COVID 19 - INDUCED STRESS IN DOGS OWNED BY ELDERLY PEOPLE

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Abstract

The study was conducted over a period of 2 months, between March and May 2020, in collaboration with 3 private clinics in Moldova region on 23 dogs of different breeds, sex and ages, paraclinically examined by hematological and biochemical tests. The inclusion criterion in the study was the ownership of all subjects by elderly persons affected.by COVID 19 limitations during the emergency state in Romania. The study aimed to establish the correlation between the limited walking time in dogs and the level of stress induced by it. Each subject underwent 2 paraclinical check-ups in term of hematological testing and cortisol dosage at the end of March and beginning of May. Also, a control group of 13 dogs owned by active people was examined in a similar manner, both at the beginning of the experiment and also at the end of it. Compared with the initial values which were highly elevated (10,89±1,66 µg/dl) in all dogs owned by elderly people, the second testing revealed values comparable to normal, but still increased (4,85±1,22 µg/dl) . The study demonstrates the impact of COVID 19 limitations in terms of outdoor time for dogs which produced transitional changes in cortisol levels, but also the adaptive compensatory mechanisms used to cope with modified environmental conditions.

Keywords: COVID 19, dogs, stress, cortisol

INTRODUCTION

Cortisol is a steroid hormone that regulates a wide range of vital processes throughout the body, including metabolism and the immune response. It also plays a very important role in helping the body respond to stress. Cortisol production by the adrenal glands is regulated by the pituitary gland.[4]

Cortisol, though widely known as the body's stress hormone, has a variety of effects on different functions throughout the body. It is the main glucocorticoid released from the zona fasciculata layer of the adrenal cortex. Both production and secretion of cortisol is regulated by the hypothalamus-pituitary-adrenal axis. Loss of regulation can lead to disorders of cortisol excess, such as Cushing Syndrome, or cortical insufficiency, such as Addison Disease.[1]

Cortisol is known as the stress hormone because of its role in the body's stress response. Stress triggers a combination of signals from both hormones and nerves. These signals cause the adrenal glands to release hormones, including adrenaline and cortisol. The result is an increase in heart rate and energy as part of the fight-or-flight response. It's the body's way of preparing itself for potentially dangerous or harmful situations. Cortisol also helps to limit any functions that aren't essential in a fight-or-flight situation. Once the threat passes, the hormones return to their usual levels while under constant stress, this response doesn't always turn off. Long-term exposure to cortisol and other stress hormones can disturb almost all of the body's processes.[1, 3]

MATERIAL AND METHODS

The study was conducted over a period of 2 months, between March-May 2020, in 3 private clinics in Moldova region, 2 of those in Iasi county and the other one in Braila, on a total number of 36 dogs, 23 of those being owned by elderly people (65+ years), referred as test group, while 13 dogs were owned by active people (control group). The dogs in the test group were between 2-13 years old, of different breeds and sex, while the dogs in the group had between 1 to 9 years old.

Blood samples were collected twice for biochemistry, once at the beginning of the experiment and the second time at the end of it, while for the hematology were collected once, at the end of the experiment. All dogs lived in flats and the outdoor time decreased considerably.

Hematology was performed using Phoenix NCC-30 VET and BIOBASE BK-6200 automated hematological analyzers. Blood samples were collected from the external saphenous or the jugular veins. The vacutainers contained EDTA, an anticoagulant substance and the samples were analyzed immediately after collecting them. For each case have been determined the following parameters: red blood cells (RBCs), packed cell volume (PCV), hemoglobin, mean corpuscular volume (MCV), mean corpuscular hemoblobin (MCH) and mean corpuscular hemoglobin concentration (MCHC), WBC (white blood cells) and platelets. Also, a blood film was analyzed for each sample using May-Grunwald Giemsa or Diff Quick staining methods.

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Biochemistry was performed in accredited laboratories, having been determined the cortisol levels, all the samples being collected at the same moment as for hematology, using vacutainers with activating gel inside.

RESULTS AND DISCUSSION

Cortisol has many functions in the body, such as mediating the stress response, regulating metabolism, the inflammatory response, and immune function.

As far as the immune response concerns, glucocorticoids have a number of actions in the immune system. For example, they induce apoptosis of proinflammatory T cells, suppress B cell antibody production, and reduce neutrophil migration during inflammation.[2]

In stress response, the body is continually responding to internal and external stressors. It processes the stressful information and elicits a response depending on the degree of threat. In times of stress, the sympathetic nervous system gets activated being responsible for the fight or flight response, which causes a cascade of hormonal and physiological responses. Based on the action of the stressors, the hypothalamus activates the sympathetic nervous system and the adrenal glands release catecholamines, such as epinephrine.[5, 6] This results in effects such as increased heart rate and respiratory rate. As the body continues to perceive the stimuli as a threat, the hypothalamus activates the hypothalamus-pituitary-adrenal axis. Cortisol is released from the adrenal cortex and allows the body to continue to stay on high alert. Acutely, cortisol's catabolic mechanisms provide energy to the body. Thus, blood glucose levels drive key systemic and intracellular pathways.[2] The presence of glucocorticoids, such as cortisol, increase the availability of blood glucose to the brain. Cortisol acts on the liver, muscle, adipose tissue, and the pancreas. In the liver, high cortisol levels increase gluconeogenesis and decrease glycogen synthesis. Cortisol also enhances the activity of glucagon, epinephrine, and other catecholamines.[3]

The cumulative effects of stress produced changes at the level of white blood cells, observing a decrease in the total number of eosinophils, while neutrophils and monocytes got increased. These changes were observed in both test group but also control group. The hematological results revealed severe changes for the test group as far as total eosinophil count was concerned (0,02±0,01 x 103/mm3), while for the control group, the mean values for eosinophils were 0,05±0,02 x 103/mm3. The total neutrophils count reached 88,20±7,33 x 103/mm3 for the test group and 82,15±6,63 x 103/mm3 for the control group. Monocytes levels got very close to upper limit not only for the test group (1,32±0,80 x 103/mm3) but also for the control group (1,21±0,92 x 103/mm3).

Cortisol levels showed very elevated values at the beginning of the experiment for the test group (10,89±1,66 µg/dl) compared to control group (2,06±0,61 µg/dl) while at the end of the experiment, although the values for the test group were still elevated (4,85±1,22 µg/dl), they fit within the physiological range and got closer to the values of the control group (1,86±0,89 µg/dl) (Fig. 1).

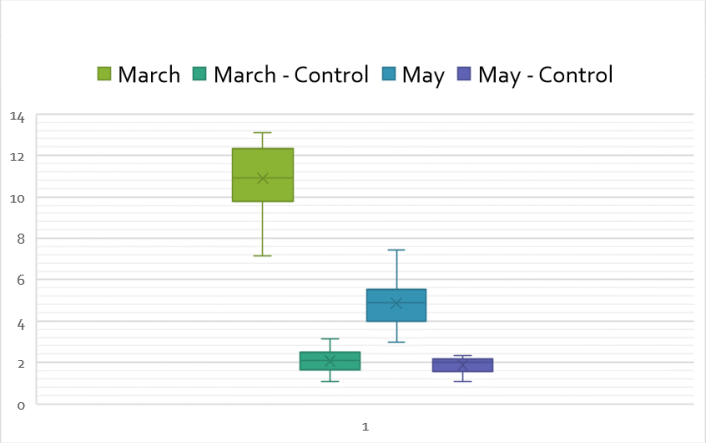

Fig. 1. Cortisol values of dogs owned by elderly people compared to control group

Although individuals from both groups got a less extended time outdoor, we consider the increased time spend together with their owners substantially increased for subjects of the control group, making them happier and coping with the change in terms of outdoor time.

The body's stress-response system is usually self-limiting. Once a perceived threat has passed, hormone levels return to normal. As adrenaline and cortisol levels drop, the body will return to its regular activities.[4] On the other hand, when stressors are always present and the body constantly feels under attack, that fight-or-flight reaction stays turned on. The long-term activation of the stress-response system and the overexposure to cortisol and other stress hormones that follows can disrupt almost all of body's processes.[5]

However, the conducted study showed that the changes that have been observed are only transitional, after removing the stress agent, the levels of cortisol dropping to normal values.

CONCLUSIONS

The study revealed a significant increase of cortisol levels in individuals owned by elderly

people at the beginning of the emergency state in Romania. However, the conducted study showed that the changes that have been observed are only transitional and have also highlighted the great capabilities of the body to adapt and to reduce the impact of the stressor agents.

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