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Behavioural Disorders in Dogs and Cats: A Review

A.U. Haq[1], H.U. Malik[2], S.S. Randhawa[1], M. El-Shazly[3], D. Chandran[4]

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ABSTRACT

Psychiatry is a specialized branch of medicine that studies behavioural disorders in humans and animals. In dogs and cats, behavioural problems are analogous to human psychiatric diseases, with the most common psychopathologies addressed being generalized anxiety disorder, obsessive compulsive disorder, separation anxiety and post-traumatic stress disorder. The level of bizarre behaviours displayed by the pets varies due to a variety of factors such as hereditary, prenatal dam modification and events during their neonatal and socializing phase. The behavioural changes recorded in dogs and cats include trembling, vocalizing, urinating, soiling, defecating, salivating, hiding, destructiveness, aggression, fear and obsessive behaviours. It is critical to remember that other medical complications, that can produce similar behavioural changes, must be addressed for the animal's specific therapy. For the treatment of behavioural disorders in pets, different therapeutic agents (like Tricyclic antidepressants, selective serotonin reuptake inhibitors, benzodiazepines and a typical antidepressants) are used together with the behavioural modification strategies.

Key words: Behaviour, Cat, Dog, Psychopathologies, Therapy.

Behavioural and other medical disorders have long been treated separately in human and animal medicine and it is essential to recognise that human and animal behaviour is closely linked to their medical status (Camps *et al*., 2019). Animal behavioural disorders are analogous to human psychiatric diseases and with a specific focus on pets (dogs and cats), their psychopathologies are investigated, followed by correction using various therapeutic and behavioural modification approaches (Crowell-Davis, 2009; Haq *et al*., 2017). As a result, one of the most recent contributions to the area of psychiatry focuses on our four-legged companions (Haq *et al*., 2017). The most common behavioural or psychological problems studied and reported in dogs and cats are obsessive-compulsive disorder (OCD), generalised anxiety disorder (GAD), separation anxiety disorder (SAD) and post-traumatic stress disorder (PTSD) (Crowell-Davis, 2009). Not all dogs and cats behave and show their level of anxiety, in the same way, hence the individual variation in the display of their behaviour might be caused due to a variety of influences such as hereditary, prenatal dam modification and events during their neonatal and socializing periods (Camps *et al*., 2019). Due to the development of anxiety, stress levels increase, which can be measured by serum cortisol levels (Marques *et al*., 2010; Wormald *et al*., 2017; Franzini de Souza *et al*., 2017). For treatment of behavioural disorders in dogs and cat's pharmacological interventions (like tricyclic antidepressants, selective serotonin reuptake inhibitors, benzodiazepines and atypical antidepressants) are used together with pet behavioural alteration therapy which may protect the well-being of our four-legged companions (Overall and Dunham, 2002; Haq *et al*., 2017; Crowell-Davis, 2009). This review paper describes the common behavioural disorders seen in dogs and cats along with their therapeutic management.

[1]Department of Veterinary Medicine, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141 012, Punjab, India.
[2]Division of Clinical Veterinary Medicine, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agriculture Sciences and Technology of Kashmir, Srinagar-190 006, Jammu and Kashmir, India.
[3]Department of Pharmaceutical Biology, Faculty of Pharmacy and Biotechnology, German University in Cairo, 11432, Egypt.
[4]Department of Veterinary Sciences and Animal Husbandry, School of Agricultural Sciences, Amrita Vishwa Vidyapeetham University, Coimbatore-642 109, Tamil Nadu. India.

Corresponding Author: A.U. Haq, Department of Veterinary Medicine, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141 012, Punjab, India.
Email: dr.abrar79@gmail.com

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Animal psychiatry

Psychiatry is the medical specialty concerned with the diagnosis, treatment and prevention of mental, emotional and behavioural complications (Alarcon, 2016; Haq *et al*., 2017). This super specialty medicine treats behavioural disorders which are conventionally categorized into three phases *i.e*., mental illness, severe learning disabilities and personality disorders (Haq *et al*., 2017). In the case of animal psychiatry, with a special focus on pets, their psychopathologies are studied followed by its correction through different therapeutic and behavioural modification techniques (Overall and Dunham, 2002). When it comes to behavioural diseases in animals or pets, they are quite analogous to human psychiatric illnesses. As a result, one

of the most recent contributions to the area of psychiatry is aimed at dealing with our four-legged companions (Haq *et al.*, 2017). Pet psychiatry is a developing discipline in which clinicians are entrusted with dealing with pets displaying problematic behaviours which have gotten so severe that they've been affecting the happiness and welfare of their animal owners. Aggression against public or other creatures, obsessive behaviour, improper elimination, soiling, hyperactivity, or signs of anxieties and phobias are examples of such behaviours (Haq *et al.*, 2017)). In cats, behavioural problems associated with elimination includes house soiling, urine spraying (marking). Pet animal psychiatry involves both medical and behavioural modifications. It is now commonly acknowledged that domestic pets like dogs and cats can suffer from mental health difficulties that are quite similar to those experienced by humans. Dogs have been proven to exhibit depression rates analogous to people (Haq *et al.*, 2017). Behavioural disorders such as obsessive-compulsive disorder (OCD), generalised anxiety disorder (GAD), separation anxiety disorder (SAD) and post-traumatic stress disorder (PTSD), are the most frequently detected behavioural or psychiatric disorders in pet animals (Overall and Dunham, 2002; Haq *et al.*, 2017; Forster *et al.*, 2020).

Behavioural disorders

When presented with the same circumstance, not all animals behave in the same way. Individual variations in the display of their behaviour might be caused by a variety of influences. Among these influences include hereditary, prenatal dam modification (Kaiser and Sachser, 2005; Weinstock, 2008), events of the animal during different periods of development especially neonatal and socializing periods, events during maturity and the efficient functioning of animal's organ systems (Scott, 1962; Camps *et al.*, 2019). Discussing the proper organ function in animals, it is affected due to an array of medical complications which can cause behavioural problems directly or indirectly in our pet animals and these complications include those that alter or eliminate external perception (*e.g.,* blindness), information perception (*e.g.,* brain tumour), stress reaction owing to pain and those that drastically alter internal processes due to hormonal or neurological issues (Camps *et al.*, 2019). In general, behavioural disorders in animals are characterized as abnormally unpleasant behaviour seen by the animal owner that can be harmful to people, other animals, or even the patient itself and that can directly or indirectly impair the patient's wellbeing (Haq *et al.*, 2017; Camps *et al.*, 2019). In felines, younger and older cats have similar behavioural issues, but older cats are more likely to have a pathophysiologic underlying disease (Ahola *et al.*, 2017). Furthermore, cognitive dysfunction has been mostly seen in canines with lesser prevalence in cats (Landsberg *et al.*, 2010). The most common behavioural disorders reported and studied in dogs and cats are described under the following subheadings and the common dog behavioural problems are depicted in Fig 1. A list of drugs that may benefit pets with behavioural disorders is mentioned in Table 1.

Generalized anxiety disorder (GAD)

This condition is a significant issue in both human and animal species (Crowell-Davis, 2009; Ferdowsian *et al.*, 2012; Craske and Stein, 2016). GAD occurs in human patients for 6 months with irrepressible and noticeable anxiety (Craske and Stein, 2016). Dogs with GAD display continual or nearly constant signs of anxiety and worry, regardless of the situation, diminishing their quality of life and everyday functioning (Crowell-Davis, 2009). The clinical presentation of the illness differs across patients, but in general, at least 2 to 3 months of chronic anxiety symptoms in dogs and cats (like trembling, vocalizing, urinating, defecating, salivating, hiding, destructiveness) are required to diagnose GAD (Crowell-Davis, 2009). The patient

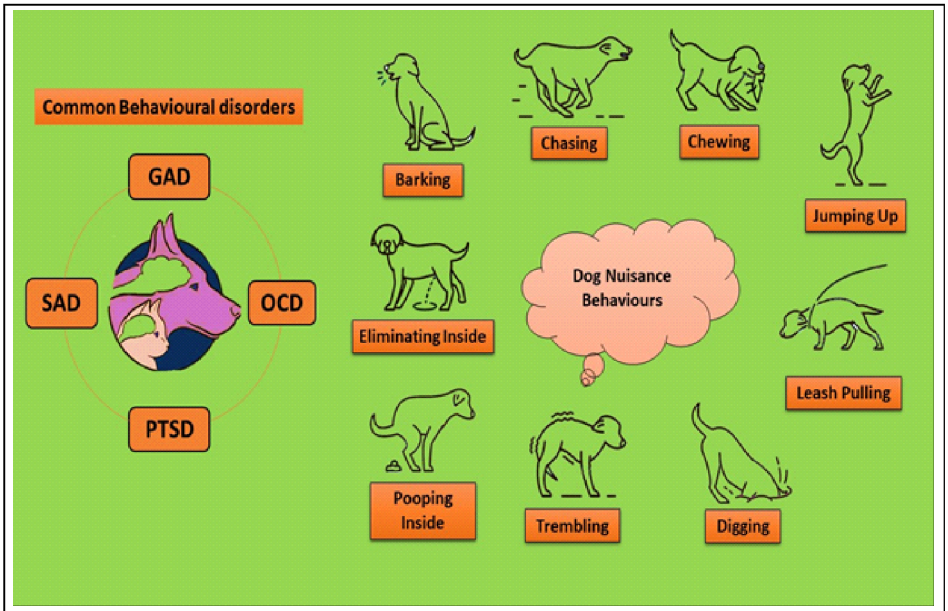
Table 1: List of common drugs used in behavioural disorders of dogs and cats.

Medication	Dogs	Cats	Reference
Fluoxetine	1-2 mg/kg	0.5-1 mg/kg	(Haq *et al.*, 2017; Crowell-Davis, 2009; Overall and Dunham, 2002; Amat *et al.*, 2014)
Amitriptyline	1-4 mg/kg	2-10 mg/kg	(Overall and Dunham, 2002; Haq *et al.*, 2017; Crowell-Davis, 2009)
Clomipramine	1-3 mg/kg	0.24-1.3 mg/kg	(Overall and Dunham, 2002; Haq *et al.,* 2017; Crowell-Davis, 2009; Amat *et al.*, 2014)
Alprazolam	0.02-0.1 mg/kg	0.0125-0.25 mg/kg	(Haq *et al.*, 2017; Crowell-Davis, 2009; Overall and Dunham, 2002)
Diazepam	0.5-2 mg/kg	0.1-1 mg/kg	(Haq *et al.*, 2017; Crowell-Davis, 2009; Overall and Dunham, 2002)
Paroxetine	1-1.5 mg/kg	0.5-1.5 mg/kg	(Haq *et al.*, 2017; Crowell-Davis, 2009; Overall and Dunham, 2002)
Sertraline	0.5-4 mg/kg	0.5-1.5 mg/kg	(Haq *et al.*, 2017; Crowell-Davis, 2009; Overall and Dunham, 2002)
Buspirone	0.5-2 mg/kg	0.5-1 mg/kg	(Overall and Dunham, 2002; Crowell-Davis, 2009; Haq *et al.*, 2017)

develops a tendency for behavioural problems, which is primarily influenced bygenetic predisposition (demonstrated in dogs due to the presence of a fearful phenotype), environmental reasons and initial life experiences (like poor socialization, low-quality nursing care and bad experience during puppyhood (Tiira and Lohi, 2015; Zapata *et al*., 2016; Craske *et al*., 2017; Sarviaho *et al*., 2019). The consequence of all these influences makes the pets susceptible to develop GAD that presents a major negative impact on the quality of life for affected animals (Blackwell *et al*., 2013). Anxiety causes stress levels to rise, as measured by serum cortisol levels (Marques *et al*., 2010, Franzini de Souza *et al*., 2017, Wormald *et al*., 2017). Therefore, GAD has severe psychological and physical forfeits for the affected individual, forcing owners to seek necessary treatment. So for this, behavioural modification therapy, along with the psychopharmacological interventions is required, which will protect well-being or enable behavioural management (Mills, 2003, Herron *et al*., 2008; Ibanez and Anzola, 2009; Karagiannis *et al*., 2015). Pharmacological treatments include the use of various drugs like alprazolam, clomipramine and diazepam (Haq *et al*., 2017). Medication is an important part of treatment for dogs and cats that are persistently anxious. Most patients can benefit from azapirone, serotonin and norepinephrine reuptake inhibitor or a selective serotonin reuptake inhibitor (Crowell-Davis, 2009). These medications are administered to the pet on daily basis for several weeks to produce a long-term change in the pet's underlying emotional state. Benzodiazepines should not be used excessively since they have the potential for addiction (Crowell-Davis, 2009). Recent research has shown that treating GAD in dogs with imepitoin at a dose of approximately 20 mg/kg orally twice daily has an anti-stress effect. The medication reduced serum cortisol levels, indicating a reduction in stress (Forster *et al*., 2020). Imepitoin possesses anxiolytic and anticonvulsant action (Rundfeldt and Löscher, 2014) and it has exhibited benzodiazepine-like effects in several conventional anxiety models (Engel *et al*., 2018), as well as anxiolytic effects in canine patients (McPeake and Mills, 2017).

Obsessive compulsive disorder (OCD)

OCD is a well-documented behavioural abnormality in animal psychiatry that is rated as the most debilitating. The compulsive component of obsessive-compulsive disorder (OCD) in dogs and cats is marked by ritualistic and stereotypic behaviour (Overall and Dunham, 2002). Spinning, circling, tail chasing, trying to suck the flank (common in the Doberman), fly nibbling, fence jumping, self-mutilation, hair or wind smacking, pica including coprophagy, staring and making sounds, aggression and cloth sucking or biting are all examples of OCD in canines (Haq *et al*., 2017; Overall and Dunham, 2002). OCD in cats may be linked to environmental and social stress and in cats, signs of self-mutilation, excessive grooming, chasing of tail and wool or fabric sucking or chewing are also noticed (Overall and Dunham, 2002). Differential diagnoses of OCD signs should be done with the other behavioural conditions like attention-seeking behaviour, separation anxiety, GAD and hyperactivity (Overall, 1997; Overall and Dunham, 2002). Researchers have discovered chromosome 7 in dogs, which imparts a significant likelihood of vulnerability to OCD, therefore signifying genetic element for OCD incanines (Haq *et al*., 2017). Canine chromosome 7 is



GAD (Generalized anxiety disorder); SAD (Separation anxiety disorder); OCD (obsessive compulsive disorder); PTSD (Post traumatic stress disorder).

Fig 1: Common behavioural problems in dogs.

expressed in the brain's hippocampus, the same region where OCD is present in human sufferers. Similar pathways are implicated in pharmacological treatment responses in both people and dogs, providing more evidence that the two species display symptoms and respond to therapy in similar ways. This knowledge can help scientists develop more effective and efficient ways to treat OCD in people by investigating obsessive compulsive disorder in dogs (Haq *et al.*, 2017). Miniature bull terriers, Staffordshire bull terriers and German shepherds are the dog breeds most prone to OCD (Nuwer, 2012; Overall and Dunham, 2002). The first line of therapy for OCD is the use of serotonin reuptake medications in conjunction with cognitive behavioural modification (Haq *et al.*, 2017; Overall and Dunham, 2002). Tricyclic antidepressants (Clomipramine and amitriptyline), selective serotonin reuptake inhibitors (like fluoxetine) and monoamine oxidase type B (MAO-B) inhibitors (like Selegeline) are the most effective and commonly used medicines for OCD (Overall and Dunham, 2002; Haq *et al.*, 2017). TCAs should not be given to animals that have a history of urinary retention or severe, uncontrolled heart arrhythmia (Reich *et al.*, 2000).

Separation anxiety disorder (SAD)

It is a behavioural condition that occurs in dogs and cats whenever they are left alone at home or once they are separated from their owner (Sherman and Mills, 2008; Haq *et al.*, 2017). Symptoms of this illness appear frequently when the animal suspects that it will be left alone and gets more severe between 30 and 60 minutes after the departure of the owner (Haq *et al.*, 2017). Excessive vocalization, disruptive behaviour, impatience, premature urine and defecation, excessive salivation, psychogenic grooming in cats and attempts of escape are among the clinical manifestations of the pets documented in SAD (Amat *et al.*, 2014; Haq *et al.*, 2017). Symptoms of vomiting, anorexia and acral lick dermatitis have also been recorded. The owners often describe their pets welcoming behaviour as excessively profuse. This condition is often found in puppies around 2-3 months old as a result of early separation from their mother (Haq *et al.*, 2017). Furthermore, separation anxiety has a detrimental impact on the human-animal relationship, which may lead to owner abandonment of healthy dogs or a decision of euthanizing their pets (Salman *et al.*, 1998; Amat *et al.*, 2014). One factor that contributes to SAD in canines is their prediction of the owner's leaving, which is based on the dog learning the relationship between the real departure as well as several signals that accompany it and are provided by the owner, mostly unknowingly, such as picking the keys and wearing a jacket (Amat *et al.*, 2014). One advice often recommended to owners of canines suffering from a separation anxiety disorder is to give false departure signals by behaving as if they are ready to leave. The goal of this strategy is to keep the animal's expectation for the owner's actual departure and so it minimizes the dogs fear and anxiety (Horwitz 2002; Takeuchi *et al.*, 2000; Appleby and Pluijmakers, 2003; Blackwell *et al.*, 2006; Sherman and Mills, 2008; Overall, 2013). Thus, the most effective treatment for SAD is to educate the dog to tolerate the owner's absence, followed by correction of particular issues such as destruction, barking and elimination. A combination of behavioural modification and pharmaceutical therapy has demonstrated superior outcomes in the treatment of SAD (Simpson *et al.*, 2007; Landsberg *et al.*, 2008). In the United States of America, two drugs, clomipramine and fluoxetine (both commonly used antidepressant drugs in humans), have been approved for the treatment of separation anxiety in dogs (King *et al.*, 2000; Simpson *et al.*, 2007). Clomipramine is used at a dose of 1-2 mg/kg every 12 hours, which decreases pacing, scratching and whining of dogs with separation anxiety in the absence of their owners (Simpson *et al.*, 2007). Drug clonidine that is used in humans for hypertension, is also used in combination with clomipramine for the treatment of SAD with behavioural improvements recorded in dogs (Ogata and Dodman, 2011). Besides pharmacological remedies for SAD, another intervention has been found to alleviate symptoms of SAD and that is a 'Dog appeasing pheromone therapy' given through an electric diffuser (Kim *et al.*, 2010). The sebaceous glands (of mammary glands) of lactating bitches naturally produce dog-appeasing pheromone immediately after whelping. Anxious young and adult dogs in stressful situations can detect this pheromone *via* the vomeronasal organ, which results in a calming effect (Pageat and Gaultier, 2003). When diffusing the pheromone in absence of the owner, it was revealed that this therapy together with behavioural modification was as effective as using clomipramine and had fewer undesirable side effects (Kim *et al.*, 2010).

Post-traumatic stress disorder (PTSD)

Domestic pets, particularly military dogs, are prone to post-traumatic stress disorder (Haq *et al.*, 2017). It happens as a result of being exposed to terrifying events such as intense personal attacks, natural or man-made calamities, tragedies, or military combat (Yamamoto, 2003; Haq *et al.*, 2017). It is believed that around 650 million army dogs (5%) returning from the battlefields suffer from PTSD, although domestic canines may get this disorder in a variety of settings (Dao, 2011). If a dog is abandoned in the wild, has experienced a natural disaster such as a storm, is abused, or has lost his owner, he may acquire PTSD (Yamamoto, 2003). Anxiety, panting, nervousness, being frightened and clutching to their caregivers, aggressive behaviours, despair and hyper-vigilant are all indications of PTSD in canines. Military canines often shut down and refuse to do any work (Haq *et al.*, 2017; Dao, 2011). Treatment for any dog patient suffering from PTSD can be tough and varies depending on the particular sufferer. PTSD treatment is a blend of medication and behavioural change. A doctor must prescribe an anxiolytic medication (*e.g.*, clomipramine, fluoxetine and amitriptyline), followed by a behavioural program, *i.e.*, desensitization. The drug is

discontinued after favourable results in dogs. Desensitization entails progressively increasing the dog's exposure to troublesome stimuli (Haq *et al*., 2017). If indeed the problem was noise, the animal behaviourist would begin by delivering the noise at a very low level. The dog is rewarded with food if he tolerates that noise. The sound is delivered in such a way that it becomes gradually louder with each presentation. Aside from Systematic desensitization, regular exercise, play activities and positive reinforcement conditioning are also key components of the PTSD dog behaviour plan. Many of the medications used to treat SAD in dogs are often used in treating PTSD (Yamamoto, 2003; Haq *et al*., 2017).

CONCLUSION

Dog and cat behavioural issues are very comparable to human psychiatric illnesses. A veterinarian needs to assess their patients thoroughly to ensure no medical reason for such abnormal behaviour. The most common diagnosed behavioural disorders in canines and felines are GAD, SAD, OCD and PTSD. In pet psychiatric disorders, pharmacological therapy must be combined with behavioural education, training, counselling and modification, with the ultimate goal of withdrawing pharmaceutical medication. Based on these facts, a thorough understanding of pet clinical psychology prompts urgent familiarity with behavioural medicine, molecular genetics and psychoanalytical hypothesis and also diligent monitoring of behavioural and psychological symptoms and vices which could warrant psychiatric evaluation.

Conflict of interest

The authors declare no conflict of interest.

REFERENCES

Ahola, M.K., Vapalahti, K. and Lohi, H. (2017). Early weaning increases aggression and stereotypic behaviour in cats. Scientific Reports. 7: 10412.

Alarcón, R.D. (2016). Psychiatry and its Dichotomies. Psychiatric Times. 33(5): 1.

Amat, M., Camps, T., Brech, S.L. and Manteca, X. (2014). Separation anxiety in dogs: The implications of predictability and contextual fear for behavioural treatment. Animal Welfare. 23: 263-266.

Appleby, D. and 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: 321-344.

Blackwell, E., Casey, R.A. and Bradshaw, J.W.S. (2006). Controlled trial of behavioural therapy for separation-related disorders in dogs. Veterinary Record. 158: 551-554.

Blackwell, E.J., Bradshaw, J.W.S. and Casey, R.A. (2013). Fear responses to noises in domestic dogs: Prevalence, risk factors and co-occurrence with other fear related behaviour. Applied Animal Behaviour Science. 145: 15-25.

Camps, T., Amat, M. and Manteca, X. (2019). A review of medical conditions and behavioural problems in dogs and cats. Animals. 9(12): 1-17.

Craske, M.G. and Stein, M.B. (2016). Anxiety. Lancet. 388: 3048-3059.

Craske, M.G., Stein, M.B., Eley, T.C., Milad, M.R., Holmes, A., Rapee, R.M. and Wittchen, H.U. (2017). Anxiety disorders. Nature Reviews Disease Primers. 3: 17024.

Crowell-Davis, S.L. (2009). Generalized anxiety disorder. Compendium on Continuing Education for the Practising Veterinarian. 31: 427-430.

Dao, J. (2011). The Dogs of War, Suffering Like Soldiers. The New York Times.

Engel, O., Masic, A., Landsberg, G., Brooks, M., Mills, D.S. and Rundfeldt, C. (2018). Imepitoin shows benzodiazepine-like effects in models of anxiety. Frontiers in Pharmacology. 9: 1-11.

Ferdowsian, H.R., Durham, D.L., Johnson, C.M., Brüne, M., Kimwele, C., Kranendonk, G., Otali, E., Akugizibwe, T., Mulcahy, J.B. and Ajarova, L. (2012). Signs of generalized anxiety and compulsive disorders in chimpanzees. Journal of Veterinary Behavior: Clinical Applications and Research. 7: 353-361.

Forster, B., Engel, O., Erhard, M. and Bartels, A. (2020). Short-term imepitoin treatment reduces stress level in dogs with generalized anxiety disorder. Journal of Veterinary Behavior. 38: 67-73.

Franzini de Souza, C.C., Maccariello, C.E.M., Dias, D.P.M., Almeida, N.A.D.S. and Medeiros, M.A.D. (2017). Autonomic, endocrine and behavioural responses to thunder in laboratory and companion dogs. Physiology and Behavior. 169: 208-215.

Haq, A.U. (2017). Canine psychiatry: Addressing animal psychopathologies. Journal of Entomology and Zoology Studies. 5(6): 1126-1128.

Herron, M.E., Shofer, F.S. and Reisner, I.R. (2008). Retrospective evaluation of the effects of diazepam in dogs with anxiety-related behavior problems. Journal of the American Veterinary Medical Association. 233: 1420-1424.

Horwitz, D. (2002). Separation-related problems in dogs. In: BSAVA Manual of Canine and Feline Behavioural Medicine. [Horwitz, D. Mills, D. and Heath, S. (eds)]. pp. 154-163.

Ibanez, M. and Anzola, B. (2009). Use of fluoxetine, diazepam and behavior modification as therapy for treatment of anxiety-related disorders in dogs. Journal of Veterinary Behavior: Clinical Applications and Research. 4: 223-229.

Kaiser, S. and Sachser, N. (2005). The effects of prenatal social stress on behavior: Mechanism and function. Neuroscience and Biobehavioral Reviews. 29: 283-294.

Karagiannis, C.I., Burman, O.H. and Mills, D.S. (2015). Dogs with separation related problems show a less pessimistic cognitive bias during treatment with fluoxetine (Reconcile) and a behaviour modification plan. BMC Veterinary Research. 11: 1-10.

Kim, Y.M., Lee, J.K., Abd el-aty, A.M., Hwang, S.H., Lee, J.H. and Lee, S.M. (2010). Efficacy of dog-appeasing pheromone (DAP) for ameliorating separation-related behavioral signs in hospitalized dogs. Canadian Veterinary Journal. 51(4): 380-384.

King, J.N., Simpson, B.S., Overall, K.L., Appleby, D., Pageat, P., Ross, C., Chaurand, J.P., *et al*., (2000). Treatment of separation anxiety in dogs with clomipramine: results from a prospective, randomized, double-blind, placebo-controlled, parallel-group, multicenter clinical trial. Applied Animal Behaviour Science. 67(4): 255-275.

Landsberg, G., Melese, P., Sherman, B., Neilson, J., Zimmerman, A. and Clarke, T. (2008). Effectiveness of fluoxetine chewable tables in the treatment of canine separation anxiety. Journal of Veterinary Behavior: Clinical Applications and Research. 3: 12-19.

Landsberg, G.M., Denenberg, S. And Araujo, J.A. (2010). Cognitive dysfunction in cats: A syndrome we used to dismiss as 'old age'. The Journal of Feline Medicine and Surgery. 12: 837-848.

Marques, A.H., Silverman, M.N. and Sternberg, E.M. (2010). Evaluation of stress systems by applying noninvasive methodologies: Measurements of neuroimmune biomarkers in the sweat, heart rate variability and salivary cortisol. Neuroimmunomodulation. 17: 205-208.

McPeake, K.J. and Mills, D.S. (2017). The use of imepitoin (Pexion) on fear and anxiety related problems in dogs-A case series. BMC Veterinary Research. 13: 1-14.

Mills, D.S. (2003). Medical paradigms for the study of problem behaviour: A critical review. Applied Animal Behaviour Science. 81: 265-277.

Nuwer, R. (2012). From tail chasing to hand washing. Scientific American. 307(5): 25.

Ogata, N. and Dodman, N.H. (2011). The use of clonidine in the treatment of fear-based behavior problems in dogs: An open trial. Journal of Veterinary Behavior: Clinical Applications and Research. 6(2): 130-137.

Overall, K.L. (1997). Clinical behavioral medicine for small animals. St Louis: Mosby Year Book Inc. pp. 209-250, 404, 410-423, 508-520.

Overall, K.L. (2013). Manual of Clinical Behavioral Medicine for Dogs and Cats. Elsevier Mosby: USA.

Overall, K.L. and Dunham, A.E. (2002). Clinical features and outcome in dogs and cats with obsessive-compulsive disorder: 126 cases (1989-2000). Journal of the American Veterinary Medical Association. 221(10): 1445-1452.

Pageat, P. and Gaultier, E. (2003). Current research in canine and feline pheromones. Veterinary Clinics of North America: Small Animal Practice. 33: 187-211.

Reich, M.R., Ohad, D.G., Overall, K.L. and Dunham, A.E. (2000). Electrocardiographic assessment of antianxiety medication in dogs and correlations with serum drug concentration. Journal of the American Veterinary Medical Association. 216: 1571-1575.

Rundfeldt, C. and Löscher, W. (2014). The pharmacology of imepitoin: The first partial benzodiazepine receptor agonist developed for the treatment of epilepsy. CNS Drugs. 28(1): 29-43.

Salman, M.D., New, J.G J.r., Scarlett, J.M., Kass, P.H., Ruch-Gallie, R. and Hetts, S. (1998). Human and animal factors related to the relinquishment of dogs and cats to 12 selected animal shelters in the United States. Journal of Applied Animal Welfare Science. 1: 207-226.

Sarviaho, R., Hakosalo, O., Tiira, K., Sulkama, S., Salmela, E., Hytönen, M.K., Sillanpää, M.J. and Lohi, H. (2019). Two novel genomic regions associated with fearfulness in dogs overlap human neuropsychiatric loci. Translational Psychiatry. 9: 1-11.

Scott, J.P. (1962). Critical periods in behavioral development. Science. 138: 949-958.

Sherman, B.L. and Mills, D.S. (2008). Canine anxieties and phobias: An update on separation anxiety and noise aversions. Veterinary Clinics of North America: Small Animal Practice. 38: 1081-1106.

Simpson, B.S., Landsberg, G.M., Reisner, I.R., Ciribassi, J.J., Horwitz, D., Houpt, K.A., *et al*. (2007). Effects of reconcile (fluoxetine) chewable tablets plus behavior management for canine separation anxiety. Veterinary The rapeutics: Research in Applied Veterinary Medicine. 8(1): 18-31.

Takeuchi, Y., Houpt, K.A. and Scarlett, J.M (2000). Takeuchi Evaluation of treatments for separation anxiety in dogs. Journal of the American Veterinary Medical Association. 217: 342-345.

Tiira, K. and Lohi, H. (2015). Early Life Experiences and Exercise Associate with Canine Anxieties. PLoS One. 10: e0141907.

Weinstock, M. (2008). The long-term behavioral consequences of prenatal stress. Neuroscience and Biobehavioral Reviews. 32: 1073-1086.

Wormald, D., Lawrence, A.J., Carter, G. and Fisher, A.D. (2017). Reduced heart rate variability in pet dogs affected by anxiety-related behaviour problems. Physiology and Behavior. 168: 122-127.

Yamamoto, T. (2003). An unusual behavior and post-traumatic stress disorder (PTSD)-like syndrome in dogs after the vigorous earthquake with seismic scale of 5+ Degree. Journal of Veterinary Medicine. 984: 535-41.

Zapata, I., Serpell, J.A. and Alvarez, C.E. (2016). Genetic mapping of canine fear and aggression. BMC Genomics. 17: 1-20.