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Impact of stress on the body of service dogs and alleviation methods: Literature overview

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Abstract. Stress causes changes in the immune, nervous and endocrine systems, which can lead to diseases and behavioural problems in animals. The study of these changes can be used to develop effective methods of diagnosis and prevention. The study aims to investigate the effect of stress on the body of dogs at the anatomical and physiological levels; and methods of diagnosis, treatment and prevention of stress disorders in these animals. The study analysed scientific publications on the detection, diagnosis, control and treatment of service dogs under stressful conditions. The main criteria that helped to differentiate different forms of behavioural reactions in service dogs under the influence

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of stressors were recorded by the methods of comparison, synthesis and analysis. Physiological criteria that should be used in the diagnosis of stress were established and methods for diagnosing stressful conditions in service dogs were described. Service dogs are more stress-resistant than other animals, but they are also exposed to negative environmental factors. This leads to physiological changes in the body of animals, which affects their performance and behavioural reactions. The physiological and behavioural markers of acute and chronic stress in dogs were determined. Changes in the immune system of dogs and the importance of cortisol as a stress-correlated marker were analysed. The study determined that the content of cortisol in blood plasma, saliva, and hair correlates with stress indicators in animals, but may also depend on many other factors. This indicates that this indicator alone cannot be relied upon to diagnose stress in animals. The results of the study can be used in the development of diagnostic criteria and methods for monitoring and correcting changes in the bodies of animals caused by stressful phenomena

Keywords: acute stress; chronic stress; diagnosis; behavioural changes; cortisol; post-traumatic stress disorder

Introduction

Stress is a common occurrence in everyday life, as all beings have to adapt to environmental instability to ensure survival and reproduction. At the same time, animals of different species, including dogs, are easily exposed to stressors, which affect their health, behaviour and functions. For service dogs that regularly perform complex tasks in stressful conditions, such as searching for explosives, participating in search and rescue operations, or ensuring security at mass events, this impact can be particularly pronounced. Constant exposure to stress can cause not only temporary disorders in the body but also chronic changes that reduce their performance and jeopardise the performance of their professional duties. Physiologically, stress in dogs is manifested by increased cortisol levels, changes in the cardiovascular system, and disorders of the immune system and metabolism. Behavioural signs of stress, such as aggression, anxiety or non-cooperation, are also serious indicators that require immediate intervention. Failure to identify and correct a stressful condition in time can lead to the development of somatic diseases, a decrease in the quality of life of the animal and even the premature end of its career.

M. Salonen *et al*. (2020) determined that the prevalence of fear and anxiety in dogs averages between 26% and 50%, which corresponds to millions of animals potentially suffering from behavioural problems caused by fear and anxiety. Research conducted by Green Element (USA) in 2022 shows that in the last two years alone, anxiety levels in dogs during the COVID-19 pandemic have increased from 40% to over 70% (Weng & Ogata, 2023). The fear of strangers and separation behaviour is particularly acute. However, under martial law, the risks of stress in animals are much higher and are often associated with loud noises, lack of food, owners and life safety. At the same time, service dogs that are actively involved in search and clearance operations are also exposed to stress, which hinders their effective use. High levels of noise from cars, explosions, shooting, shock waves; constantly changing terrain; high levels of dust and smoke; noisy machinery and movement are stressful factors for animals. J. Herbel *et al.* (2020) noted that transport is also a stressful factor for dogs.

In addition, animals that have been exposed to extreme situations, including those caused by loud explosions or gunfire, may eventually develop post-traumatic stress disorder (PTSD), which affects the behaviour of a service dog with various manifestations. As noted by S. Nichiporuk *et*

al. (2023), the issue of PTSD in dogs was not sufficiently covered, as it is inappropriate to transfer the signs of human PTSD to animals. However, since dogs have a much larger hearing range, loud sounds of uncertain aetiology are usually the cause of PTSD in dogs. This was confirmed by A.S. Mann *et al.* (2024), who found that 44.4% of dogs had fear associated with fireworks, thunder, gunshots, and vehicle noise. Animals may respond to these with behavioural signs of fear or anxiety, including depression or agitation, withdrawal or aggression, chaotic movements, or freezing. Even animals that are accustomed to gunshots may react inappropriately.

Service dogs often work for many hours in difficult conditions, in the presence of other animals, with different people who may also have different stress tolerances. Thanks to their sense of smell, dogs can easily detect the smell of cortisol, adrenaline and norepinephrine in humans in a calm state and a stressful situation. C. Wilson *et al.* (2022) pointed out that during the development of stress, physiological processes occur in the body that cause the release of volatile organic compounds in breath or sweat. Service dogs can distinguish these compounds with high accuracy. The ability to recognise different compounds is used for the service characteristics of service dogs and helps the interaction between a person and a service dog, which is used for emotional support and treatment of post-traumatic stress disorder (PTSD).

K.E. Rodriguez *et al.* (2018) highlighted that the engagement of military personnel returning from combat zones with guide dogs has a positive impact on recovery and significantly reduced the severity of post-traumatic stress disorder symptoms, as well as reduced anxiety, anger, and sleep disturbances. These findings were confirmed in a study by S.C. Leighton *et al.* (2024) indicating that military personnel and veterans with post-traumatic stress disorder have better psychosocial outcomes when using specially trained service dogs compared to conventional treatment. Therefore, as noted by H. Yatsenko (2022), since 2019, the SES units in Ukraine have been implementing canine therapy, allowing employees to recover from the events experienced through interaction with specially trained service dogs.

At the same time, such interaction requires constant control of the service dog. E. De la Fuente-Moreno *et al.* (2023) noted that service dogs used as guides for blind people have higher levels of cortisol in their blood and saliva, which is associated with their cognitive and emotional processes. Elevated levels of cortisol have also been observed in service dogs used by the military.

Notably, service dogs often hide their stress, so the signs can be unnoticed, however, changes at the biological level still occur. L. Lazarowski *et al.* (2020) determined that a prominent example is the behaviour of service dogs, which, being trained and hardy, suddenly change their behaviour towards their owners after service in dangerous conditions for a long time.

In view of this, it is necessary to determine the physiology of stress in service dogs, analyse the changes they cause in the body of these animals and understand the approaches to diagnosing and timely correction of pathological conditions of the animal's body in the event of stress.

The study aims to summarise the existing literature on the impact of stress on the body of service dogs, ways to diagnose stressful conditions and prevent their development in these animals.

The research material included scientific data on the impact of stress on the body of service dogs and methods of its diagnosis in experimental conditions and veterinary clinics. PubMed and Elsevier databases and specialised scientific journals were used as information sources. The comparison method, analysis and synthesis, and the descriptive method were used. The method of comparison was used to compare different approaches to the diagnosis and treatment of stressful conditions in dogs described in scientific sources. This method identified commonalities and differences between the methods used in experimental conditions and practical veterinary medicine. The method of analysis consisted of a

detailed study of each data source, including the identification of physiological, behavioural and biochemical markers of stress. This determined the mechanisms of stress on the body of service dogs, as well as assess the effectiveness of existing approaches to their diagnosis and correction.

Results

Behavioural manifestations of fear and anxiety in service dogs

Service dogs are specially trained animals that can perform specific tasks to ensure the safety of people. The behavioural, physiological and structural characteristics of the animals selected for such work are of great importance. In particular, the developed sense of smell, stress resistance, the animal's ability to learn, and the level of basic excitability of the animal.

L. Lazarowski *et al.* (2020) distinguish between negative arousal (stress) and positive arousal (e.g. excitement) in service dogs. A high level of arousal in an animal can interfere with performance. Initially, arousal can improve task performance up to a certain point, after which the inhibition stage begins. This effect depends on the animal's baseline level of excitability. In addition, increased arousal in service dogs can impair learning, memory and decision-making, and lead to the activation of physiological reactions such as increased respiration and heart rate, which reduces olfactory abilities, as dogs cannot smell and breathe at the same time (Bray *et al*., 2015).

As noted by L. Townsend & N.R. Gee (2021), dogs can experience triggered stress accumulation when an animal is exposed to multiple stressors at the same time. Triggered accumulation can occur over a short or long period, depending on the intensity and duration of the stressor. This can cause unpredictable behaviour or a refusal to cooperate.

If a dog is repeatedly exposed to unavoidable stressors, intense fear, anxiety, or phobia can occur. A fear response is an animal's behaviour in response to a real perceived danger. Anxiety is an emotional state that occurs if animals are exposed to threatening situations, such as a new environment. According to E.J. Blackwell *et al.* (2013), the term "phobia" is generally used when the behavioural response is extreme, long-lasting, and involves a marked, persistent, and excessive fear of certain stimuli. However, the differentiation of these types of reactions in animals is unclear.

The causes of fear and anxiety in dogs are multifactorial and may include inherited genetic influences, environmental influences, and experiences during certain work situations. N.J. Rooney *et al.* (2016) determined that fear-related behaviour negatively affects the animal's performance or results in a significant number of service dogs failing training and becoming unfit for duty. Prolonged exposure to stressors can lead to the development of fear and general anxiety in dogs, which negatively affects their performance.

Fear in an animal can be interpreted as one of the forms of fulfilling self-preservation. Researchers C. Mariti *et al.* (2012) demonstrated that a behavioural response is often the most effective way to resolve a stressful situation, allowing the body to restore homeostasis. There are three main ways to resolve a stressful situation: active attack, passive defence, and escape.

The literature describes attempts to characterise the "coping styles" in dogs based on physiological and behavioural reactions. In particular, E.J. Blackwell *et al.* (2013) highlighted a "reactive" style of animal response to stress or a more "proactive" style. Z. Horváth *et al.* (2007) identified 3 categories of behavioural responses in service dogs. The usual behavioural response of dogs to severe stressors is defensive aggression, hiding, and avoidance of contact with people. Another group of animals, on the contrary, seek contact with people or other animals and are characterised by behaviour that attracts attention (e.g. jumping, pawing at people). The third group of behavioural reactions is excessive dog activity, increased respiratory rate, salivation, pupil dilation, vocalisation, lowered posture, flattened ears and a pinned tail, and anorexia. There are also three categories of unhealthy behaviour caused by

stress in dogs: stereotypical animal actions (e.g. excessive licking, side sucking, circling or spinning); excessive movement (tail chasing, fence running, excessive barking, polydipsia and polyphagia) and so-called "hallucinogenic" behaviour (e.g. staring and "chasing flies").

Changes in behavioural responses to chronic stress over a long period are reflected in increased movement, yawning, pawing, and body tremors, as well as increased coprophagia, low posture and vocalisation (Bodnariu, 2008). Service dogs exhibit a wide range of behavioural and physiological responses to stress, which can significantly affect performance, with excitability, adaptability to stressors and inherited behavioural traits being central.

The effect of stress on the functioning of various animal body systems

Following A. Aleme & A. Negassie (2014), stressor activates the sympathoadrenal system, which is associated with the fight-or-flight response and is characterised by the release of adrenaline and norepinephrine. These, in turn, cause the release of glucose, an increase in heart rate and blood pressure, and an increase in respiratory rate in the animal. These processes mobilise the body and increase the capacity of the animal to effectively fight or escape, i.e. survive the threat.

If the stress is short-term, the manifestation of the stress response does not cause homeostasis disorders after the stressor ceases. According to T. Kooriyama & N. Ogata (2021), markers of the sympathoadrenal system reflect a short-term response to stressors, when catecholamine secretion peaks after 1 minute and then remains elevated for about 3 minutes. With prolonged exposure to a stressor, another mechanism of the stress response is activated – the hypothalamic-pituitary-adrenal axis, the end product of which is glucocorticoids secreted by the adrenal glands under the influence of adrenocorticotropic hormone (ACTH).

D. Salgirli *et al.* (2023) noted the adaptive nature of acute stress in dogs. Species-specific defence reactions activate to help the animal cope with stress. The bodily response to endogenous or exogenous stressors is mandatory, which is manifested by a stress response, i.e. an adaptive response aimed at restoring homeostasis and vital activity of the animal's body. T. Kooriyama & N. Ogata (2021) noted that since stress responses are activated by the sympathoadrenal and hypothalamic-pituitary-adrenal axes, the immune system is activated at the same time. C. Siracusa *et al.* (2008) also highlighted that stress affects the immune system, which, after short-term exposure to a stressor, is stimulated for 30 minutes, and in the case of prolonged stress, it is suppressed, and its effectiveness is reduced by 40-70%.

As noted by B. Kumar *et al.* (2012), hormonal changes in response to stress, including increased plasma concentrations of adrenaline, cortisol, growth hormone and prolactin, have immunomodulatory effects. At the same time, cortisol can inhibit the functions of macrophages, neutrophils, basophils and eosinophils. Glucocorticoids and adrenocorticotropic hormone affect the proliferation of B and T cells and the production of cytokines and antibodies.

B.M.G. Gormally *et al.* (2020) highlighted that the changes that occur at the cellular level are characterised by changes in heat shock proteins (Hsp), DNA damage and changes in telomere length. In particular, the heat shock proteins Hsp70 and Hsp90 are significantly reduced within 30 min-2 h after exposure to acute stressors, as well as under the influence of long-term stressors. In addition, under the influence of short-term or long-term exposure to adrenaline, cortisol, and repeated exposure to stressors, DNA damage occurs in different animal species. The authors also proved that stressors lead to a significant reduction in telomere length, which affects the life span of the animal, but these data still need further study, especially their correlation with the effect and intensity of different types of stressors.

N.A. Dreschel (2010) noted that the link between stress and susceptibility to disease in pets demonstrates that dogs with manifestations of

fear and anxiety have a shorter life expectancy and a higher frequency and severity of diseases. The suppression of the animal's immune system contributes to the development of opportunistic pathogens. This includes microorganisms that cause respiratory infectious diseases and infections caused by Salmonella sp. In response, glucocorticoids or catecholamines are released, which reduce the protective capacity of cellular immune mechanisms. In addition, they reduce the accumulation of neutrophils at the site of local inflammation, which leads to complications of bacterial infections. This suggests that some disorders are most likely triggered by the development of chronic stress in animals.

Diagnostic criteria for stressful conditions in dogs

I.A. Kartashova *et al.* (2021) stated that the choice of physiological markers for the development of stress in animals should address not only physiological parameters, but also the characteristics of the animal, its lifestyle, age, concomitant diseases, physical activity, anamnesis, and even the owner's temperament. B.M.G. Gormally *et al.* (2020) combined the indicators that characterise the development of stress in vertebrates into seven large groups, such as changes in glucocorticoids and the excretion of their metabolites in saliva, faeces, and urine; the influence of the parasympathetic nervous system (changes in heart rate, heart rate variability, and respiratory rate); impact on the immune system(comparison of the ratio of leukocyte types, in particular, heterophils/neutrophils and lymphocytes, assessment of inflammation and bacterial killing test); metabolic disorders (energy mobilisation, metabolic rate, heat regulation); cellular (membrane) disorders; delayed tissue development and behavioural changes (stereotypical behaviour in animals). Blood chemistry and leukogram indicators can also be used to characterise stress, along with physiological indicators such as heart rate and heart rate variability.

According to N.L.B. Corder-Ramos *et al.* (2019), dogs exposed to acute stress develop a general leukocytosis, the leukogram is characterised by neutrophilia, monocytosis, lymphocytopenia and eosinopenia (so-called stress leukograms). B.M.G. Gormally *et al.* (2020) noted that a change in the ratio of heterophils/neutrophils to lymphocytes is recorded in the blood of animals 1-4 hours after exposure to a stressor.

Potential immunological markers in stress responses include leukocyte responses to antigens, salivary IgA, neutrophil/lymphocyte ratio, CD4/CD8 ratio, and plasma cytokines. L.M. Glenk (2017) highlighted a decrease in secretory immunoglobulin A (IgA) under stress in dogs. In practice, serum catecholamines and glucocorticoids are the most used measurements, as they correlate with stress levels. However, while adrenaline and norepinephrine quickly disappear from the blood after the stressor stops, cortisol remains in the blood for 2-6 days. If the body is stressed for a long time, cortisol becomes constant, which leads to the development of chronic stress in animals.

Cortisol is a glucocorticoid hormone produced by the adrenal cortex under the influence of adrenocorticotropic hormone. It regulates most physiological processes in animals and plays an important role in the body's response to stress. Cortisol secretion during acute stress helps mobilize the metabolic energy needed to combat short-term stressors and restore homeostasis. At the same time, prolonged cortisol elevation caused by chronic stress contributes to maladaptive changes in the body and the development of various pathological conditions. B. Beerda *et al.* (1996) determined that this leads to immune suppression, growth retardation and developmental delays in animals.

E. Chmelíková *et al.* (2020) determined that cortisol levels in dogs vary according to the circadian rhythm, with the highest peak occurring in the morning after waking up and the lowest at bedtime. In addition to cortisol, scientists have proposed using other markers to assess acute stress in dogs, including chromogranin A (CgA), which is released along with catecholamines during acute stress but is more stable. For service

dogs, a blood cortisol test can provide valuable insight into physiological health and behaviour, as well as determine of how they adapt to their environment and tasks.

Physiological and biochemical markers, such as cortisol, glucocorticoids, immunoglobulins and other blood parameters, can be used for an efficient assessment of the stressful state of service dogs, contributing to the determination of their adaptation to stressors and maintaining their functional capacity.

Non-invasive methods for studying stress indicators in animals

Predictable and immediate stress reactions caused by the blood collection procedure in animals can increase plasma hormone levels, which makes interpretation of the results difficult. Therefore, as reported by B. Beerda *et al.* (1996), non-invasive sampling methods such as saliva, urine, or hair samples can be used. Hair cortisol determination is a promising method for detecting GH axis activity over a longer period. The cortisol content in hair varies depending on the time of year and the animal's lifestyle. However, E. van Houtert *et al.* (2023), studying Labrador retriever service dogs, found no difference in hair cortisol between service dogs and companion dogs.

According to L. Mesarcova *et al.* (2017), cortisol reaches the hair through diffusion from the blood during the period of hair shaft growth. In addition, sebum secreted by the sebaceous glands also contains cortisol, which can penetrate the hair. Intrafollicular synthesis of cortisol is also possible. As noted by N.L.B. Corder-Ramos *et al.* (2019), canine hair follicle cells in vitro can metabolise progesterone to cortisol. The evaluation and interpretation of hair cortisol concentration results should be approached with caution, as its content can potentially be influenced by several factors, such as coat colour, dog age, lifestyle and maintenance, health status, and seasonality. Salivary cortisol measurement is also a practical test for assessing stress in dogs. E. De la Fuente-Moreno *et al.* (2023) noted that cortisol enters saliva as a result of passive diffusion through acinar cells.

L.M. Glenk (2017) emphasised that salivary cortisol levels reflect plasma cortisol concentrations with a 20-30 min delay. However, it is necessary to address the different cortisol content in the saliva of dogs under acute and chronic stress. In particular, the study determined that under acute stress, cortisol increases significantly. At the same time, with prolonged exposure to the same stressors, the level of cortisol in saliva decreases, but it is not fully understood whether these are adaptive changes or habituation to the environment. J. Wojtaś *et al.* (2022) confirmed that the effect of a stressor on dogs entering a shelter correlates with time and is characterised by an increase in salivary cortisol in dogs of 2.7 ng/ml on admission, 2.1 ng/ml 24 hours later, and 1.9 ng/ml 48 hours after entry. E. Kang *et al.* (2023) suggested that alpha-amylase should be measured in saliva along with cortisol, as it was proven to correlate with cortisol levels under painful stress.

However, following E. Chmelíková *et al.* (2020), the determination of salivary cortisol as a stress marker also has certain limitations. The influence of individual variability in the level of the hormone cortisol in an animal can lead to misinterpretation of the data. Therefore, research should be supplemented with observations of animal behaviour, although symptoms of behavioural stress may not always correlate positively with cortisol production. It is advisable to supplement cortisol measurements with other stress markers in animals. R. Palme (2019) noted that the activity of the hypothalamic-pituitary-adrenal system can be monitored non-invasively by measuring faecal cortisol/corticosterone metabolites (FCM). However, physiological or biological validation of the methods used is mandatory for objective results.

Regarding the content of cortisol in urine, its concentration reflects the level of unbound and biologically active cortisol in the blood plasma. Measurement of free urinary cortisol is clinically important in the diagnosis of Cushing's

Syndrome. Not only does it measure cortisol levels as a stress marker, but it also analyses the content of ACTH, prolactin, secretory immunoglobulin A, catestatin and vasostatin in saliva, as well as salivary α-amylase activity.

In addition to the physiological parameters of stress, a visual assessment of the behaviour of dogs under stress should be considered. Veterinarians should keep in mind the factors associated with stress in service dogs not only at the diagnostic stage but also during further therapy.

Methods of overcoming stress in dogs

Normalisation of the condition of an animal after prolonged exposure to stressful factors requires time and appropriate medical care. Methods of correcting stressful conditions in dogs are based on limiting the impact of stress factors and creating a calm, quiet place for the animal with safe objects and a familiar smell. Cortisol levels in the blood decrease most rapidly during the dog's natural actions, such as chewing and biting, during free exploration of the territory and sniffing of the environment, and sleep. C. Siracusa *et al.* (2008) indicated that a dog should not be encouraged to play after a stressful event, as games and other intense physical activities exacerbate stress by stimulating the same mechanisms that are activated in the body during the stress response. G. Fallani *et al.* (2007) noted that playful interaction between the animal and its owner reduces cortisol levels in dogs. Medication therapy can help to ease a dog's stress response and help to learn new behaviours. Many medications are used to relieve anxiety symptoms, and behavioural or sensory disturbances, but not all are registered as veterinary medicines for dogs.

The drug of choice for acute stress is gabapentin. According to S. Nichiporuk *et al.* (2023), the use of gabapentin in a dose of 15-30 mg/kg for dogs every 6-8 hours, if necessary, prevents the development of a stress reaction in animals. In addition, alprozolam can be used immediately after exposure to a stressor at a dose of 0.04-0.08 mg/kg every 6-8 hours.

S.A. Kim *et al.* (2022) indicated that administration of trazodone at a dose of 9-12 mg/kg to dogs once before transport reduces signs of stress and is useful as a means of preventing anxiety in dogs. M. Brown *et al.* (2024) also noted that trazodone significantly reduces plasma cortisol concentrations through alpha-1 adrenergic activity, and therefore can be used to treat anxiety and stress in service dogs. However, the use of this drug in dogs with adrenal disease may affect diagnosis and clinical decision-making. E. Yalcin (2010) recommends using the antidepressant clomipramine in combination with gabapentin or trazodone at a dose of 0.5-2 mg/kg twice daily.

The effectiveness of clomipramine in the treatment of noise fear and anxiety in dogs was reported by K. Seksel & MJ. Lindeman (2001), who administered the drug at a dose of 1-2 mg/kg body weight and noted a calming effect. O. Williamson *et al.* (2024) proved the effectiveness of clomipramine hydrochloride at a dose of 2 mg/kg and fluoxetine hydrochloride at a dose of 1 mg/kg per day in relieving anxiety and stereotypical behaviour in dogs. A. Erickson *et al.* (2020) compared and confirmed the benefits of gabapentin, trazodone, oral dexmedetomidine and alprazolam in dogs with increased anxiety and stress.

The sedative effect of cannabinoids on animals is crucial. For instance, H.E. Flint *et al.* (2024) reported that the use of cannabidiol distillate, which does not contain tetrahydrocannabinol (CBD), reduces physiological and behavioural indicators of stress in dogs during transport. I. Corsato Alvarenga *et al.* (2023) and C.H.J. Yu & H.P.V. Rupasinghe (2021) also noted the positive effects of cannabidiol (CBD) for the treatment of reducing anxiety and aggression in dogs. M. Susol & A. Vinyarska (2024) noted the potential benefits of CBD in reducing stress, and maintaining health and immunity in animals, and its use is considered one of the main elements of an integrated approach to animal care. In addition to the drugs described above, J. Coates (2023) also used amitriptyline, buspirone, diazepam, lorazepam, paroxetine, and sertraline to treat and prevent

stress disorders in dogs. To prevent stress in dogs, products containing herbal components such as KalmVet, Anti-stress, No stress, and synthetic compounds such as Stop stress, Dolvit calm, Antistress and Stressostop can be used. There is also an anti-stress diffuser called Adaptil, which contains a synthetic pheromone that calms dogs.

Notably, the normalisation of an animal's condition under chronic stress requires time. The primary goal of treatment of animals returning from the combat zone is to eliminate the associative links in the animal's mind that bring it back to the stressful situation.

Conclusions

Human-animal interaction is becoming increasingly relevant globally. Service dogs are used in operational and investigative activities, perform security, transportation, and detection of illegal substances or explosives, and accompany people with various sensory, mental or psychological disorders. The use of service dogs for the treatment of post-traumatic stress disorder in military personnel returning from the combat zone has a positive impact on their mutual emotional health and well-being. At the same time, service dogs often react to stressors in the same way as humans. Therefore, it is necessary to study and determine the signals that indicate changes in the body of these animals.

Stress in service dogs, their fear and behavioural reactions can be specific reactions to the service environment, or cumulative reactions for an animal suffering from stress, fatigue, pain or several other factors. Signs of stress and fear are manifested in the animal's body language, posture and attitude to work tasks.

The main behavioural reactions of stress in service dogs are aggression, refusal to perform tasks, increased excitability, rapid fatigue, stereotypical behaviour, digestive system disorders, and depression. Diagnostics of stressful conditions in animals include a thorough analysis of stress factors, exclusion of concomitant diseases, analysis of catecholamines in blood, saliva, hair, immunological parameters, metabolic disorders and behavioural changes.

Methods of correction for stress in service dogs include drug therapy, elimination of stress factors, creation of comfortable conditions for the animal, and correction of negative experiences through positive training and socialisation. At the same time, it is necessary to improve the study of behavioural medicine and develop a methodological framework for determining behavioural and physiological markers of stress in service dogs during their service tasks in military operations.

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Conflict of Interest

None.

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Вплив стресу на організм службових собак та методи його корекції: огляд літератури

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Анотація. Стрес викликає зміни в імунній, нервовій та ендокринній системах, що може призводити до захворювань і проблем з поведінкою у тварин. Дослідження цих змін дозволяє розробити ефективні методи діагностики та профілактики. Метою роботи було дослідити вплив стресу на організм собак на анатомічному та фізіологічному рівнях; методів діагностики, засобів лікування та профілактики стресових розладів у цих тварин. У статті проаналізовано наукові публікації щодо виявлення, діагностики, контролю та лікування службових собак за стресових станів. Методами порівняння, синтезу та аналізу зафіксовано основні критерії, які допомагають диференціювати різні форми поведінкових реакцій у службових собак за впливу стресорів. Встановлено фізіологічні критерії, на які варто опиратися під час діагностики стресу та описано методи діагностики стресових станів у службових собак. Службові собаки є більш стресостійкими, ніж інші тварини, проте вони також піддаються впливу негативних факторів зовнішнього середовища. Це призводить до фізіологічних змін в організмі тварин, що відображається на їх роботоздатності та поведінкових реакціях. Визначено фізіологічні та поведінкові маркери гострого і хронічного стресу в собак. Проаналізовані зміни в імунній системі собак та значення кортизолу як кореляційного зі стресом маркера. Визначено, що вміст кортизолу в плазмі крові, слині, волоссі корелює із показниками стресу у тварин, проте може залежати також від багатьох інших факторів. Це вказує на те, що під час діагностики стресу у тварин не можна покладатися лише на цей показник. Результати дослідження будуть корисними при розробці діагностичних критеріїв та методів контролю і корекції змін в організмі тварин, викликаних стресовими явищами

Ключові слова: гострий стрес; хронічний стрес; діагностика; поведінкові зміни; кортизол; посттравматичний стресовий розлад