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## Abstract

Awareness of the strong connection between observed behaviour and physical and emotional health is essential for the well-being of the animal patient. Often, it is a change in the individual's normal behaviour that alerts guardians and veterinarians to the possibility of a psychosomatic pathology. There is ample evidence in the veterinary literature that physiological and behavioural health go hand in hand. In most cases involving domestic cats, physiological and behavioural conditions simultaneously contribute to clinical signs. Our domestic cats do not express changes in their physiological and emotional states in an easily recognisable way. Therefore, it can be difficult to diagnose physiological diseases and quantify the contribution of each to the final diagnosis of a psychosomatic pathology. The presence of various levels of stress, especially distress, compromises behavioural and physical health and influences treatment outcomes. This review aims to assist veterinarians in recognising physical and behavioural changes associated with acute stress and chronic distress, including stress-related diseases. Emphasis on a complete history will allow the clinician to determine which signs are behavioural and which are medical, with the understanding that they are not mutually exclusive. Equally important is the contribution of pain, chronic diseases, and adverse environmental situations to behavioural changes and the expression of psychosomatic disorders. There is a growing body of evidence that stress and distress have profound effects on the health, behaviour, and well-being of cats. The author drew on a substantial body of clinical realities and published veterinary research to produce this review.

**Keywords:** Behaviour. Ethology. Psychobiology. Veterinary psychiatry.

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## 1 Introduction

Understanding animal behaviour and needs is extremely important for providing excellent care. Animal behaviour is closely linked to the evolutionary process of neurological tissues that move toward the cephalic region, promoting the creation of a central nervous system closer to the sense organs, providing an increase in sensory and cognitive functionalities.

The functional analysis of animal behaviour establishes a relationship between a given action and changes that occur in the environment surrounding the living being or within the individual itself. Changes in these factors can occur incidentally, in which case the veterinarian must know all the factors involved in order to contribute to the solution of this pathology (FURTADO; SILVA; TELES, 2018; GAIA et al., 2019).

Psychosomatic diseases in outdoor cats rarely manifest themselves, as psychosomatic disorders, in which physical illnesses result from psychological stress, are common in domestic cats due to the lifestyle they have come to have (FURTADO; SOBRAL, 2023).

The many treatments and consultations carried out contribute to the suspicion of a strong psychological component, particularly linked to viral infections, urinary tract diseases, respiratory tract diseases, and diabetes, which lead us to reflect on questions such as: Why are cats prone to develop psychosomatic diseases? Furthermore, which feline patients are at risk? How can psychological stress be recognized? And what is the responsibility of guardians regarding their mental health?

## 2 Material and Methods

An extensive literature review was conducted on the factors involved in the adaptation syndrome found in captive animals. Interpretations provided by veterinarians and veterinary psychiatry professionals were included (BARDIN, 1977; DIAS et al., 2011; GIL, 2017).

This article represents a study based on a review of specific literature addressing ethology, veterinary psychiatry, and animal behaviour. It synthesizes information available in electronic databases such as Google and Scholar Google, using keywords such as Behaviour, Ethological Studies, and Veterinary Medicine. The relevant literature was critically read to extract the most important issues (BARDIN, 1977; DIAS et al., 2011; GIL, 2017).

## 3 Psychosomatic Diseases in Cats

When we reflect on human history, when humans began storing their crops in barns, the ancestors of *Felis catus* Linnaeus, 1758 voluntarily joined humans about 10,000 years ago. A self-domestication that only cats can claim for themselves. They fought against the army of rodents that attacked supplies and were therefore valued, and nothing else was required of these felines (DENENBERG; DUBÉ, 2018; BENEDITO; VASCONCELOS, 2023).

It was not common at that time to consider this feline a desirable pet that, with its purring comfort and elegant appearance of a domestic panther, could change the desire to have them in their homes in a privileged way, just like dogs, and so these felines were largely spared from selective breeding interventions until about 150 years ago. As a result, cats are considered stubborn, independent, individualistic, wild, and domestic at the same time (DENENBERG; DUBÉ, 2018; BENEDITO; VASCONCELOS, 2023).

Genetically, our domestic cats (*Felis catus*) contain many more wild cat characteristics than dogs contain wolf characteristics. This factor may explain why many cats are less tolerant of interference in their natural way of life and why they react relatively frequently with psychosomatic disorders to significantly different housing and environmental conditions (DENENBERG; DUBÉ, 2018; BENEDITO; VASCONCELOS, 2023).

### 3.1. Triggers of psychosomatic illnesses in cats

The system in which many owners raise their domestic cats provides living conditions that are not stimulating for the cat and ends up being a disturbed relationship, taking into account the pet's perception of its interaction with the owner, which can promote the development of psychosomatic pathologies, a fact commonly observed in veterinary psychiatry clinics (DENENBERG; DUBÉ, 2018; HALLS, 2018).

Domestic cats are often only partially adapted to group living, and many of them do not adapt at all. In addition to boredom and misunderstandings between cats and humans, the simple fact of being forced to socialise in a confined space with the guardian and/or other domestic cats can act as a stress factor for the cat, causing various pathologies (DENENBERG; DUBÉ, 2018; BENEDITO; DE VASCONCELOS, 2023).

With the increase in guardians who are now raising domestic cats, due to the greater ease of having them inside their homes, it is mainly these cats that remain indoors full-time and thus develop psychological disorders more easily.

It has been observed that domestic cats that have access to the outside environment of the home are rarely affected by psychiatric disorders. This is due to the activities they engage in, having multiple opportunities to perform actions that are more natural to their origins and thus favouring the lesser development of psychiatric disorders (DEMONTIGNY-BÉDARD et al., 2016; DEMONTIGNY-BÉDARD; FRANK, 2018).

Although this reflects the reality of domestic cats, it still does not explain all cases of veterinary psychiatry presented by them. Similar to what happens with humans, the triggers for the onset of psychosomatic disorders are undefined, varying from individual to individual. While one domestic cat tolerates certain things without difficulty, another may become overwhelmed and develop symptoms that can be attributed to living conditions perceived as unpleasant or threatening (DENENBERG; DUBÉ, 2018; BENEDITO; DE VASCONCELOS, 2023).

It has been observed that even among individuals from the same litter, there can be significant differences in their perceptions and behavioural responses. Among a wide variety of factors that influence the onset of psychiatric disorders in domestic cats, breed, age, gender, and social environment are significant factors in the development of behavioural disorders and psychosomatic illnesses (DEMONTIGNY-BÉDARD, et al., 2016; DEMONTIGNY-BÉDARD; FRANK, 2018).

### **3.2. Chronic overload**

Perceived stress is essential for the development of psychosomatic diseases. It occurs when a cat's essential needs are not met. Domestic cats are exposed to a variety of stressors that can trigger various behavioural changes (ELLIS et al., 2017; DELGADO; DANTAS, 2020; FURTADO; SOBRAL, 2023).

Stress in these cases should be understood in the biological-medical sense, as a response to tension that challenges the feline patient's body. It is defined as a physical and psychological reaction that occurs to harmful or unpleasant stimuli, which our patients perceive as stressors, whose processing and control the animal is unable to deal with acutely or chronically, that is, continuously, and in these cases, the animal's body reacts by releasing hormones that are stressors (ELLIS et al., 2017; DELGADO; DANTAS, 2020; FURTADO; SOBRAL, 2023; FURTADO; DA SILVA; SOBRAL, 2022).

In cats, stress triggers the release of hormones such as glucocorticoids (especially cortisol) and catecholamines (adrenaline and noradrenaline). These hormones are indicators of adrenal activity and disorders and are released in stressful situations to prepare the body to respond to the stressor.

These are the same hormones that the human body uses to respond to stressful situations (STELLA; CRONEY; BUFFINGTON; 2013; HORWITZ; RODAN, 2018; FURTADO; DA SILVA; SOBRAL, 2022).

Cortisol is a stress hormone that can play a significant role in psychosomatic diseases in domestic cats. Chronic stress can lead to increased cortisol levels, negatively affecting the animal's physical and mental health. This condition can trigger or aggravate various diseases, including gastrointestinal problems, feline idiopathic cystitis (FIC), and dermatological diseases (STELLA; CRONEY; BUFFINGTON; 2013; HORWITZ; RODAN, 2018; FURTADO; DA SILVA; SOBRAL, 2022).

### **3.3. Coping - the cat's protective shield against stress**

Domestic cats that are more sensitive to anxiety, pain, generalised trauma, and stressful situations are unable to control and/or predict the factors that cause them great discomfort and end up triggering psychological disorders more easily. In contrast, more robust domestic cats with high stress tolerance have learned to cope with stressful factors or have adapted to develop ways to avoid them (FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022).

These animals are less susceptible to developing psychosomatic disorders. They develop appropriate coping strategies in potentially stressful situations, a skill known as coping. Coping skills are determined in part by genetic factors and in part by environmental factors, known as epigenetic influences. The latter determines which existing genes are activated and which are not (FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022).

### **3.4. Epigenetics**

Every living being has a blueprint that is encoded in its genes. These are present in the nucleus of every cell in the body in the form of DNA. However, not every gene should manifest itself, with all its potential and behavioural reflexes, on every occasion. One gene may need to be temporarily or permanently deactivated in a given place and situation, while another may need to be activated in other realities (URREGO; RODRIGUEZ-OSORIO; NIEMANN, 2014). Environmental influences and needs within the body itself determine the epigenetic programming of the genome, the results of which can even be passed on to descendants (URREGO; RODRIGUEZ-OSORIO; NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022).

The science of epigenetics studies changes in gene expression that do not involve changes in DNA sequence but can be hereditary.

Thus, epigenetics explores how environmental factors and lifestyle can influence how genes are activated or deactivated, affecting the functioning of the organism (URREGO; RODRIGUEZ-OSORIO; NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022).

The genes themselves are not altered. Studies with cloned mice have shown that even genetically identical siblings develop into different individuals through the influence of the environment in which they live and the resulting epigenetic influences. In the end, no two organisms are alike, even if their genes are identical (URREGO; RODRIGUEZ-OSORIO; NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022).

### **3.5. The influence of care and a friendly environment**

Epigenetic factors influence the behaviour, metabolism, and resilience of offspring. They also shape the organism in terms of when and how much cortisol is produced, as they program the organs and brain regions associated with cortisol metabolism. Parts of the brain are also affected, most notably the hippocampus, a brain region that acts as an emotional filter in processing external influences. It is also involved in cognitive functions, including memory, learning, and problem solving, as well as orientation, creativity, and emotional performance (URREGO, RODRIGUEZ-OSORIO, NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022).

Epigenetic influences include, for example, maternal stress during pregnancy, maternal care of offspring, but also the mother's nutritional status and the environment during rearing. Compared to their outdoor counterparts, domestic cats raised in a low-stimulation environment, for example, show impaired responses and discrimination to visual stimuli and a delayed reaction to acoustic stimuli, indicating that growing up in a low-stimulation environment can impair perceptual performance in adult cats. Some of these effects are long-lasting and even transmitted to the next generation; others are modified or reversed by subsequent experiences (URREGO, RODRIGUEZ-OSORIO, NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022).

### **3.6. Kittens need a lot of positive information**

In summary, this means that the fewer positive stimuli the puppy receives, and the more stressors affect its body and that of its mother, before and during the prenatal period and in the early stages of life, the more susceptible the animal becomes to stress. And the greater the susceptibility to stress, the greater the likelihood of developing psychosomatic illnesses (URREGO, RODRIGUEZ-OSORIO, NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022; BENEDITO; DE VASCONCELOS, 2023).

A well-nourished and affectionate cat that raises her kittens in a pleasant environment, with positive environmental stimuli and little physical and mental stress, will also give birth to kittens that are more mentally and physically stable than a malnourished cat that has to raise her kittens under constant threat in a low-stimulus environment (URREGO, RODRIGUEZ-OSORIO, NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022; BENEDITO; DE VASCONCELOS, 2023).

If a pregnant cat gives birth in sudden captivity, this stress can lead to psychological vulnerability, reduced coping skills, and resilience (psychological resilience) in kittens. The same applies to kittens kept in poor conditions. If kittens grow up in the sparse environment of an empty room or kennel (the norm in mass breeding operations for profit), their sensory perceptions are impaired. Early weaning and inexperienced or indifferent mothers also increase the likelihood of susceptibility to stress and, therefore, the occurrence of behavioural disorders and the development of psychosomatic illnesses. If the cat is subjected to additional stress later in life, reduced coping skills can potentially lead to disease (URREGO, RODRIGUEZ-OSORIO, NIEMANN, 2014; FERREIRA; SOUSA; COSTA, 2016; FURTADO; DA SILVA; SOBRAL, 2022; BENEDITO; DE VASCONCELOS, 2023).

However, kittens born to sociable, people-focused cat mothers are proven to be more open to familiar and unfamiliar people than kittens born to shy cats, and therefore more prone to stress. Late weaning, as is generally practised by responsible breeders, has a positive effect on psychological stability, as does raising a kitten with a confident, calm, and affectionate mother (URREGO, RODRIGUEZ-OSORIO, NIEMANN, 2014; FERREIRA et al., 2016; FURTADO; DA SILVA; SOBRAL, 2022; BENEDITO; DE VASCONCELOS, 2023).

Important risk factors for the development of psychosomatic diseases in domestic cats (DENENBERG; DUBÉ, 2018; HALLS, 2018; FURTADO; DA SILVA; SOBRAL, 2022; FURTADO; SOBRAL, 2023):

#### **Kittens**

- Stressful experiences during the mother's pregnancy and during the rearing of kittens;
- Poor nutritional status of the mother animal;
- Inexperienced or aggressive mothers;
- Lack of attention and care from the mother animal;
- Parent animals that are aggressive towards humans;
- Little or bad experience with humans during rearing;
- Low-stimulation environment during rearing;
- Early weaning.

**Adult cats**

- Low-stimulation living environment for adult cats;
- Lack of access to the outdoors;
- Traumatic experiences;
- Violent treatment;
- Inappropriate handling of the cat;
- Arbitrariness in training and interaction;
- Constantly changing daily routines;
- Frequent changes and exchanges of ownership;
- Socialisation of cats that are not socially compatible with their peers;
- Lack of interaction with members of the same species in socially inclined animals, bullying by peers;
- A disturbed relationship between humans and cats
- A life with access to the outdoors offers a lot of variety.

**3.7. Psychosomatics (or somatisations): chronic stress rather than challenge**

Psychosomatics, or somatisations, are understood as physical experiences (symptoms) that may originate from emotional, psychological, or mental factors. It is an area in which veterinary psychiatry explores the relationship between the mind and body, and where internal conflicts or emotional stress can manifest as symptoms of psychosomatic pathologies (DENENBERG; DUBÉ, 2018; HALLS, 2018).

The triggers for the development of psychosomatic diseases can be divided into physical (e.g., threats, punishments, poor housing conditions), intraspecific social triggers (e.g., incompatibility with other cats), and the relationship between owner and animal (e.g., inappropriate handling and arbitrary behaviour). As long as the cat has learned to deal with these factors (confrontations), it is not a matter of stress, but rather a challenge (DENENBERG; DUBÉ, 2018; BENEDITO; DE VASCONCELOS, 2023).

Although the challenge does not permanently affect the cat, chronic stress overloads the internal control system. For this to happen, repeated occurrences and/or prolonged exposure, but especially the unpredictability and uncontrollability of the situation on the part of the cat, must meet appropriate genetic predispositions. For example, if the cat is exposed to bullying by other cats or arbitrary treatment by humans, several of these stimuli occur simultaneously (stress accumulation), the resulting stress accumulates, and the likelihood of a psychosomatic illness increases (DENENBERG; DUBÉ, 2018; BENEDITO; DE VASCONCELOS, 2023).

Psychosomatic illnesses usually develop gradually. The cat appears to show physical symptoms suddenly. However, the medical history reveals that behavioural changes were already present previously. These changes are often dismissed as signs of ageing, eccentricity, or disobedience. However, behavioural changes are often a cry for help and an indication of increased stress.

With early intervention through root cause analysis and appropriate behavioural counselling by trained behavioural consultants and therapists, physical manifestation can often be prevented (ELLIS et al., 2017; DELGADO; DANTAS, 2020; FURTADO; SOBRAL, 2023).

**3.8. Behavioural changes that indicate stress in cats**

Behavior	Behavioural change
<b>Appetite</b>	As a general rule, it is reduced, but in certain situations, less commonly, it is increased.
<b>Cleaning</b>	As a general rule, it is reduced, but in certain situations, less commonly, it is increased.
<b>Activity level</b>	Reduced
<b>Playing behavior</b>	Reduced
<b>Exploratory behavior</b>	Reduced
<b>Friction marking on the head</b>	Reduced
<b>Positive interactions with other cats or people</b>	Reduced
<b>Vocalization</b>	Enhanced
<b>Alertness</b>	Increased
<b>Hide</b>	Amplified
<b>Urine marking</b>	Reinforced
<b>Aggression against members of the same species and humans</b>	Reinforced
<b>Obsessive-compulsive disorder</b>	Amplified

Note: Cats in an ideal environment and/or with access to the outdoors do not develop obsessive-compulsive disorders.

**4 Conclusions**

Psychosomatic disorders are a reality that afflicts many feline patients, and it is up to veterinary professionals, especially those in the field of veterinary psychiatry, to make it their primary goal to help owners deal with behavioural changes in their domestic cats, contributing to improving the well-being of pets and the quality of life of everyone involved.

**CREDIT AUTHORSHIP CONTRIBUTION STATEMENT**

G.D.F.: conceptualisation, writing; G.D.D.: writing review; A.L.M.O.: writing review.

## DECLARATION OF INTEREST

The authors declare that there is no conflict of interest with the participants or collaborators of this article, either directly or indirectly.

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