCTs), quasi-experimental studies, cohort studies, case-control studies, and case series.
- Dogs of any breed, age and sex that have been diagnosed with anxiety or show symptoms of anxiety were included as participants. Given the lack of specific relevant studies with dogs (one of the difficulties in this study), studies with human models and other animals are taken as a reference.
- Osteopathic treatments will be defined as manual techniques applied by qualified osteopathic professionals.
- Studies comparing osteopathic treatments with other treatments for canine anxiety (pharmacological, behavioral, etc.) or with control groups (placebo, usual treatment, etc.).
- Studies that measure outcomes related to canine anxiety, such as changes in behavior, reduction of anxiety symptoms, quality of life, and objective measures related to anxiety such as cortisol levels, inflammatory indicators, etc.
- Studies published after 2010

Eligibility criteria: Due to the characteristics of the topic, which is little studied, qualitative studies, systematic reviews, meta-analyses and theoretical studies are included. Studies with manual treatments that are not osteopathic (for example, acupuncture, massage, etc.) will be excluded.

To date, the scientific literature on the relationship between osteopathy and anxiety in dogs is relatively limited, making it difficult to draw conclusions. Although there have been some studies and reviews exploring this connection, many of the existing studies are of small sample size and quasi-experimental design, which may limit the generalizability of the results (Haussler, 2021).

Another complication lies in the variability in techniques and the frequency of osteopathic treatment which can complicate comparison between studies.

However, in practice, the field of animal rehabilitation is experiencing a maturation, with the use of interventions from the specialty of physiotherapy, specifically manual

techniques, which have widely demonstrated their effectiveness in the case of humans. These include, among others, and according to Lamoreaux (Lamoreaux, 2014); “techniques of range of motion and stretching, mobilization or manipulation of soft tissues, peripheral joints and the spine, neuromuscular facilitation techniques, techniques exclusive to osteopathy, thoracic physiotherapy, manual lymphatic drainage techniques.

Osteopathy in particular is commonly used to reduce pain and improve mobility. Several systematic reviews (Ferreira, 2002), (Bialosky, 2009), (Bulbulian, 2002)have shown that this therapy can be effective for various musculoskeletal conditions. However, the exact mechanisms behind its clinical benefits are varied and complex. Initially, manual therapy was believed to work primarily through a biomechanical model, addressing altered biomechanics due to tissue damage. But this model has been questioned, especially in cases of chronic pain.

Recently, there has been a shift towards a neurophysiological model, which focuses on the effects of manual therapy at the spinal, supraspinal and sympathetic nervous system levels (Kesava, 2019). Osteopathic manipulation is said to have a positive effect on body functions by influencing the autonomic nervous system (ANS), using joint, myofascial, balanced ligament tension and craniosacral techniques, among others, whether applied individually or in combination. This is a theoretical relationship between the autonomic nervous system and osteopathic manipulative treatments, but it is scientifically documented (Rechberger, 2019), as measured by heart rate and heart rate variability (Henley, 2008).

This model also considers the production of biochemical markers such as tumor necrosis factor (TNF-α) and substance P, as well as the hypothalamic-pituitary-adrenal (HPA) axis.

The HPA axis is crucial for homeostasis and the stress response. Activation of the HPA axis leads to the production of adrenocorticotropic hormone (ACTH) and glucocorticoids such as cortisol, which play a role in the anxiety response and the inflammatory response.

In a 2019 systematic review study (Llinás, 2019)evaluating 18 studies of acceptable quality, it was concluded that both structural and cranial osteopathy exert a modulating effect on the sympathetic nervous system that would have been quantified through heart rate measurements. The results would show an excitation of the parasympathetic nervous system after the application of osteopathic manipulative treatments.

Along the same lines, a study conducted with horses found an increased response of the parasympathetic system when osteopathic manipulative treatments were applied, with a consequent effect on the HPA axis and the immune system. The sample size was 30 horses and the evaluation instruments used were noninvasive biomarkers such as heart rate, respiratory rate, temperature, serum cortisol concentration and white blood cell count (Giedrė, 2023).

At this point it seems relevant to establish the relationship between “anxiety” and the HPA axis, specifically how anxiety is linked to the physiological pathways that regulate the response to stress.

The HPA axis is a key part of the neuroendocrine system that helps control the body's responses to stress. When activated, the hypothalamus releases corticotropin-releasing hormone (CRH), which stimulates the pituitary gland to release adrenocorticotropic hormone (ACTH). In turn, ACTH stimulates the adrenal glands to release cortisol, a steroid hormone that plays a key role in the stress response.

In situations of prolonged or chronic stress, alterations in the neurobiological functioning of stress occur, which can lead to dysregulation of the HPA axis. This can result in an inadequate response to stress, contributing to the onset and persistence of anxiety and other related disorders. Dysregulation can involve very high levels of hormones in the blood, such as cortisol, which the liver, responsible for its elimination, may not have sufficient capacity to process, generating endogenous toxicity.

Endogenous toxicity and deregulation of the HPA axis can alter the hormonal and neurochemical balance of the body, which directly affects the central nervous system. This can manifest itself in anxiety symptoms such as hyperactivity, obsessive-compulsive behaviors, fears, aggression, among others.

In summary, HPA axis dysregulation can contribute to anxiety in dogs by altering the stress response and generating hormonal and neurochemical imbalances that affect the central nervous system, causing anxiety symptoms and other stress-related disorders (Ferrer, 2024).

One of the difficulties in studying whether manipulative treatments such as osteopathy in this case have the potential to reduce anxiety in the canine population, and therefore, whether these treatments can be included as part of a behavior modification program, is the difficulty in identifying anxiety as a problem and even defining it.

Anxiety is a complex condition that manifests itself in different ways and can be interpreted in different ways by different professionals. Anxiety is not easy to categorize, and attempts to classify it into specific types are often frustrating.

The important thing is to understand anxiety as a state of alert that is activated when the body detects a threatening situation, whether internal or external, and that manifests itself through physiological and behavioral symptoms. This is key, since they are necessary responses that occur simultaneously.

Anxiety manifests itself and can also be said to be “stored” in the body. It is a response to the environment that is normal and guarantees the survival of the individual. The problem occurs when this response is maladaptive and the stimuli that cause it are too intense or too repetitive. The dog will have physiological changes in response to this threat (perceived or real, internal or external) and will be accompanied by behaviour.

Behaviors associated with anxiety, what we “see” in dogs and which usually pose a problem for coexistence, or also called “behavioral problems,” are a problem with a studied prevalence of more than 40% according to a 2019 study (Dinwoodie, 2019).

Focusing on behavior rather than the causes of anxiety can be a mistake because it is a superficial approach that does not address the roots of the problem.

Anxiety is a complex emotional state that arises from an internal imbalance and manifests itself through observable behaviors. These behaviors are the external expression of an internal discomfort that can have multiple causes. Understanding anxiety and its possible causes is essential to recognize and treat it effectively.

When problematic behavior is observed in a dog, it is important to see it as a communication signal that indicates an underlying discomfort. This discomfort can be related to internal factors such as stress, fear, frustration or lack of stimulation, among others. But it can also be related to physiological alterations that affect the homeostasis of the metabolism, signaling a threat to health and physical integrity. Diet, alterations in the microbiota, toxicity, pain, are just some examples that can be at the origin of anxiety, and that will manifest themselves in the long term as health problems and alterations in behavior.

These behaviors are typically seen as fear of external stimuli such as noise, storms, traffic, new environments, people, moving objects, surfaces, and heights (Dreschel, 2010). Loneliness anxiety or separation anxiety, which manifests itself in behaviors such as destruction, vocalizations, elimination, self-harm, and panting. Social anxiety, which can be seen in behaviors such as social avoidance, territorial aggression, resource guarding, and "submissive" urination or urine marking. Attention seeking, when a dog follows its owner everywhere , guards, requests frequent petting, barks, etc. Such as inactivity, avoiding interaction, running away, or hiding.

Anxiety manifested in a generalized manner and characterized by excessive reactivity, hypervigilance or alertness, intense exploratory behavior, muscular tension, and which may be persistent over time and disproportionate to the stimulus.

Generalized anxiety, in this context, would be a type of anxiety that is not necessarily linked to a specific external stimulus or a particular situation. It is a persistent and excessive anxiety that occurs without an apparent cause and can affect various aspects of the dog's life. It is characterized by excessive and continuous worry, and may be associated with physical and behavioral symptoms that reflect a constant state of alertness that is inappropriate for the current situation.

These behaviors are communication signals that reflect underlying emotional distress and can vary in intensity and frequency depending on the individual dog and the causes of the anxiety.

Focusing solely on behaviour risks ignoring the underlying causes of anxiety, which can lead to temporary or inappropriate solutions. For example, if a dog shows signs of anxiety when alone and you address the problem only by limiting the behaviour (such as avoiding leaving it alone), you miss the opportunity to identify and treat the cause of the anxiety (such as trauma, type of bond, the possibility of performing natural behaviours and other basic needs, such as lack of exercise or environmental enrichment, predictability of the environment, capacity for agency, decision-making and control). To which other factors of a more physiological nature may be added. Because anxiety is often multifactorial.

Therefore, one suggestion would be to address behavioral problems effectively, which requires a comprehensive approach that considers both the causes of anxiety and its behavioral manifestations. This involves a thorough assessment of the situation, including the environment, the dog's history, its physical and emotional health, and the factors that could be contributing to the development of anxiety (Tiira, 2016).

Among the physical manifestations that we will see associated with anxiety are the symptoms at the muscular and articulatory level; generalized muscular tension or localized in certain areas of the body, physical tremors, muscular pains and stiffness. Facial tension, hyperactivity, which can manifest itself in excessive movements or restlessness.

These symptoms are part of the body's response to chronic stress and anxiety. Sustained muscle tension can lead to joint and muscle pain, and in severe cases, to conditions such as osteoporosis or general weakness. Chronic anxiety can also be associated with dental problems and digestive disorders, both of which can impact muscle and joint health.

Despite the extensive scientific literature on anxiety, its treatment has a low rate of effectiveness in terms of remission (Dixon, 2020). In both humans and dogs, treatments are usually based on cognitive behavioral therapy and medication.

This therapy and its techniques are used in dogs to treat behavioral problems and emotional disorders. In general terms and in theory, it consists of identifying (through reactions to specific stimuli) and modifying unwanted behavior patterns through positive and negative reinforcement techniques.

The common strategy for anxiety is gradual, controlled and positive exposure to situations or stimuli that trigger anxiety, a systematic desensitization. It is a repeated and progressive exposure over time, seeking to establish contact with the stimulus, but without triggering the anxiety reaction, linking it to the sensation of feeling relaxed, which is a response incompatible with feeling anxious. The nervous system cannot respond simultaneously in an antagonistic way.

Although systematic desensitization has proven to be an effective technique in many cases, it has been criticized. Some of the limitations attributed to it include:

1) Effectiveness may vary between individuals. Not everyone responds the same way, and some may not experience the same degree of anxiety relief as others.

2) It is not suitable for all anxiety disorders or situations. There are cases in which other forms of intervention may be more effective. This is especially true in non-specific or generalized forms of anxiety, when the stimuli that cause it cannot be identified.

3) Gradual exposure to feared situations can be intense and challenging for some dogs, it is difficult to determine this intensity, which can lead to resistance or abandonment of the treatment.

Another technique used in anxiety is counterconditioning. When faced with a situation that generates anxiety, it involves teaching new behaviors that can replace an emotion that has a negative valence, such as anxiety itself, with a positive one.

These treatment programs are often accompanied by medication, although in this case, there is also data indicating that a large proportion of patients, particularly with generalized anxiety disorder, do not respond to pharmacotherapy (Koen, 2011).

That is why the medical and scientific community has turned to alternative or complementary medicine, along with lifestyle changes (diet therapy, physical exercise, meditation) in search of more effective ways to treat anxiety.

In a review article, (Blumer, 2017)osteopathic cervical manipulation techniques (HVLA) are correlated with improved heart rate variability (a factor associated with anxiety), due to its impact on the regulation of the parasympathetic nervous system, which was already anticipated in previous studies reviewed in this same thesis.

The techniques proposed as treatment for anxiety in this study are specifically;

- High velocity, low amplitude thrust with either a rotary or lateral bending approach.
- Sacral decompression
- Suboccipital decompression, beneficial due to its proximity to the vagus nerve
- Pressure on the diaphragm

Results

The systematic review of the existing literature has revealed a set of significant findings in relation to the impact of osteopathic treatments in reducing canine anxiety. Although the number of specific studies in this area is limited and the methodological quality varies, an emerging pattern has been identified that suggests a potential benefit of osteopathy in regulating the autonomic nervous system and, by extension, in reducing anxiety in dogs.

The studies included in this review have evaluated the efficacy of osteopathic techniques such as high velocity, low amplitude (thrust) manipulations, sacral and suboccipital decompression, and diaphragmatic pressure. These treatments have been associated with favourable changes in heart rate variability, indicating possible excitation of the parasympathetic nervous system and reduction of sympathetic activity. These effects could be mediated by osteopathic influence on the vagus nerve and other components of the autonomic nervous system.

Furthermore, it has been observed that osteopathy may play a role in the regulation of the HPA axis, suggesting a direct influence on the stress response and, consequently, on the experience of anxiety. Some studies have shown that osteopathic treatments can modulate cortisol levels and other inflammatory indicators, which is consistent with a reduction in the stress response.

Importantly, the effectiveness of osteopathy in reducing anxiety appears to be most evident when considered as part of a multimodal approach to treatment, which includes other therapies such as cognitive behavioural therapy, systematic desensitisation and lifestyle changes. This integrated approach recognises the complex nature of anxiety and the need to address multiple factors to achieve sustainable results.

In summary, the results of this thesis indicate that osteopathy may be a valuable therapeutic tool in the management of anxiety in dogs, with observable effects on stress physiology and behaviour. However, further rigorous research is needed to establish definitive conclusions and to explore the mechanisms underlying these therapeutic effects.

Future Research

- Randomized Controlled Trials (RCTs): More RCTs are needed to establish the efficacy of osteopathy in reducing canine anxiety.
- Meta-Analysis: Future meta-analyses could synthesize the findings from multiple studies to provide a clearer view of the impact of osteopathy.
- Mechanism Studies: Further research into the physiological mechanisms by which osteopathy might influence anxiety may be useful.

Conclusion

The research conducted in this thesis has explored the potential of osteopathy as a valuable component in the management of canine anxiety and its possible integration into behaviour modification programmes. Although current scientific evidence is limited and the studies reviewed present methodological challenges, there is a

promising indication that osteopathic techniques could modulate the sympathetic and parasympathetic nervous system, positively influencing the response to stress and anxiety in dogs.

The findings suggest that osteopathy, by interacting with the HPA axis and other biochemical markers, could contribute to the regulation of dogs' emotional and behavioural response to stressful situations. This opens the door to new therapeutic perspectives that complement traditional approaches in the treatment of anxiety.

It is imperative to recognize that anxiety is a multifactorial problem and that its treatment must be addressed in a comprehensive manner, taking into account the underlying causes, the environment and the individual needs of the animal. Therefore, osteopathy should not be considered as a sole cure, but as an additional tool within a treatment plan that also includes behavioral, environmental and, if necessary, pharmacological strategies.

In view of the preliminary results and the need for a deeper understanding of the physiological mechanisms at play, further controlled and higher quality studies are recommended to strengthen the evidence and guide clinical and educational practice in the future. Osteopathy could be a key component in the development of holistic canine wellness programs that address anxiety effectively and compassionately.

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