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Efficacy of treatment of small animals with triamcinolone-based medications for atopic dermatitis

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Abstract. Among the diseases of small pets, skin diseases are one of the leading ones. Atopic dermatitis is a common skin condition in small pets, which, according to veterinarians' estimates, affects 10-15% of dogs and 7-18% of cats. Depending on the allergens involved, clinical signs can be seasonal or non-seasonal, and the disease

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usually requires lifelong treatment. The purpose of this study was to investigate the therapeutic efficacy of treating atopy in dogs and cats with the use of triamcinolone-based veterinary medications (oral suspension). Standard clinical, haematological, biochemical, and immunological methods were used in the study. The increased content of total immunoglobulin E (Ig E) in the blood of experimental animals before treatment (Group I – 3.4 times, and Group II – 3.9 times compared to the control) indicates the presence of an allergic response in the body. It was found that the tested veterinary medications do not substantially affect the haematological parameters of dogs and cats when administered orally, and in therapeutic doses do not have a toxic effect on the functional state of the liver and kidneys. It was proved that on Day 4 of use of oral suspension No. 1 and No. 2 based on triamcinolone (1%) acetonide and a complex of B vitamins in a therapeutic dosage, an improvement in the general clinical condition of animals was recorded. On Day 8 of treatment, dogs and cats in experimental Groups I and II showed improvement in skin condition: a reduction in the lesion area, absence of redness, scratching, and exfoliation. The general clinical condition of the skin of the experimental animals stayed unchanged from Day 8 to Day 12. The developed oral suspensions have a pronounced anti-allergic effect and improve the skin condition of small pets (dogs and cats) with atopic dermatitis

Keywords: atopy; immunoglobulin; treatment; suspension; blood plasma; research; dogs; cats

INTRODUCTION

The issue of treating dermatological diseases in cats and dogs is a highly relevant issue in veterinary medicine. The principal causes of skin diseases in animals are ectoparasites (fleas, ticks), insect bites, household chemicals, feed components, plant and tree pollen, and mould spores. Dermatitis can also be associated with the development of autoimmune processes, dysfunction of the endocrine glands, or a lack of vitamins and minerals. A. Paliy *et al.* (2019, 2020) and V.L. Kovalenko *et al.* (2020) noted that a vital role in ensuring animal health is played by the conditions of their keeping, including the level of sanitation, which must be constantly maintained at a high level to prevent animal diseases.

Atopic dermatitis is a systemic disease that occurs because of hypersensitivity to specific (allergens) and non-specific stimuli (Marchegiani *et al.*, 2020; Franco *et al.,* 2021). Typical clinical manifestations of atopy are inflammation of the skin, which manifests itself in the form of eczematous and lichenoid rashes and is accompanied by itching (Case & Burgess, 2018; Jaffey *et al.*, 2020). The disease is progressive and has a recurrent course, which has an extremely negative impact on the quality of life of the animal and can be very unpleasant for its owners (Bensignor & Videmont, 2021). According to S. Segarra *et al.* (2023), the development of atopy is the result of a complex interaction of genetic and environmental factors that shape the immune response and skin barrier function. The concept of atopic dermatitis proposed by L.M. Tomich and J.B. Pieper (2019) explains the hyperproduction of Ig E from the standpoint of congenital immune deficiency and impaired T-suppressor function, which is manifested in the weakening of the predominant effect on the B-cell clone with which Ig E synthesis is associated.

Recently, in the pathogenesis of atopic dermatitis, great importance has been attached to disorders of fatty acid metabolism in the formative elements, blood plasma, and adipose tissue. According to A.K. Masters *et al.* (2018), it is the lack of certain fatty acids that leads to a deficiency of the components of the prostaglandin cascade, which have regulatory functions primarily in relation to cellular synthesis of Ig E and contribute to the reduction of inflammatory phenomena. According to A.R. Vaughn *et al.* (2019), a lack of B vitamins in cats and dogs can contribute to the development of dermatitis and seborrhoea. B. Hesselmar *et al.* (2018) proved the effectiveness of glucocorticoids in atopic dermatitis due to their haemodynamic effect: they help to normalise blood pressure, counteract the development of vasodilation; have an anti-oedematous effect on cells, including neurons of the central nervous system (CNS); reduce the aggregation of polymorphonuclear white blood cells and prevent the occurrence of leukostasis in the vascular bed; inhibit the formation of substances that act on the reticuloendothelial system; and inhibit the release of histamine. I. Dávila *et al.* (2018) indicate the effectiveness of synthetic glucocorticoids in the regimen of complex therapy for faster and more reliable control of clinical manifestations of dermatitis on the skin of animals.

J. Altamirano-Vallejo *et al.* (2018) and M. Langworthy *et al.* (2019) prove the high efficiency of using a medication based on the synthetic glucocorticoid triamcinolone acetonide for the treatment of inflammatory, allergic, and autoimmune diseases. The authors recommend the medication as a safer alternative to injections of other corticosteroid medications. Data from N.K.Y. Gedon and R.S. Mueller (2018) indicate a high (70-80%) clinical efficacy of injectable and topical forms of glucocorticoids in the general anti-inflammatory and antipruritic therapy of atopic dermatitis in dogs and cats. The authors note that the addition of essential fatty acids and vitamins to the diet of sick animals can be beneficial: improving the quality of the coat, strengthening

the skin barrier, reducing transepidermal water loss, which reduces the doses of glucocorticoids required to control the disease. The purpose of this study was to scientifically substantiate the effectiveness of triamcinolone-based veterinary medications on cats and dogs of different breeds and sexes.

MATERIALS AND METHODS

The study was conducted in 2020-2022 at the Laboratory of Veterinary Sanitation, Parasitology, and Bee Diseases of the National Research Centre "Institute of Experimental and Clinical Veterinary Medicine", at an animal shelter (Balakliia, Kharkiv region) and a multidisciplinary laboratory of Odesa State Agrarian University. The research programme was reviewed and approved following the current procedure by the Bioethics Committee of the National Research Centre "Institute of Experimental and Clinical Veterinary Medicine".

The following medicinal products (oral suspensions) were used in this study:

• Product No. 1 – a bright yellow suspension with a specific smell of its components. The product contains (1 ml): triamcinolone acetonide – 1 mg; vitamin B_1 – 2 mg; vitamin B_2 – 4 mg; vitamin B_3 – 10 mg; vitamin B_6 – 2 mg; excipients (xanthan gum, potassium sorbate, bentonite, glycerine, purified water).

• Product No. 2 – a light yellow to dark yellow suspension. The product contains (1 ml): triamcinolone – 1 mg; vitamin B_6 – 3 mg; vitamin B_2 – 5 mg; vitamin B_3 – 10 mg; excipients (xanthan gum, potassium sorbate, bentonite, glycerine, purified water).

The medications were administered to animals individually orally, once a day, in the morning feeding hours with a small amount of feed or injected into the root of the tongue using a syringe-dispenser in therapeutic doses (Table 1).

***Table 1**. Dosage of the medications under study*

Animal species	Animal body weight, kg	Medication dosage per animal, ml
Dogs	up to 10	0.5
	10-20	1.0
	20-30	1.5
	30-40	2.0
	over 40	2.0
Cats	up to 3	0.25
	3 or more	0.5

***Source**: compiled by the authors of this study*

For the first 4 days, the medications were administered at a therapeutic dose, and for the next 8 days, the dose was halved. The vials with medications were thoroughly shaken before use. Clinical studies were conducted on cats and dogs of different breeds, ages, and body weights. The study used laboratory glassware, spectrophotometer, thermostat, dispensers, reagent kits for haematological and biochemical studies (manufactured by the Scientific and Production Enterprise "Filisit-Diagnostics" (Ukraine)); a kit for the quantitative determination of the concentration of immunoglobulin E (Ig E) in blood serum by enzyme-linked immunosorbent assay (ELISA) (Monobind (USA)); automatic single- and multi-channel pipettes of fixed or variable volume of 5-1000 µl. General laboratory equipment. Immunoassay analyser with a wavelength of 450 nm.

At the first stage of the study, the efficacy of veterinary medications was investigated on outbred cats of different ages and sexes. To conduct the study, a control and two experimental groups were formed based on the principle of analogues, considering the body weight, age, and type of animal constitution. The number of animals in each group was 5. Animals of the control and experimental groups were kept in enclosures on a standard balanced diet with free access to water, according to physiological needs. Animals in the control group were clinically healthy outbred cats aged 1 to 5 years, weighing 2.7-4.8 kg, vaccinated against calicivirus, rhinotracheitis, and panleukopenia. Before the experiment, the cats were dewormed.

Experimental Group I – cats with clinical signs of allergic dermatitis, which were administered with product No. 1. Experimental Group II – cats with clinical signs of allergic dermatitis, which were administered with product No. 2. Clinical studies of cats in the experimental groups included a detailed anamnesis, study of skin lesions, considering the course of pathological changes. Animals in the control group received dry feed (Ukraine) and clean drinking water without medications. During the experimental period, blood samples were taken from cats for haematological, biochemical, and immunological studies: before medication administration, on Day 1, Day 4, and Day 8 of the experiment. Before and during the experiment, cats were clinically examined, including inspection, palpation, thermometry, examination of respiratory and heart rate. The study recorded the nutritional state, condition of the ears, and visible mucous membranes. The study was conducted using general and special diagnostic methods.

At the second stage of experimental research, the efficacy of veterinary medications was investigated on

outbred dogs of different ages and sexes. To conduct the study, a control and two experimental groups were formed based on the principle of analogues, considering the body weight, age, and type of animal constitution. The number of animals in each group was 5. Animals of the control and experimental groups were kept in enclosures on a standard balanced diet with free access to water, according to physiological needs.

The animals of the control group were clinically healthy dogs aged 1 to 5 years, weighing 7.5-12 kg, vaccinated against canine distemper, adenovirus type II, canine parvovirus, and canine parainfluenza. Prior to the experiment, the dogs were dewormed and underwent coprological tests to rule out the presence of canine endoparasitic diseases. Experimental Group I – dogs with clinical signs of atopic dermatitis, which were administered with product No. 1. Experimental Group II – dogs with clinical signs of atopic dermatitis, which were administered with product No. 2.

Clinical examination of the hair coat of the dogs in the experimental groups included registration of alopecia. The skin thickness, elasticity, dryness, and oiliness were determined. Attention was paid to the potential sites of primary changes in dermatitis of parasitic origin (interdigital area, ventral surface of the body in the abdomen, skin of the ears and external auditory meatus, areas of the head, specifically around the mouth, brow arches, between the auricles; detection of primary skin lesions (papules, pustules), assessment of their location and number.

Dogs in the control group received dry feed and clean drinking water without medications. During the experimental period, blood samples were taken from dogs for haematological, biochemical, and immunological studies: before medication administration, on Day 1, Day 4, and Day 8 of the experiment. Blood for research in dogs and cats was taken from the *vena cephalica antebrachii*. Blood was collected following the rules of asepsis and antisepsis.

To obtain serum, the tubes with blood samples were incubated in a thermostat for 15 min. To separate the blood serum from the clot, a stainless metal stick was used to draw along the inner wall of the tube. The sample tubes were centrifuged at 3,000 rpm for 15 min. Serum was collected using a pipette dispenser into sterile Eppendorf tubes. Haematological tests included determination of total haemoglobin (HGB), haematocrit (HCT), red blood cell (RBC), and white blood cell (WBC) counts. The study of the functional state of the liver and kidneys of cats and dogs included the determination of total protein according to the turbodimetric method, albumin with bromocresol green, urea according to the diacetyl monoxide method, and creatinine with picric acid. The activity levels of the following enzymes were found in the blood serum of cats and dogs: alanine aminotransferase (ALT; GCF 2.6.1.2) and aspartate aminotransferase (AST; GCF 2.6.1.1) according to the Reitman-Frankel method, gamma-glutamyl transpeptidase (GGTP; GCF 2.3.2.2).

Immunological methods included the determination of the level of total allergen-specific serum Ig E in the blood serum of cats and dogs using the ELISA test system "Granum" (Ukraine). The specified test system uses a sandwich method based on the principle of a two-site enzyme-linked immunosorbent assay. The test sample was introduced into the well of the plate with immobilised antigen (specific Ig E antibodies). Ig E total from the sample binds to antibodies on the surface of the well. Unbound material is removed by washing. Conjugate (second anti-Ig E antibody labelled with peroxidase) is added to the well. Then, the washing was repeated. The activity of the enzyme (bound on the surface of the plate well) was evaluated after substrate addition and measurement at 450 nm. The intensity of the colour reaction was directly proportional to the amount of total Ig E in the sample.

Statistical processing of the research results was carried out using statistical methods (STATISTICA 10.0 for Windows). The results obtained were processed using standard methods of variation statistics with non-parametric and parametric criteria. Numerical data were processed using one-factor analysis of variance (ANOVA). In case of a parametric distribution, the quantitative characteristics of the traits were presented in the form of the arithmetic mean of the sample and the standard deviation (M±m). Differences between samples were considered significant at $P<0.05$. Comparison of three or more groups on a quantitative basis with the correct distribution of values was carried out using the Tukey test for subsequent pairwise comparisons of groups, considering the Bonferroni correction (Xu *et al.*, 2010).

All experimental studies were conducted following the modern methodological approaches and corresponding requirements and standards that follow DSTU ISO/IEC 17025:2005 (2006). Animal husbandry and all manipulations were performed according to the provisions of the Procedure for conducting tests and experiments on animals by scientific institutions (Law of Ukraine No. 249, 2012), and of the European Convention for the protection of vertebrates used for experimental and other scientific purposes (1986).

RESULTS AND DISCUSSION

Results of cats' treatment. According to the results of observations, no changes in the clinical condition were detected in the cats of the control group during the experiment. The cats were active, eagerly consumed feed and water, and their nutritional state was average. Visible mucous membranes are pale pink, moderately shiny, without damage, pigmented. Skin was smooth, medium thickness, elastic, undamaged. Coat was thick, shiny, tight against the body. Prior to the experiment, cats in experimental Groups I and II showed clinical signs of allergic dermatitis: the skin on the limbs, neck, and back

was dry, not elastic, the coat was thin, dull, tousled, and not tight against the body. Animals showed constant itching, redness, exfoliation, and soreness of the skin. Two of the cats in the group had cracks, bleeding, and changes in skin pigmentation. The cats' appetite deteriorated compared to the control group. Animals were lethargic and apathetic.

On Day 4 of the experiment, after administration of the experimental medications to cats of Groups I and II, respectively, an improvement in the general clinical condition of the animals was recorded. The area of the lesion and skin itching decreased in cats. An improvement in appetite was noted. On Day 8, the skin condition of cats in experimental Groups I and II improved. No redness, scratching, exfoliation, or cracking of the skin was observed. Visible mucous membranes were moderately moist, pale pink. Animals' activity increased, they eagerly consumed feed and water. Therewith, a range of morphological parameters of the blood of cats of the control and experimental groups were determined (Table 2).

***Table 2**. Morphological and physiological parameters of cat blood under the influence of veterinary medications (M±m, n=5)*

Experimental groups	Duration of the study, days			
	before administration	Day 1	Day 4	Day 8
		Haemoglobin (HGB), g/dm^3		
Group I	120.18±1.21^a	121.26±1.48^a	122.13±2.14^a	122.15±1.58^b
Group II	119.15±1.34^a	120.14±2.07^a	121.17±1.26^a	122.06±1.47^b
control	124.23±1.11^a	125.73±1.13^a	125.06±1.41^a	125.26±1.31^a
		Haematocrit (HCT), %		
Group I	40.23±1.19^a	37.12±0.45^b	37.08±1.19^b	36.99±1.43^b
Group II	39.32±1.24^a	37.96±0.99^b	35.87±1.28^c	38.25±1.71^b
control	37.65±1.23^a	36.25±1.32^a	37.12±1.11^a	38.15±1.18^a
		Erythrocytes (RBC), 10^{12}/dm^3		
Group I	8.21±0.68^a	8.83±0.45^a	8.97±0.18^a	9.11±0.21^a
Group II	8.27±0.43^a	9.11±0.32^a	8.58±0.12^a	8.94±0.57^a
control	8.16±0.23^a	8.16±0.13^a	8.46±0.98^a	9.25±0.67^a
		White blood cells (WBC), 10^9/dm^3		
Group I	13.36±0.62^a	11.17±0.48^b	9.64±0.53^c	9.27±0.22^c
Group II	11.97±0.24^a	10.36±0.62^a	9.98±1.12^b	8.76±0.74^b
control	9.63±0.54^a	9.61±0.21^a	9.87±0.24^a	9.54±0.15^a

***Notes**: different letters indicate values significantly different from each other within one line of Table 3 based on the results of comparison using the Tukey test (P<0.05) with Bonferroni correction*
***Source**: compiled by the authors of this study*

Table 2 shows that the veterinary medications under study cause significant changes in haematological parameters in cats when administered orally. A significant improvement in the level of haemoglobin in the blood of cats on Day 8 of the experiment was found (in Group I by 2.03 g/dm^3, and in Group II – by 2.91 g/dm^3), compared with this indicator before the administration of medications. On Day 8 of treatment, the count of white blood cells decreased to the normalised level: in Group I – by 4.09×10^9/dm^3, and in Group II – by 3.21×10^9/dm^3. The study also investigated the dynamics of biochemical parameters in the blood serum of cats (Table 3).

***Table 3**. Biochemical parameters in the blood serum of cats under the influence of veterinary medications (M±m, n=5)*

Experimental groups	Duration of the study, days			
	before administration	Day 1	Day 4	Day 8
		Total protein, g/l		
I experimental	76.64±1.21^a	75.48±0.46^a	76.48±0.94^a	77.19±1.02^b
II experimental	73.89±0.59^a	79.03±0.32^b	77.13±0.93^b	75.36±1.27^b
control	77.65±0.43^a	78.64±0.87^a	77.24±1.03^a	78.51±1.74^a
		Albumin, g/l		
I experimental	37.9±1.07^a	37.16±0.52^a	38.25±0.17^b	39.24±1.44^b
II experimental	36.13±1.21^a	38.92±0.37^b	38.43±0.5^b	39.88±1.72^b
control	35.67±1.11^a	38.41±0.12^b	39.05±0.14^b	37.69±0.85^a
		ALT, IU/l		
I experimental	13.48±1.14^a	12.94±0.12^a	13.19±1.11^a	12.17±0.31^a

Table 3. Continued

Experimental groups	Duration of the study, days			
	before administration	Day 1	Day 4	Day 8
II experimental	13.88±0.27[a]	14.01±0.24[a]	13.56±0.15[a]	13.54±1.05[a]
control	12.17±0.71[a]	13.92±0.15[a]	14.17±0.18[b]	13.25±0.78[a]
AST, IU/l				
I experimental	29.26±1.48[a]	28.91±1.53[a]	29.15±0.51[a]	30.78±1.47[a]
II experimental	29.94±0.62[a]	29.17±0.51[a]	30.92±1.16[a]	29.78±0.52[a]
control	28.14±0.23[a]	29.56±0.37[a]	30.24±0.28[a]	31.74±0.45[a]
Gamma-glutamyl transpeptidase (GGT), IU/l				
I experimental	5.42±0.83[a]	5.73±0.12[a]	5.37±0.22[a]	6.67±0.29[a]
II experimental	5.99±0.17[a]	6.67±0.18[a]	6.55±0.11[a]	6.15±0.17[a]
Control	4.58±0.31[a]	5.12±0.16[a]	6.49±0.12[b]	6.28±0.18[b]
Creatinine, μmol/l				
I experimental	74.14±1.05[a]	74.85±0.17[a]	75.26±0.21[a]	76.18±1.09[b]
II experimental	74.97±0.53[a]	76.01±0.12[b]	75.17±0.28[a]	75.53±1.42[a]
control	73.58±1.06[a]	75.39±1.25[b]	74.57±0.45[a]	74.31±0.75[a]
Urea, mmol/l				
I experimental	5.12±0.94[a]	5.19±0.31[a]	5.63±0.21[a]	4.18±0.26[a]
II experimental	5.46±0.17[a]	5.71±0.19[a]	6.11±0.37[b]	5.58±0.15[a]
control	4.74±0.29[a]	4.88±0.12[a]	5.94±0.18[a]	6.23±0.15[b]

***Notes**: different letters indicate values significantly different from each other within one line of Table 3 based on the results of comparison using the Tukey test (P<0.05) with Bonferroni correction*
***Source**: compiled by the authors of this study*

Table 3 shows that the veterinary medications under study improve the functional state of the liver and kidneys of experimental animals when administered orally. The study found a significant improvement in the level of creatinine in the blood serum of cats on Day 8 of the experiment (in Group I – by 2.04 μmol/l, and in Group II – by 0.56 μmol/l) and albumin (in Group I – by 1.34 g/l, and in Group II – by 3.75 g/l) compared with this indicator before the administration of the medications.

The next step was to conduct immunological studies to determine the concentration of total Ig E in the blood serum of cats that had been administered veterinary medications. It was found that the concentration of total Ig E in the blood serum of cats of Groups I and II was significantly higher than the control values at all study periods: before administration – 3.4 times and 3.9 times, on Day 1 – 3.8 times and 4.3 times, on Day 4 – 2.9 times and 3.1 times, on Day 8 – 2.2 times and 2.1 times, respectively (Fig. 1).

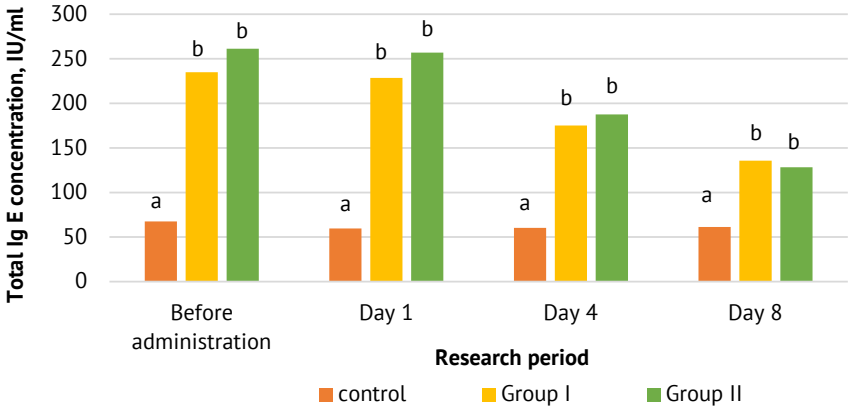

***Figure 1.** The content of total Ig E in the blood serum of cats after the use of veterinary medications (M±m, n=5)*
***Source**: compiled by the authors of this study*

The increased content of total Ig E in the blood indicates the presence of an allergic reaction in the body of experimental animals. Notably, on Days 4 and 8 after administration of medication No. 1 to cats, the level of Ig E in the blood of cats of the experimental groups was significantly lower compared to the previous study period.

Results of treatment of dogs. Therewith, clinical trials were conducted on outbred dogs of different ages

and sexes to establish the effectiveness of veterinary medications. The general clinical condition of dogs was investigated; haematological, biochemical, and immunological studies of dogs' blood were performed under conditions of oral administration of a suspension of experimental medications. The clinical condition of the dogs in the control and experimental groups was determined daily throughout the study. Thermometry, examination of visible mucous membranes, examination of the skin and coat were carried out. No changes in clinical condition were observed in the dogs of the control group during the experiment. The animals were active, eagerly consumed feed and water, and their nutritional state was average. Visible mucous membranes are pale pink, moderately shiny, without damage, pigmented. Skin was smooth, medium thickness, elastic, undamaged. Coat was thick, shiny, tight against the body.

Prior to the experiment, dogs in experimental Groups I and II showed clinical signs of atopic dermatitis: hair loss, scabs, itchy skin, which was manifested by scratching, licking, and biting their skin, irritability and changes in habitual behaviour (anorexia, aggressiveness). In the dogs of the experimental groups, the affected skin areas were recorded in the muzzle, interdigital areas, and the outer surface of the elbow joints. The skin on the limbs, neck, and back was dry, not elastic, the coat was thin, dull, tousled, and not tight against the body. Animals showed constant itching, redness, exfoliation, and soreness of the skin. Two of the dogs in the group had cracks, bleeding, and changes in skin pigmentation. The dogs' appetite deteriorated compared to the control. Animals were lethargic and apathetic.

On Day 4 of the experiment, after administration of the experimental veterinary medications to dogs of Groups I and II in a therapeutic dose, an improvement in the general clinical condition of the animals was recorded. The area of the lesion and skin itching decreased in dogs. There was an improvement in appetite. On Day 8, the skin condition of dogs in experimental Groups I and II improved. No redness, scratching, exfoliation, or cracking of the skin was observed. Visible mucous membranes were moderately moist, pale pink. Animals' activity increased, they eagerly consumed feed and water. In addition, a range of morphological parameters of the blood of dogs of the control and experimental groups were determined (Table 4).

***Table 4**. Morphological and physiological parameters of dog blood under the influence of veterinary medications (M±m, n=5)*

Experimental groups	Duration of the study, days			
	before administration	Day 1	Day 4	Day 8
Haemoglobin (HGB), g/dm^3				
Group I	140.37±3.14^a	141.19±3.31^a	143.17±1.36^a	150.15±2.11^b
Group II	139.96±2.31^a	141.27±3.14^a	142.65±3.01^a	148.44±1.26^b
control	149.66±1.18^a	148.16±4.52^a	147.99±2.16^a	149.18±1.17^a
Haematocrit (HCT), %				
Group I	58.61±1.85^a	57.55±1.24^b	50.51±1.49^b	50.11±1.21^b
Group II	56.36±2.87^a	54.17±2.91^a	51.91±1.83^b	49.67±2.31^b
control	49.19±2.16^a	49.16±1.26^a	49.56±1.27^a	51.24±1.13^a
Erythrocytes (RBC), 10^{12}/dm^3				
Group I	8.22±0.24^a	8.56±0.24^a	8.63±0.26^a	7.99±0.25^a
Group II	9.01±0.31^a	8.17±0.23^a	8.42±0.19^a	8.51±1.23^a
control	8.41±0.52^a	8.92±0.16^a	7.89±0.76^a	7.91±1.12^a
White blood cells (WBC), 10^9/dm^3				
Group I	16.28±1.72^a	14.83±1.23^a	12.93±1.52^b	10.47±1.65^b
Group II	14.08±1.33^a	13.32±1.12^a	12.43±0.98^a	11.64±1.22^b
control	11.12±0.14^a	11.52±1.14^a	10.15±1.76^a	11.33±1.21^a

***Notes**: different letters indicate values significantly different from each other within one line of Table 4 based on the results of comparison using the Tukey test (P<0.05) with Bonferroni correction*
***Source**: compiled by the authors of this study*

Table 4 shows that the veterinary medications under study, when administered orally, have a positive effect on the haematological parameters of dogs in the experimental groups. On Days 1 and 4 of the experiment, a significant (P<0.05) decrease in haemoglobin content was recorded. On Days 4 and 8, this indicator did not differ significantly from the control. In dogs of experimental Groups I and II, a significant increase in haematocrit content was found before the administration of medications and on Day 1 of the experiment compared to the control. On Days 4 and 8, a significant (P<0.05) decrease in this indicator was recorded in dogs of the experimental groups. The dynamics of biochemical parameters in the blood serum of dogs was investigated (Table 5).

***Table 5**. Biochemical parameters in the blood serum of dogs under the influence of veterinary medications (M±m, n=5)*

Experimental groups	Duration of the study, days			
	before administration	Day 1	Day 4	Day 8
		Total protein, g/l		
I experimental	64.23±1.96[a]	63.18±0.68[a]	62.94±0.15[a]	61.30±1.53[b]
II experimental	67.75±0.14[a]	67.28±0.43[a]	64.54±1.06[b]	60.18±1.19[b]
control	60.22±0.17[a]	61.69±0.15[a]	61.95±1.03[a]	59.75±1.16[a]
		Albumin, g/l		
I experimental	41.57±1.21[a]	41.99±0.35[a]	37.23±0.18[b]	36.48±1.05b
II experimental	39.44±1.52[a]	37.41±0.44[a]	37.42±0.21[a]	36.12±0.31[a]
control	35.52±1.12[a]	35.48±0.52[a]	35.06±0.57[a]	36.51±0.16[a]
		ALT, IU/l		
I experimental	10.55±1.24[a]	11.57±0.52[a]	10.48±1.27[a]	10.28±0.33[a]
II experimental	11.22±0.81[a]	10.83±0.45[a]	11.59±0.13[a]	11.87±1.12[a]
control	11.12±0.17[a]	10.54±0.15[a]	11.52±0.16[a]	11.27±0.47[a]
		AST, IU/l		
I experimental	21.16±1.22[a]	20.95±1.47[a]	19.99±0.61[a]	20.55±1.25[a]
II experimental	19.89±0.53[a]	21.74±0.63[a]	21.91±1.44[a]	21.44±0.53[a]
control	20.14±0.13[a]	19.57±0.29[a]	20.71±0.54[a]	20.73±0.12[a]
		Gamma-glutamyl transpeptidase (GGT), IU/l		
I experimental	9.58±0.53[a]	10.78±0.21[a]	8.69±0.52[b]	7.32±0.28[b]
II experimental	8.18±0.23[a]	9.55±0.42[a]	6.78±0.19[a]	6.96±0.35[a]
control	7.28±0.12[a]	7.98±0.15[a]	7.25±0.23[a]	7.28±0.27[a]
		Creatinine, μmol/l		
I experimental	74.21±1.19[a]	75.15±0.78[a]	74.78±0.37[a]	75.46±1.21[a]
II experimental	74.98±0.15[a]	74.21±0.99[a]	75.28±0.69[a]	74.88±1.62[a]
control	73.75±1.12[a]	74.36±1.37[a]	73.62±0.73[a]	74.16±0.25[a]
		Urea, mmol/l		
I experimental	5.19±0.32[a]	6.12±0.11[a]	6.75±0.21[a]	5.33±0.12[a]
II experimental	5.87±0.23[a]	5.57±0.18[a]	5.78±0.39[a]	6.05±0.67[a]
control	5.76±0.28[a]	5.81±0.29[a]	5.65±0.23[a]	5.44±0.15[a]

***Notes**: different letters indicate values significantly different from each other within one line of Table 5 based on the results of comparison using the Tukey test (P<0.05) with Bonferroni correction*
***Source**: compiled by the authors of this study*

Table 5 shows that the administration of the experimental medications to dogs in therapeutic doses does not have a toxic effect on the functional state of the liver and kidneys. Thus, before administration and on Day 1 of the experiment, a significant (P<0.05) increase in the level of total protein and albumin in the blood serum of dogs was observed. However, on Days 4 and 8 of the experiment, a decrease in these indicators to the control was observed. No significant changes in enzyme activity were recorded in dogs of the experimental groups. Along with this, a study was conducted to determine the concentration of total Ig E in the blood serum of dogs that had been administered veterinary medications (Fig. 2).

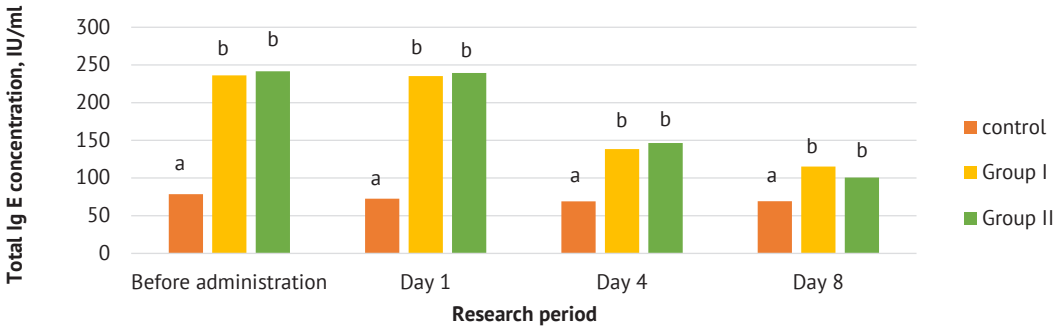

***Figure 2.** The content of total Ig E in the blood serum of dogs after the use of veterinary medications (M±m, n=5)*
***Source**: compiled by the authors of this study*

Figure 2 shows that the concentration of total Ig E in the blood serum of dogs of Groups I and II was significantly higher than the control values at all study periods: before administration – 3.0 times and 3.1 times; on Day 1 – 3.2 times and 3.3 times; on Day 4 – 2.0 times and 2.1 times; on Day 8 – 1.7 times and 1.5 times, respectively. On Days 4 and 8 of treatment with medication No. 1, the level of Ig E in the blood of the experimental animals was significantly lower compared to the previous study period. Thus, the detection of high concentrations of total Ig E (up to 240…245 IU/ml) in the serum of cats and dogs is a vital indicator that allows differentiating atopy from other pathological conditions clinically manifested by dermatitis.

The clinical manifestations of atopic dermatitis (itching and erythema) can be reliably controlled using complex topical medications containing corticosteroids (triamcinolone acetonide) and B vitamins. As a result of the studies, it was found that the use of veterinary medications (oral suspension) in a dose of 1 mg of triamcinolone acetonide (active ingredient) in cats and dogs has a pronounced anti-allergic effect and improves the condition of the animals' skin already on Day 8 of use.

Ö. Barili and D. Pekmezci (2019) show that in atopic dermatitis in dogs, specific Ig E levels are above the threshold. They note that genetic factors affect the level of Ig E in dogs. Based on clinical studies, it was proved that the concentration of total Ig E in the blood serum of dogs over 130 IU/ml indicates atopic dermatitis. D.T. Morena *et al.* (2021), in their study to identify the most relevant environmental allergens in a population of atopic dogs living in Northern Italy, found that the concentration of total Ig E in the serum of affected dogs was more than 186 IU/ml. These data correlate with the findings obtained in the present study. However, in the studies conducted, the concentration of total Ig E in the blood serum of dogs was 230…245 IU/ml, while in cats – 227…240 IU/ml. It is believed that this is caused by the prolonged absence of treatment of the animals under study in the shelter against the background of a chronic course of the disease.

The publicly available literature data indicate the effectiveness of corticosteroid medications in the treatment of atopic dermatitis, which is the reason for the choice of the active ingredient for the proposed oral suspension. According to P. Chauhan *et al.* (2017), corticosteroid medications in small pets (cats and dogs) have a pronounced local anti-inflammatory and anti-allergic effect, which significantly reduces itching and helps to accelerate the completion of the pathological process in the skin. T.H. Yang *et al.* (2018) shows the effectiveness of using external dosage forms containing fluorinated corticosteroids, specifically triamcinolone. Notably, fluorinated compounds are safer than their non-fluorinated counterparts due to slower resorption through the skin surface. T.J. Nuttall *et al.* (2019) note that triamcinolone can be used orally, by inhalation, injection (intramuscular, intra-articular, intravitreal), and topically (in the form of ointments, liniments). However, T. Weitzer and R. Mueller (2023) warn that, when administered orally, the medication has a stimulating effect on the secretion of hydrochloric acid and pepsin in the stomach, which may contribute to the development of peptic ulcer disease. In the present study, no adverse reactions to the use of oral suspension from the gastrointestinal tract were found.

M. Fuller (2021) notes the high efficacy of topical use of 0.015% triamcinolone acetonide (GENESIS Topical Spray, Virbac) in atopic dermatitis in dogs. Adverse events of polyuria and polyphagia with this treatment were reported in <6% of dogs. T. Olivry and R. Mueller (2020) noted the efficacy of triamcinolone acetonide for the treatment of feline atopic skin syndrome (FASS) at a dose of 0.18 mg/kg once daily for ⩽14 days to achieve remission. V. Bruet *et al.* (2022) reported that topical treatment with a 0.015% triamcinolone acetonide solution applied to the affected skin for 28 days was efficacious and clinical improvement was observed in 67.3% of treated dogs. D.Z. Telci *et al.* (2023) also reported that topical application of 0.015% triamcinolone spray for 28 days was efficacious in the treatment of canine atopic dermatitis. The findings presented in the current study correlate with the data of scientists, however, upon the use of the developed oral suppressants, a stable remission occurs ⩽8 days of treatment. It is believed that this is achieved by enriching the study medications (oral suspensions) with B vitamins: vitamin B_1 – 2 mg; vitamin B_2 – 4 mg; vitamin B_3 – 10 mg, and vitamin B_6 – 2 mg were added to the composition of medication No. 1, and vitamin B_6 – 3 mg; vitamin B_2 – 5 mg, and vitamin B_3 – 10 mg were added to medication No. 2. N. Suwannasom *et al.* (2020) have scientifically proven that a lack of B vitamins in cats and dogs leads to the development of dermatitis and seborrhoea. The use of a combination of B vitamins (B_1,B_2,B_3,B_6) in the developed medications was chosen based on the findings of scientific research by P.H. Kook *et al.* (2018), who note that B vitamins affect a range of processes in the body: they are part of enzymes that catalyse the metabolism of carbohydrates, lipids, and proteins, contribute to the normalisation of the metabolism of autonomic centres, the processes of formation, impulse transmission, and neurocyte trophism, and improve the functioning of nerve cells and subcortical centres.

According to scientists, triamcinolone is the main component of the treatment regimen for chronic atopy in small pets, which is a moderately potent corticosteroid according to the European Classification of Corticosteroids, which does not have a negative effect on the animal's body. The developed oral suspension based on triamcinolone (1%) acetonide and enriched with a complex of B vitamins for the treatment of atopy in dogs (0.5…2.0 ml per day) and cats

(0.25...0.5 ml per day) contributed to the improvement of the general clinical condition of animals within a week (on Day 8 of treatment).

CONCLUSIONS

The findings of morphological and physiological parameters of the blood of experimental animals before treatment indicate the presence of an allergic reaction in the body of experimental animals: the increased content of total Ig E in the blood of experimental cats by 3.4....3.9 times, and in dogs – by 3.0....3.1 times compared to the control groups. According to the results of experimental studies of triamcinolone veterinary medications, they are well tolerated by cats and dogs and do not cause changes in the clinical condition of animals. A significant improvement in haemoglobin levels in the blood of experimental animals on Day 8 of the experiment was found: in cats – by 2.47±0.44 g/dm^3, and in dogs – by 9.13±0.65 g/dm^3.

It was found that the administration of the experimental veterinary medications (oral suspension) to cats and dogs at a dose of 1 mg of triamcinolone acetonide (active ingredient) does not have a toxic effect on the functional state of the liver and kidneys: on Day 8 of treatment, the level of total protein and albumin in the blood serum decreased to the control level. No significant changes in enzyme activity were recorded in the animals of the experimental groups. It was proved that the medications under study in doses for dogs within 0.5-2.0 ml and for cats within 0.25-0.5 ml per animal, depending on its body weight, exhibit pronounced anti-inflammatory, anti-allergic, and desensitising activity. The prospect of further research is to investigate the recurrence of atopy in the follow-up control using the developed medication.

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CONFLICT OF INTEREST

The authors of this study declare no conflict of interest.

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Ефективність лікування дрібних тварин препаратами на основі триамцинолону за атопічного дерматиту

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Анотація. Серед хвороб дрібних домашніх тварин одне з провідних місць займають захворювання шкіри. Атопічний дерматит є поширеним захворюванням шкіри дрібних домашніх тварин, яке, за оцінками ветеринарних лікарів, вражає від 10 до 15 % собак та від 7 до 18 % котів. Залежно від залучених алергенів, клінічні ознаки можуть бути сезонними або несезонними, і захворювання, як правило, вимагає довічного лікування. Метою роботи було вивчити терапевтичну ефективність лікування атопії у собак та котів за застосування ветеринарних препаратів (пероральна суспензія) на основі триамцинолону. В роботі використано стандартні клінічні, гематологічні, біохімічні та імунологічні методи дослідження. Підвищений вміст загального імуноглобуліну Е (Ig E) в крові дослідних тварин до початку лікування (I група – у 3,4, а II група – у 3,9 рази у порівнянні з контрольною) свідчить про наявність алергічного процесу в організмі. Встановлено, що апробовані ветеринарні препарати суттєво не впливають на гематологічні показники собак та котів за перорального застосування, у терапевтичних дозах не чинять токсичного впливу на функціональний стан печінки та нирок. Доведено, що на 4-ту добу використання оральної суспензії № 1 та № 2 на основі триамцинолону (1 %) ацетоніду та комплексом вітамінів групи В у терапевтичній дозі реєстрували покращення загального клінічного стану тварин. На 8-му добу лікування у собак та котів I та II дослідної групи встановили покращення стану шкіри: зменшення площі ураження, відсутність почервоніння, розчосів та лущення. Загальний клінічний стан шкіри дослідних тварин з 8-ї до 12-ї доби залишався без змін. Розроблені оральні суспензії проявляють виражену протиалергійну дію та покращують стан шкіри дрібних домашніх тварин (собак та котів) за атопічного дерматиту

Ключові слова: атопія; імуноглобулін; лікування; суспензія; плазма крові; дослідження; собаки; коти