Takeuchi, Y., Ogata, N., Houpt, K. A., & Scarlett, J. M. (2001). Differences in background and outcome of three behavior problems of dogs. *Applied Animal Behaviour Science*, *70*(4), 297–308. [https://doi.org/10.1016/S0168-1591(00)00156-8](https://doi.org/10.1016/S0168-1591%2800%2900156-8)

**Summary**:

Behavioural problems in dogs often result in euthanasia and increased populations at shelters. Research into this field has decreased these numbers and offers treatment in preventing and curbing the problem. This article was a study aimed at categorizing three behavioural problems (aggression towards owners, aggression towards strangers and separation anxiety). Each of these behaviours were studied in context of influencing factors (breed, sex, age, housing, training, and behavioural correction). Results were studied within each behavioural problem and then analyzed against each other (i.e., significant separation anxiety results were listed then compared to one or both aggression behaviours). The diagnosis for each behaviour was given by the Cornell University Animal Behaviour Clinic. Data was collected from the clinic and from follow up questionaries. The study analyzed 78 individuals presenting with separation anxiety (SA) from the years 1993- 1997.

When it comes to SA, mixed breed dogs presented at a higher proportion than pure breed dogs and males were more likely to present as well. The later statement is inconclusive when compared to other studies. Dogs with SA were significantly more likely to be found in city’s/towns and in apartments than dogs with aggression. This could be due to the increased proximity to others and therefore more likely to be noticed. This study showed that all behaviours were at the same chances of being treated but other studies found SA at lower chance of treatment. It was noted that treatment outcome was improved when treatment for SA was sought under a year of manifesting. The reasons as to why need to be further studied. Dogs with SA were more likely to be reprimanded verbally than physically. The average age of dogs with SA was notably higher at the time of acquisition and at the time of onset and examination for the behaviour.

**Contribution**:

While this study is not the first of its kind to approach this subject, the comparative nature shed light on how these behaviours can be categorized. The multiple factors considered allowed for each behavior to be studied in a more holistic perspective. Its results show discrepancy in influencing factors such as sex and are cause for further research.

REASON FOR INCLUSION:

A review article also chosen for research noted how there was a lack of comparative studies. This is one such rare comparative study I was able to find and could add another perspective on the contributing factors for separation anxiety.

Ogata, N. (2016). Separation anxiety in dogs: What progress has been made in our understanding of the most common behavioral problems in dogs? *Journal of Veterinary Behavior*, *16*, 28–35. <https://doi.org/10.1016/j.jveb.2016.02.005>

**Summary**:

Separation anxiety (SA) is considered an anxiety related disorder. The symptoms of this disorder are only noted when the affected individual is not in the presence of their owner or believes that the owner is not nearby. This disorder is the second most common behavioural problem in dogs and is the primary reasoning towards relinquishment rates. There is an inconsistency towards terminology, etiology, treatment, and prevention when it comes to SA in dogs and must be addressed for future studies. This is also cause for the review. This review collected/analyzed data from various peer-reviewed studies published from 1970-2014 from PubMed, Web of Science and Scopus. Keywords in this search include: *“separation anxiety; separation-related behavior; separation-related problems; separation- related distress; and separation-related disorders.”* The results were described in terms of history of research into this topic, etiological factors (factors contributing to the problem), behavioural patterns associated with SA, hyper attachment, and underlying fear/anxiety.

The history of this subjected noted the lack of controls used during the emergence of this field. Most studies were clinical descriptions and until the late 1990’s did not include study-based data. The review indicates half the studies mentioned had a focus on treatment for the problem. Etiological factors (i.e., sex and breed) do not have consistent results. This is due to the mentioned discrepancy towards sampling methods, definitions, etc. For similar reasons, there is discrepancy when it comes to the association of underlying fear with SA. Behaviours associated with SA were maladaptive in nature and often presented with a *“peak of intensity”* even if they did not stop. There is no concrete evidence that hyper attachment must be associated with SA and can instead present by itself.

The review suggests genome-wide studies and underlying mechanism studies as fields of future research among others.

**Contribution**:

This review from start to end mentions the inconsistent nature of gathering data in this field. Through describing various studies and their results, it provides evidence to how results in studying SA are inconclusive and vary from other studies. It provides specific examples on methods that need to be changed while highlighting the developments in this field using a broad range of articles.

REASON FOR INCLUSION:

This review felt like a good starting point to grasp the fundamentals of this field as it addresses many different aspects of the subject.

Storengen, L. M., Boge, S. C. K., Strøm, S. J., Løberg, G., & Lingaas, F. (2014). A descriptive study of 215 dogs diagnosed with separation anxiety. *Applied Animal Behaviour Science*, *159*, 82–89. <https://doi.org/10.1016/j.applanim.2014.07.006>

**Summary**:

There is a high frequency of behavioural problems in multiple dog populations. This prevalence is often cause for the owner to give up their dog or euthanize them. As behavioural problems are causing detrimental impacts on canine health, it creates cause for further analysis. This study is aimed at describing characteristics of one such behavioural problem – separation anxiety (SA), and focuses on understanding the impact genetics and the environment may have in the manifestation of SA. Records of 215 dogs diagnosed with SA at the same clinic in Norway were analyzed for breed, sex, neutering status, reasons for neutering, owner induced risk, other behavioural issues, sleeping habits and status when the owner was away. The diagnosis for SA was given based on behavioural history and presence of diagnostic behaviours.

It was found that mixed breed dogs were the most common in terms of breed distribution followed by Cocker Spaniels. This is somewhat like other studies that also showed mixed breeds as the most common but have spaniels slightly further down the list. When compared to the breed distribution of the Norwegian kennel club, breeds presenting for SA were not at the same proportion as the general population. This implies that there may be a link between breed and genes but needs to be further investigated. Frequency of neutering status was more common than the control population, but it is important to note neutering is prohibited in Norway unless for health and behavioural reasons. In the case of this study behavioural problems are common cause for neutering and happens to more males than females. Sex of the owner may also play a role in manifestation of SA as more dogs with SA belonged to single female houses than single male houses.

**Contribution**:

As pointed out in this study, there is a correlation between behavioural problems and their associated behaviours and negative impacts on dogs. By creating a more descriptive account of separation anxiety, this study offers insight into various factors contributing to SA. This in turn offers insight into future studies on the topic.

REASON FOR INCLUSION:

I wanted to include a study that accounts and describes various factors that contribute to separation anxiety. Since the issue is so multifaced, it would be useful to get an understanding of some of the common ones.

Appleby, D., & Pluijmakers, J. (2003). Separation anxiety in dogs: The function of homeostasis in its development and treatment. *Veterinary Clinics of North America: Small Animal Practice*, *33*(2), 321–344. [https://doi.org/10.1016/S0195-5616(02)00101-8](https://doi.org/10.1016/S0195-5616%2802%2900101-8)

**Summary**:

Behavioural specialists often confront behaviours associated with the separation of the dog from its owner. These behaviours are often destructive and unwanted (i.e., loud vocalizations). This review aims to provide insight into understanding the needs of each dog to maintain homeostasis and its relation to the environment to in turn, offer insight into diagnosis and treatment.

The review describes separation anxiety (SA) as the problematic behaviours caused by anxiety in situations where the owner is thought to be absent. It states the opponent-process theory as a useful method to understanding SA. It involves a hypothetic neural system being responsible for the regulation of emotional arousal in which the trigger is appealing or negative stimulation.

The relation to maintaining homeostasis and environmental effects can be explained with various factors. The affected individual will respond to an adverse situation by engaging in psychobehavioural and neuroendocrine (hormone changes due to nervous system signaling) changes. This results in the various associated behaviours and internal changes such as the activation of the HPA axis (neuroendocrine stress response system).

The review addresses SA and its associated behaviours as responses when the affected individual is deprived of maintenance stimuli. Maintenance stimuli refers to an object that an individual has been conditioned (via cues and responses from *“social and non-social objects”*) to rely on for maintaining homeostasis. This dependence on maintenance stimuli may have developed in the breeding process of canines in which more social and affectionate dogs are selected for and then perpetuated by conditioning. In a situation caused by internal or external factors depriving the individual of maintenance stimuli, homeostasis is disrupted. The associated behaviours are responses to the disruption and are the individuals attempt at re-establishing homeostasis.

Treatment is to be personalized to each dog in which circumstance and environment is considered. Both drug and behavioural alteration are options based on the individual.

**Contribution**:

This review offers insight into the reasoning for the (destructive) behaviours associated with separation anxiety. By understanding why, a dog might experience separation anxiety, it allows for more process to be made in the treatment and diagnosis of the problem.

REASON FOR INCLUSION:

I was looking for a study that offers insight into why the behaviour might happen. This review does exactly that.

Palestrini, C., Minero, M., Cannas, S., Rossi, E., & Frank, D. (2010). Video analysis of dogs with separation-related behaviors. *Applied Animal Behaviour Science*, *124*(1), 61–67. <https://doi.org/10.1016/j.applanim.2010.01.014>

**Summary**:

Behavioural issues that accompany separation anxiety (SA) is one of the primary reasons behind the *“breakdown of the human-companion bond.”* This in turn leads to the surrender of the affected dog to shelters. As the study addresses, the high levels of owner dependent surveys used for studying SA may have created an inaccurate representation on proportion and severity. This study aims to film dogs with SA related problems after the owner leaves the house to collect more objective data. 23 dogs of various breeds, including mixed, were monitored. Age ranged from 3 months to 13 years of age. Along with filming using the focal animal continuous method, owners were also surveyed on various factors such as history, household size, presence of other pets, etc.

All data was processed through various statistical calculations to check for behavioural relation, data suitability, subject distribution, and effect of external factors. Primary results are as follows. Majority of the dogs in this study lived in an apartment, belonged to single member households, had another pet present in the house, and were fearful of thunderstorms. Most observed behaviours included oral vocalizations and *“orienting to environment”* (responding to external stimuli such as noise). Overall, destructive behaviour, stress response and locomotive behaviours were increased, and passive behaviours were decreased (i.e., lying down without environmental orientation). Vocal expression decreased overtime and panting increased over time. Noticeably, dogs adopted between 2-3 months of age exhibited more passive behaviour which may indicate a relation to inappropriate adoption age and SA. The study also notes from their results that SA related behaviours may *“consequences”* of underlying state (fear, discomfort, and anxiety). This means that a different syndrome is the cause of the behaviour(s) and may not be due to SA. Improved diagnostic tools are needed to improve this problem.

**Contribution**:

As this study points out, majority of SA related studied are dependent on surveys from owner perspective. This is one of the few studies that records how affected individuals present in an objective sense. It also offers detailed descriptions of behaviours in an ethogram that allows for the reader to understand how and why the data is collected.

REASON FOR INCLUSION:

I was looking for a study with a ethogram to describe the commonly associated behaviours of SA and this study does exactly that.

Parthasarathy, V., & Crowell-Davis, S. L. (2006). Relationship between attachment to owners and separation anxiety in pet dogs (*Canis lupus familiaris*). *Journal of Veterinary Behavior*, *1*(3), 109–120. <https://doi.org/10.1016/j.jveb.2006.09.005>

**Summary**:

The relationship between a dog and a person is something people actively seek. This phenomenon of attachment is necessary in social groups. Further studying this occurrence in the dog-human relationship, can help to understand the connection between attachment and behavioural problems such as separation anxiety (SA) as well as improving diagnosis and treatment. This study establishes the multifactorial nature of attachment and SA and offers insight into future areas of study.

The study was conducted in two parts. The first was an Attachment Test (AT) at a test facility with the owner and the stranger. The second was a videotaped analysis of behaviours at home. Video recording took place at of the owner’s last exit point or at the crate/restricted area. Behaviours were noted using two separate ethograms (dependent on if they were free range dogs or restricted dogs). Results were compared between dogs with SA and dogs without SA. The three hypotheses are as follows: 1.) Dogs with SA will have a different level of attachment 2.) Dogs that are left with free range in the house will spend more time near the owner’s last point of exit. 3.) Crated dogs will show a positive correlation between SA related behaviours when alone during the AT and alone at home. The results, however, showed no statistical difference between the results for dogs with and without SA (there was no significant difference in behaviours and frequency in both categories). This means that SA is not dependent on “hyperattachment.”

Future studies should study the relationship between successful treatment and change in behavioural patterns as well as changes the relationship between treatment and changes in attachment. The study also indicates various changes to the diagnostic method for the test involving a shorter and promoting SA related behaviours.

**Contribution**:

This study specifically analyses the relationship between attachment and SA. Other studies have noted discrepant opinions in this field, but the results serve to help rectify this inconsistency. The results are also valuable in the treatment and diagnosis of SA.

REASON FOR CONTRIBUTION:

A few other articles have noted the discrepancy on relationship between SA and hyperattachment. I used this study as it specifically analyses this relationship.

Pirrone, F., Pierantoni, L., Bossetti, A., Uccheddu, S., & Albertini, M. (2019). Salivary vasopressin as a potential non–invasive biomarker of anxiety in dogs diagnosed with separation–related problems. *Animals : An Open Access Journal from MDPI*, *9*(12), 1033. <https://doi.org/10.3390/ani9121033>

**Summary**:

Dogs and humans are highly social animals that form complex interactions with other individuals that create social bonds/attachments. However, this can also cause problems in canines as it can cause separation related problems. This study was aimed at analysing behavioural and physiological differences between dogs with separation related problems (SRP) and non-affected dogs to determine if there were any bioindicators of SRP.

Salivary hormone levels of vasopressin (AVP) and oxytocin (OT) as well as behaviour were studied during 3 phases during the test. AVP increases when stressed and oxytocin alleviates stress.

In phase 1, a dog was introduced to 2 new individuals (camerawoman and behaviourist) in a novel area. No differences in behaviour between the affected and control (non-affected) group was seen and there was no statistical difference in either hormone. This is concurrent with results in recent studies. In the second phase, the owner left, and the dog remained with the behaviourist and camerawomen. The behaviourist interacted with the dog only when the dog initiated the interaction. AVP levels at this phase were statistically higher than control dogs. Levels gradually decreased during the period of separation. Affected dogs also spent more time engaging in *“passive stress coping strategies”* (i.e., oriented toward the fence where owner left). In phase 3, the dog was reunited with its owner. There was a greater level of jumping up at the behaviourist than control dogs. This could be due to the attempted interaction during phase 2 when the dog was separated from the owner. Once reunited with the owner, this made the behaviourist a point of investigation. OT levels showed a gradual decrease in affected dogs, but this was not statistically different

More research, with larger sample sizes, should be conducted to prove the validity of using AVP as an indicator of SRP.

Contribution:

This study applied knowledge from previous studies in other animal models to find a potential biomarker of SRP. As the results prove the possibility of SVP being an early indicator, this can then be applied to fixing the problem and reducing surrender rates.

REASON FOR INCLUSION:

This study looked at physiological changes than can arise with SA and was useful as I was looking for a study that investigated internal changes that occurred within affected individuals.

Moesta, A., Kim, G., Wilson-Frank, C. R., Weng, H.-Y., & Ogata, N. (2020). Comparison of serum brain-derived neurotrophic factor in dogs with and without separation anxiety. *Journal of Veterinary Behavior*, *35*, 14–18. <https://doi.org/10.1016/j.jveb.2019.10.013>

**Summary**:

The nature of the relationship between the dog and owner can have many psychological benefits for both the human and canine. Separation anxiety (SA) can cause problems that disrupt the positives. There has been little investigation in the neurochemical functioning in dogs with SA. This study aims to rectify this problem and study BDNF levels in dogs with and without SA in hopes of finding an earlier indicator of SA. BDNF or brain derived neurotrophic factor is a crucial component in the regulation and maintenance of neurons, prevalently in the areas of the brain related to mood, emotion, and cognition. The study hypothesized that dogs with SA will have lower levels of BDNF than dogs without SA.

By retrieving blood samples from fasted dogs, BDNF levels were analysed using absorbance (ability of substance to absorb light) readings and a standard measurement curve of BDNF. Samples that did not show a readable level were replaced with random values. As the sample size in the study was small, this was the better option (Clarke, 1998).

In support of the hypothesis, dogs with SA had statistically lower levels of BDNF than dogs without SA. However, as the dogs with SA in this study also had other diagnoses and previous studies in humans show BDNF relates to multiple psychiatric conditions, the suitability of BNDF as a biomarker needs to be further investigated with larger sample sizes. This could be done by studying the BDNF levels in relation to treatment (i.e., antidepressants). As previous studies show maternal care and early social environment are crucial in its influence on stress behaviours, the relationship between these factors and BDNF should also be investigated for further validity of BDNF as a biomarker.

**Contribution**:

This study is the first to study BDNF levels in dogs with SA. While BDNF has been extensively studied in other similar contexts in other animals, it has not been utilized in canines. It also offers insight into investigation in further utilizing BDNF in the study if SA.

REASON FOR INCLUSION:

This study looked at physiological changes than can arise with SA and was useful as I was looking for a study that investigated internal changes that occurred within affected individuals.

Zapata, I., Serpell, J. A., & Alvarez, C. E. (2016). Genetic mapping of canine fear and aggression. *BMC Genomics*, *17*(1), 572. <https://doi.org/10.1186/s12864-016-2936-3>

**Summary**:

Anxiety induces a detrimental impact on wellbeing. Physiology and neuroanatomy have been greatly studied in relation to anxiety but lacks in genetic research. While studying humans are difficult to analyse in terms of genetic basis of behaviour, canines have differences that make them advantageous to study. These differences include having more genetic variation between breeds than within breeds and having large levels of phenotypic variation. This aimed to study two groups of datasets (canine cohorts) to conduct a genome wide association study to map the genes involved in fear and aggression traits.

First, a PCA analysis (principal component analysis) for multivariable evaluation was used to see if breed impacted the results. PCA results show that breeds in the study did not impact result. After, the two cohorts were sequenced to find genetic components that contribute to fear and aggression behaviours. In terms of separation anxiety (SA) there were a few significant outliers. The IGF1 (insulin like growth factor 1 is hormone involved in growth) gene on chromosome 15, the HMGA2 (High Mobility Group AT-Hook 2 is a protein involved turning DNA into RNA) gene on chromosome 10 and chrX at 105mb (mb – megabases). Both the variants on chromosome x and chromosome 10 are seen across both cohorts and the variant on chromosome 15 is seen in the second cohort. Both the HMGA2 gene and IGF1 variants are also associated with small body size. This creates an association with small body size with separation anxiety and is supported by other studies. However, it is “*unclear*” if this association is *“due to developmental, physiological or psychological effects.”*

**Contribution**:

This study is a start in understanding the genetic basis of behaviours, a field that has not been investigated. It shows that there is a contributing genetic basic for separation anxiety.

REASON FOR INCLUSION:

I was looking for studies that explore the genetic basis (if there was) of SA. This study does exactly that.

 Tiira, K., Sulkama, S., & Lohi, H. (2016). Prevalence, comorbidity, and behavioral variation in canine anxiety. *Journal of Veterinary Behavior*, *16*, 36–44. <https://doi.org/10.1016/j.jveb.2016.06.008>

**Summary**:

Fear and anxiety play a vital role in the survival of an organism. However, when prolonged, these traits can become pathological meaning they become detrimental to an individual. This study aimed to study the frequency of various fear/anxiety related problems and assess the comorbidity (relatedness). It is important to note that because of the nature of the study, there is no clinical diagnosis support given to the results of the questionaries. Answers may be highly interpretive from the owner’s perspective. The study analysed results from a questionnaire of 3284 individuals, all of which were pure breed dogs. 17.2% or 564 of the dogs were reported to have separation anxiety (SA).

From the dogs that had SA (17.2%), 58.8% of the dogs also had generalized fear and 49.5% had a fear of loud noises. This proves a high comorbidity rate between SA, fear of noise and general fear. Other research on the relatedness of these issues varies. Some show a correlation between SA and fear of noise while others do not. As an additional note, is could be possible that the dogs presenting with SA in this study are just generally fearful dogs and/or have a noise phobia without having SA due to the interpretational nature of the study. Other studies show that there may be a genetic component and personality contribution to SA.

There is a need for additional knowledge on the behaviours attributed to SA for reliability of results.

**Contribution**:

Other studies have been established that there may be a relationship between SA and other issues such as noise phobia. This study establishes data that proves an association and notes other contributing factors.

REASON FOR INCLUSION:

SA is a multifactorial problem of which the extent is still being studied. I used this article as it focuses on SA’s association with other problems, specifically since it looks at noise phobia and other articles have mentioned it.