

Original scientific paper

HAEMATOLOGICAL STATUS IN CATS WITH CHRONIC RENAL FAILURE: EFFECT OF A RENAL DIET**

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Abstract: Chronic renal failure is a disease characterized by decreased kidney function and therefore a change in haematological parameters in cats. In our work we analyzed the hematological parameters, course of renal disease and the lifespan of cats suffering from chronic renal insufficiency. The aim of the study was to compare the haematological parameters of cats suffering from CRF, fed a renal diet; cats suffering from CRF not fed a renal diet and cats that were completely healthy. Then, the importance of using CRF-approved food for diseased cats and the effectiveness of its application was determined.

The study included a total of 60 cats, divided into three groups. The blood parameters of cats used in our study were: erythrocytes, thrombocytes, total leucocytes, differential leukocyte, hemoglobin concentration, hematocrit, MCV, MCH, MCHC, creatinine and urea. The study lasted for three years at the Veterinary Ambulance for pets "MIM COOP" Banja Luka.

The study data were statistically analyzed using a T-test ($p < 0.05$) and Pearson's correlation coefficient. The results of our study show that the mean values of haematological parameters in the group of cats that did not use a renal diet for cats suffering from CRF were different statistically from other two groups of cats: the group that used a renal diet for cats suffering from CRF and control groups of cats. Also, cats that used a renal diet have better quality of life and live longer than cats that did not receive this diet. Dietetic food recover kidneys of the cats suffering from CRF.

Key words: renal failure; hematology; cat; dietetic food;

INTRODUCTION

Kidneys in cats are paired organs built from a large number of kidney glomeruli and canals arranged in nephrons. Nephrons filter metabolic waste products from the blood out from the body in the form of urine. Due to various infectious and immune diseases, as well as cats' aging, there is a decrease in functional capacity of nephron, resulting in damage to the kidney

tissue, toxin accumulation in cats and possible chronic renal failure (CRF). By the time the first symptoms of chronic renal insufficiency occur, most often over half of renal nephrons have already lost their blood filtration function. This disease leads to definite and irreversible destruction of kidney nephrons (Mizutani H. et al. 2008, Dean R. and Downes M. 2015).

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Nephron destruction results in loss of their filtering capacity and accumulation of metabolic waste products in cats. This means that harmful substances which should be eliminated through urine stay in the cat's body and kidney insufficiency occurs. Chronic renal insufficiency does not only lead to impaired renal excretory function but it also damages its endocrine function. This reduces or completely eliminates erythropoietin secretion resulting in decreased erythrocyte count and anemia in cats. After a long period of time anemia causes another diseases such as weakened immune system, cardiovascular disorder, reduced lung capacity, etc. (Sparkes A.H. et al. 2016).

Symptoms of chronic renal insufficiency in cats include: increased thirst, frequent urination, nausea, vomiting, loss of appetite, weight loss, uremic breath odor, diarrhea; In a severe form of this disease there is shivering, pale skin, uremia, severe itching and conjunctivitis. Urea and creatinine values are several times higher than normal. In the case of a more severe form of renal insufficiency, which is either a consequence of a disease or the consequence of a long-lasting chronic kidney disease without a tendency of improvement, the cat's organism will not be able to compensate for the condition. In addition, the kidneys will not be able to supply the body with purified blood, or with the needed amount of electrolytes which can seriously endanger the cat's life (Finch N C. C. 2016).

The outcome of the chronic kidney insufficiency

in cats mostly depends on the level of kidney damage and how soon the therapy was applied. Early detection of this disease is of a great importance in controlling this severe kidney disease. In addition to therapy, diet modifications provides great help in the treatment of chronic renal failure. Thus, the aim of our work was to examine the effect of therapeutic diets for cats with CRF on their quality of life (Brown A S. et al. 2001). When it comes to CRF it is most important to restore the balance of electrolytes in the blood, regulate acid-base balance and treat anemia. Diet for cats with CRF is based on a low percentage of proteins, phosphorus and fatty acids in order to minimize kidney damage in their metabolism.

In veterinary pharmacies there is a medical program of therapeutic diet labeled RENAL, for cats with kidney disease. The prognosis of the disease depends on many factors: how soon was the treatment applied, duration of illness, age of the cat, clinical picture during the treatment of the illness, cat's reaction to the therapy, nutrition during treatment and because of this, it is very difficult to give any information on the outcome of the disease (Mizutani H. et al. 2008).

However, as already mentioned, cat diet during CRF treatment can play a crucial role in condition and quality of life, and can affect life expectancy. Literature data show that cats with CRF fed a veterinary renal diet had significantly longer life expectancy than cats that did not receive this diet (Mathur S. et al. 2004).

MATERIAL AND METHODS OF WORK

Our study was carried out at the veterinary ambulance for pets "MIMCOOP" Banja Luka, the ambulance specialized for the treatment and prevention of animal diseases; and it lasted for three years (2014, 2015, and 2016). The study included a total of 60 cats divided into three groups: cats suffering from CRF that were fed a veterinary renal diet (group 1, total = 20 cats), cats suffering from CRF that were not fed a

veterinary renal diet (group 2, total = 20 cats) and cats that were completely healthy and were not fed a veterinary renal diet (control group, total = 20 cats).

In order to determine the health condition of cats during the clinical examination, blood samples were taken for haematological analysis, each blood sampling was approved by the owner. Blood sample was taken from vena cephalica

antebrachii. After a blood sample was taken haematological analysis was performed on VETSCIL analyser. The hematologic parameters in cats used in our study were: number of erythrocytes, thrombocytes, total number of leukocytes, differential leukocyte count: lymphocytes, monocytes, granulocytes and eosinophils; hemoglobin concentration; hematocrit value; MCV; MCH; MCHC; creatinine and urea levels.

During the diagnosis of CRF in cats and taking data on the values of analyzed hematological parameters, the owner of the cat was familiar with the study and its goals. The owner of the cat was introduced to the benefits of using specialized renal diet for CRF cats and he decided whether to use it in his cat's diet or not. If the owner accepted to use renal diet, information about the owner and the cat were taken and the cat was included in our study (group 1). With each subsequent control, regardless of the control dynamics, values of the parameters were recorded. If the owner rejected to use renal diet, but he agreed to participate in the study, information about the owner and cat were taken and the cat was also included in our study (group 2). At each subsequent control of these cats, they would be treated as cats from group 1. The control group was made of cats that were completely healthy and their blood samples were taken for the analysis of blood parameters for this study.

The diagnosis of chronic kidney insufficiency begins with a clinical examination of the cat, anamnestic data are taken from the owner. The owners usually say that the cat has a loss of appetite, is more sleepy, is not interested in the environment, drinks less water and has urine-like odor on the breath. After this examination, the blood for haematological and biochemical analysis was taken. Cats with suspected CRF are subjected to ultrasound imaging of the abdomen and the morphology of the renal parenchyma was inspected. After this the final diagnosis of CRF is done and the therapy is prescribed: fluid and electrolyte therapy in combination with vitamins, and immunomodulators. Diet adjustments are suggested. Control examinations are performed in a time interval that is individual and depends on the degree of renal insufficiency. Since it is a chronic disease it is necessary to monitor the health condition of the diseased cats for a longer period of time, and advise the owner to report any major change in the course of the disease.

The data collected in the study were statistically analyzed in Excel by determining the mean value of the parameters and significant differences between analyzed groups of cats were calculated by using t-test ($r < 0.05$) and Pearson's correlation coefficient in ANOVA program. The results obtained after processing are presented in the table.

RESULTS AND DISCUSSION

Three years of study in veterinary ambulance "MIMCOOP" Banja Luka and monitoring of changes in blood parameters of cats with chronic renal insufficiency gave the data presented in this paper. Statistical results of the mean values of haematological parameters in cats from all three analyzed groups, as well as the reference

values are shown in Table 1. Changes in parameter values match the data published by the authors of similar studies. The diagnosis of chronic renal insufficiency of cats primarily depends on the blood image and that is why we have chosen it as a reference method.

Table 1. Presentation of haematological parameters of cats from all three analyzed groups (reference values of parameters by Mizutani H et al. 2008)

haematological parameters	control group	group 1	group 2	reference parameter
erythrocytes ($10^6/\text{mm}^3$)	8,81±0,95	6,39±0,78	5,64±0,64 *	5,0-10,0
thrombocytes ($10^3/\text{mm}^3$)	378,83±87,34	372,50±79,12	328,25±81,56	300-800
leukocytes ($10^3/\text{mm}^3$)	9,79±1,43	9,05±1,95	12,85±2,11 *	5,5-19,5
lymphocytes (%)	39,49±2,97	55,77±3,45	28,61±2,99 *	12-30
monocytes (%)	1,57±0,13	1,35±0,22	1,87±0,28 *	3-14
granulocytes (%)	57,82±4,81	42,87±3,15	69,75±5,24 *	60-80
eosinophils (%)	6,02±0,55	7,22±0,14	8,44±0,34 *	2-10
hemoglobin (g/dl)	11,88±2,81	10,47±3,25	9,47±2,12 *	8-15
hematocrit (%)	41,96±5,78	35,95±6,16	31,35±5,86 *	24-45
MCV (μm^3)	51,11±6,19	56,55±6,61	62,42±7,19	64-80
MCH (pg)	14,53±1,55	16,25±1,22	18,55±1,36	17-23
MCHC (g/dl)	28,42±2,97	28,97±2,99	30,22±2,56	31-36
creatinine (mg/dl)	1,71±0,12	3,12±0,18	11,32±0,21 **	1,0-2,1
urea (mmol/l)	8,5±0,41	8,1±0,42	38,5±0,35**	6,4-12,1

* statistically significant difference for $r < 0.05$.

** exceptionally large statistically significant differences from normal values

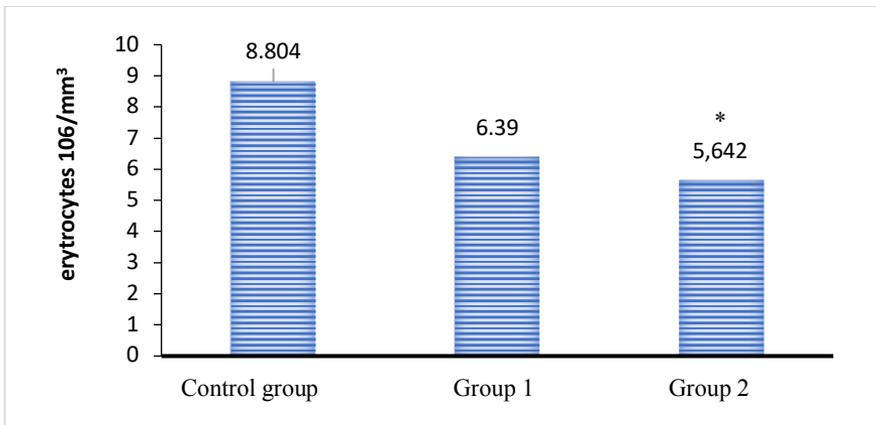
The values of haematological parameters in cats from group 2 differ from the values of the same parameters for the cats from group 1 and the control group. Comparison was done between group 1 and control group and between group 2 and control group and these values were tested for statistical significance. These differences are, for most parameters, that big that they are statistically significant for the degree of freedom $r < 0.05$ (differences marked with asterisk in Table 1). Mean values of haematological parameters: the number of erythrocytes and leukocytes, as well as the creatinine and urea levels, were most deviated in the analyzed group 2 compared to the control group. Statistically significant decrease of erythrocytes was detected in the group of cats suffering from CRF that did not use dietetic food which means that their kidneys were endangered by disease and inadequate food. Kidney load affected the poor stimulation of erythropoietin and for this reason the number of erythrocytes is lower in the group of these cats compared to the other two groups. It is important that it is not lower than the

reference values (Graph 1). Such results are in accordance with the literature, as other authors also received a decrease in the number of erythrocytes in cats with renal failure that did not use dietetic food (Dean R. and Downes M, 2015). On the other hand, the mean value of leukocytes increased in cats from group 2 compared to the other two analyzed groups. This result is expected although it does not exceed the reference value because in such cases renal insufficiency leads to intoxication and inflammatory kidney processes (Graph 2). The increase in the number of leukocytes in the case of renal insufficiency of cats that did not use dietetic food is also indicated by Finch N. C. and associates (2016).

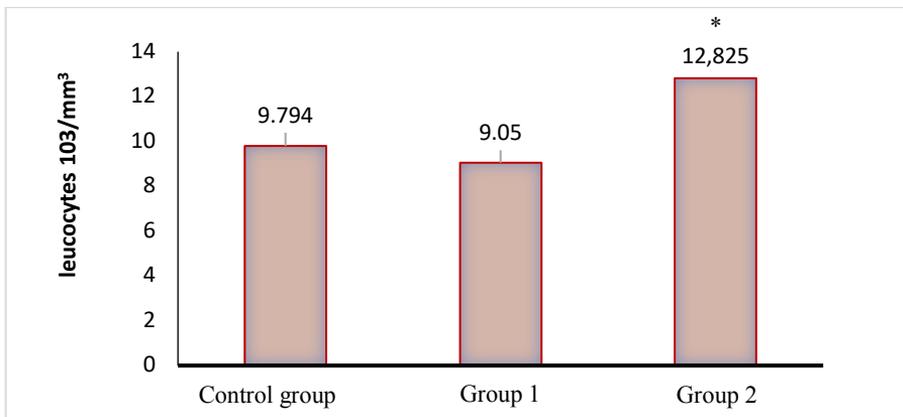
The mean values of creatinine (Graph 3) and urea (Graph 4) also increased in cats from Group 2 compared to the other two groups of cats. It is important to note that the value of creatinine and urea increased five times, which undoubtedly indicates a disturbed kidney function and a very poor filtration of blood. Cats with CRF that used renal diet (group 1) did not have such a high

value (Table 1) of urea. Similar data on the importance of dietetic food for cats with CRF are also provided by Mizutani H. and Associates (2008), who argue that the rise in urea and creatinine levels can return to normal if cats suffering from CRF are fed renal diet. There was a statistically significant difference in mean change of lymphocytes, monocytes,

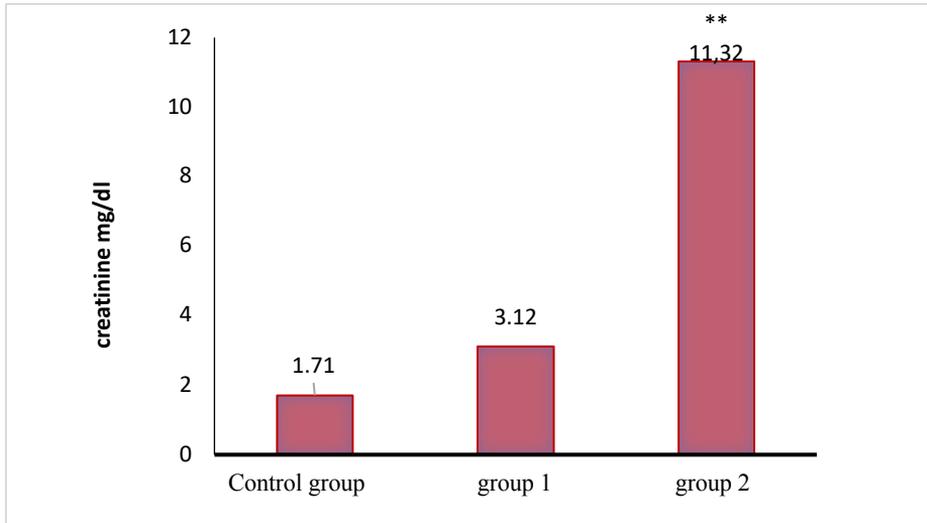
granulocytes, eosinophils, as well as of hemoglobin and hematocrit while the values of MCV, MCH, MCHC and thrombocytes change but with no statistically significant difference. Similar data are also provided by authors who show that renal failure affects erythropoiesis and reduction of erythrocyte-related haematological parameters (Dean R. and Downes M, 2015).



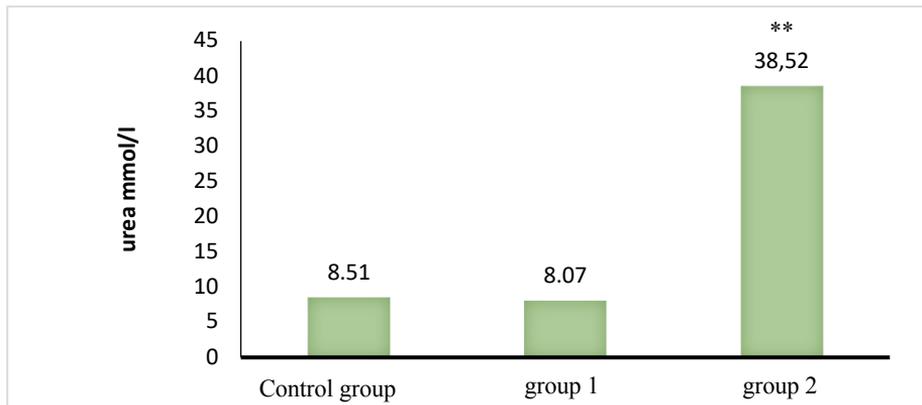
Graph 1. Presentation of mean change of erythrocytes in the analyzed cats' blood samples (* statistically significant difference)



Graph 2. Presentation of mean change of leucocytes in the analyzed cats' blood samples (* statistically significant difference)



Graph 3. Presentation of change in the level of creatinine in the analyzed cats' blood samples (large statistically significant difference)**



Graph 4. Presentation of change in the level of urea in the analyzed cats' blood samples (large statistically significant difference)**

Data on the age of cats were taken during the anamnesis, and this information enabled us to monitor their lifespan. Cats that used renal diet lived for another 1-2 years, while those who didn't use the same food lived much longer, on average for up to two years compared to the first group of cats. None of the cats from Group 1 died during the study, while 14 cats in Group 2 died. A reduced lifespan in cats suffering from

renal insufficiency is also confirmed by Brown A. S. and associates (2001) and they state that dietetic food can prolong the life of these cats. Also, quality of life is better for cats who used dietetic food, they were more lively, cheerful, more active and they have less pronounced symptoms of the disease. While those who didn't use the same food were tired, trembling, more passive, and all of the symptoms of the

disease were clearly pronounced, regardless of the therapy they received. The impact of kidneys on the quality of cats' life proves their vital role (Sparkes A, H. et al. 2016).

CONCLUSION

Comparative results of the analysis of our work clearly indicate the importance of using dietetic food for cats suffering from CRF in order to improve the quality of their health and prolong life. Cats diseased with renal insufficiency that used dietetic food had much better values of haematological parameters than those who did not use that food. Dietetic food does not put an extra burden on the kidneys and recovers them in cats suffering from CRF.

LITERATURE

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