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Risk of Hemodynamic Disorder in Cats in Surabaya and Surrounding Areas with Erythrocyte and Platelet Components Analysis

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Abstract

The community service program by lecturers of the Faculty of Veterinary Medicine, University of Wijaya Kusuma Surabaya, in collaboration with WEKA Veterinary Teaching Hospital. Many cat owners are unaware of the clinical symptoms of hemodynamic disorders, such as fatigue, weakness, tiredness, lethargy, or even a decreased or loss of appetite. However, visible clinical signs, such as pale gums or mucous membranes, and shortness of breath, sometimes prompt cat owners to consider what to do. This program aims to educate the public regarding the risk factors for hemodynamic disorders that affect the general condition of the cats with blood tests for erythrocyte and platelet components. This program focuses on cats cared for by owners in Surabaya and its surroundings. The method for identifying risks of hemodynamic disorder is a blood test with a hematology analyzer, and it is free of charge. The contribution of this activity is Improvement awareness and knowledge of pet owners, especially cat's owners, about the importance of blood tests to reduce the risk factors for hemodynamic disorders in cat health. This activity uses sample of 25 cats from 25 different owners, which were taken randomly without looking at clinical symptoms. Blood samples were taken and continued with the Raito-vet® hematology analyzer to determine the components of the erythrocyte and platelet values. The results showed that all samples had anemia, and 19 cats had thrombocytosis. After the results were obtained, a discussion and education stage was carried out with cat owners regarding the condition and further treatment of the cat. Cats without significant symptoms can experience hemodynamic disorders, as evidenced by the fact that almost all cats participating in this program had abnormal erythrocyte and platelet counts. A blood test with a hematology analyzer is an effective supporting diagnosis for detecting hemodynamic disorders or blood abnormalities in cats. Therefore, the results of this test play a significant role in ensuring cat owners are more aware and vigilant about the effects of abnormal blood results and in deciding on further action to improve their cat's health. This program also helps veterinarians provide education and advice to cat owners so they can pay more attention to their cat's health through various stages of prevention and treatment, so that diseases can be detected early, are not fatal, and improve cat health.

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INTRODUCTION

Blood functions as a medium of communication between cells throughout the body, making it an important component for living things. Blood has various purposes, including the transport of hormones and blood clotting materials, the transport of oxygen from the tissues to the lungs for excretion, and the delivery of nutrients from the intestines to the tissues and further delivery of metabolic waste through secretory organs such as glands. Blood is a liquid consisting of two parts, namely blood plasma and corpuscles. The corpuscles consist of erythrocytes, leukocytes and platelets (Aridya et al, 2023). Erythrocytes and platelets are important components of blood circulation. Just like humans, these components play an important role for animals, and if there is an abnormality in the value, either higher or lower than normal, it can affect the circulation and can be an early warning of systemic disease or other disorders. Erythrocytes are the blood

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cells with the largest number in the body, where their main benefit is as a place for food metabolism so that they can produce energy and transport oxygen and carbon dioxide (Mahmood & Mansor, 2012). Platelets are a part of the blood that play an important role when the skin is injured, blood vessels are damaged and leak, causing blood to leak out of the vessels and bleeding occurs (Lobang et al, 2020). Platelets play an important role in hemostasis function; their main function is to form a normal hemostatic response plug when vascular injury occurs, which can cause spontaneous blood leakage through small vessels. In addition, the main functions of platelets are 3, namely adhesion, aggregation, and release reactions (Hoffbrand, 2026). Erythrocytes and platelets can be determined through laboratory examinations.

Through laboratory examinations, it is an examination procedure as a supporting diagnosis and to assess the prognosis of the disease (Mus et al, 2020). Laboratory examinations, as an initial and suitable use, are through hematology tests. Hematology tests are examinations carried out to analyze the materials and blood values. This hematology test is one of the supporting diagnoses to assess the severity and predict the risk of a disease (Bararah et al, 2017). If there is an abnormality in the value of erythrocytes and platelets, it is possible that there is a systemic disease that endangers the cat's health condition.

The problem that befalls the general public is the increased risk of hemodynamic disorders in cats due to cat owners' ignorance of the importance of erythrocyte and platelet components through hematology examinations. Lack of awareness among pet owners regarding the health status of their pets, resulting in diseases that have a poor prognosis, are too severe, and are treated too late (Desiandura et al, 2023). So, Early detection, such as regular blood tests, is important to do. Cat's owners often learn about hemodynamic disorders like anemia late because its early symptoms are subtle, non-specific, and easy to miss, especially since cats are adept at hiding illness and have a number of reasons for delayed detection (Marks, 2018). This affects the quality of life and health of cats, resulting in diseases that have a poor prognosis, are too severe, and require late treatment. Hematology examination or Complete Blood Count is a very cardinal test that provides a glance at the pathophysiological state of a subject in very quick, convenient, and economical way. Thus, this review aims at understanding different parameters of the Complete Blood Count (CBC) test in important farm and companion animals (Saxena & Srivastava, 2021) and erythrocytes (RBC) and thrombocytes (platelet) are components in hematology examination. Abnormalities of erythrocytes and thrombocyte counts are a known cause of hemodynamic disorders. Erythrocyte abnormalities significantly impact hemodynamics through several mechanisms like anemia (low RBC, low hematocrit and/ or low hemoglobin), polycythemia (high RBC count), rigidity, hemolysis, etc (Mozos, 2015). Thrombocyte abnormalities also make hemodynamic disorders. That is like thrombocytopenia, throcytosis, abnormal platelet function, etc Through the analysis of erythrocyte and platelet components, this Community Service program seeks to identify risk factors for hemodynamic disorders that impact the health of cats kept in Surabaya and its surroundings. Through the results of this examination, it is hoped that hemodynamic disorders or circulatory disorders that cause systemic diseases and impact the general condition of cats can be identified early. The results of erythrocyte and platelet components are obtained from cat blood samples.

Specialized hematology testing equipment is required for animals to ensure more accurate results. This program helps cat owners in Surabaya and the surrounding areas, allowing them to access screenings and receive up-to-date information on their cat's health. Specifically, this program helps veterinarians to be able to provide education and advice for cat owners so that they can pay more attention to their cat's health through various stages of preventive measures, so that the disease can be detected early, is not fatal and improves the health of cats.

MATERIALS AND METHODS

Materials

The main equipment of these community service activities is the Raito-vet® hematology analyzer. Other materials needed include 1ml and 3ml syringes, 0.5ml EDTA tubes, and tourniquets. Meanwhile, other equipment needed to assist in the physical examination, such as scales, a thermometer and a stethoscope.

Methods

The method used in this program is Participatory Action Research. The activity & action program is summarized in the following diagram (Fig. 1). The target of the program is the general public in Surabaya and its surrounding area, especially cat's owners. The community service program has a limited participant quota because this program is free of charge. It will be followed by 25 cats from 25 different cat owners from Surabaya and its surroundings, without looking at certain clinical symptoms. The cats came on schedule and were doing a basic medical check-up, like anamnesis and physical examination. A physical examination is carried out on the cat's entire body by means of inspection (looking), palpation (feeling), percussion

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(tapping), and auscultation (listening). Next, taking the blood samples from 25 cats for hematology examination. The blood test uses a special vet hematology tool, which is the Raito-Vet® hematology analyzer. Then, based on the blood test results, if abnormalities are found, follow-up will be conducted through a discussion and education session with the cat owner regarding the results and their impact on their pet's health. This will then be followed by an evaluation with therapy based on the discussion and education results.

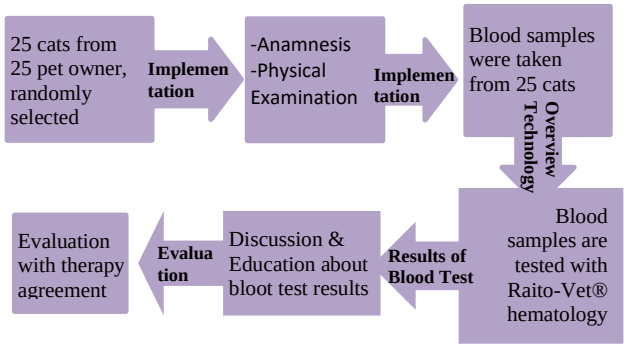

Fig. 1. Study flow

RESULTS AND DISCUSSION

Implementation

The technique in implementing this community service activity has several stages, including:

a. The strategic objectives of the program plan are expected to have a significant impact on how well community activities can run. The intended address is RSHP (Educational Animal Hospital) WEKA. Cat owners in the Surabaya area and its surroundings have made reservations.
b. Educate the public, especially animal owners, from the samples taken, regarding early knowledge of hemodynamic disorders that cause systemic diseases and impact the general condition of cats.
c. The service program will involve 25 cat owners, who are selected randomly, without looking at certain symptoms.
d. Before a physical examination is carried out, an anamnesis is carried out by asking questions to pet owners about the behavior of their pet cats, vaccination history, and any abnormalities that occur while their cats are at home. Ten minutes of discussion or question and answer period for each patient.
e. Next, continue with hematology tests by taking blood samples from cats with the owner's permission (Fig. 2).
f. Evaluation of the implementation of the program from the hematology results with animal owners through discussion & consultation sessions to explain the abnormalities of the erythrocyte and platelet components that refer to the possibility of a certain systemic disease in the animals they keep. It also allows for further laboratory tests to be carried out for the right diagnosis.

Fig. 2. Anamnesis and physical examination of the cat

g. Further assessments are carried out with discussions on solutions regarding handling related to blood results and diagnoses of the animal's disease. Furthermore, further education is carried out for cat owners whose cats experience abnormalities in erythrocyte and platelet components, so that they can be more patient and disciplined in handling/treating them. In addition, being more concerned about systemic diseases that attack cats through easy and familiar examinations, as well as prevention techniques, so that the disease can be detected earlier and can improve the health of the cats.

Overview of Science and Technology

The overview of science and technology provided in this community service is in the form of a direct application of knowledge about Risk Factors for Hemodynamic Disorders in Cats in Surabaya and Surrounding Areas Through Analysis of Erythrocyte and Platelet Components. Analysis of erythrocyte and platelet components is obtained from the results of hematology test technology specifically for animals with Raito-vet® (Fig. 3). By using this tool, in just a few minutes, we can get the results quickly and accurately with a small volume of blood sample needed. Based on these results, it can further help partners and us as veterinarians to be able to improve public education and knowledge regarding cat care that affects the health of cats and the prevention of systemic diseases. In addition, it can reduce the risk factors for hemodynamic disorders, it affects the health and standard of living of animals

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through proper care and maintenance of cats in everyday life.

Fig. 3. Blood test with Raito-vet® hematology analyzer

Results of the Blood Test

The results of blood tests it show that all cat blood samples examined experienced erythrocyte and platelet abnormalities (Table 1). All 25 cat samples experienced anemia (100%). This is evident from the low erythrocyte (RBC) and hematocrit (HCT) values below normal. The normal range in cats for erythrocytes (RBC) is 4.6-10 (10 * 12 / L) and for hematocrit (HCT) is 28-49%. In this case, the average cat experiences low RBC and HCT count, but gets the normal to high Hb count. Anemia is a condition characterized by a low red blood cell (RBC) count, low hematocrit, and/or low hemoglobin (Turner *et al*, 2023), and can reduce the blood's oxygen-carrying capacity. Basically, anemia is a common symptom due to pathological conditions in the body. Anemia can be in the form of a decrease in the number of erythrocytes (RBC), abnormal hemoglobin concentration (Hb) or a decrease in hematocrit volume (HCT). The 3 components, namely RBC, Hb, and HCT, are important components for analyzing the occurrence of anemia, and the three components are related and continuous with each other. In accordance with the statement (Turner et al, 2023), anemia is a reduction in hemoglobin, hematocrit, or erythrocytes, and this condition is divided into 3, namely macrocytic, microcytic and normocytic. Common signs of anemia include pale mucous membranes due to reduced blood volume, hemoglobin and vasoconstriction (Bijanti et al, 2010; Wuhan, 2019).

There are various factors that cause anemia in cats. These causes can occur due to parasitic infestation or due to other systemic diseases in internal organs that affect hemodynamic balance, such as liver disorders, kidney failure, GIT, bone marrow disorders, tumors or injuries to certain organs. An example of anemia due to parasitic infestation is in the case of Haemobartonellosis. Haemobartonellosis is a disease caused by Haemobartonella felis or Mycoplasma haemofelis, which attacks erythrocytes and the flea Ctenocephalides felis as a vector for the transmission of haemobartonellosis. Hematology results show that the cat is in a normochromic normocytic anemia condition (Satriawan & Octaviani, 2021). Another case showed that both cats with renal erlichiosis had non-regenerative anemia with clinical symptoms of anorexia and pale mucosa. In addition to blood parasites, indications of kidney failure were also seen based on blood chemistry results showing increased BUN and creatinine and abnormal kidney images on USG results (Kurnia et al, 2020).

Table 1. Blood test results

*Based on the results and reference values of the Raito-vet® hematology analyzer

No.	Cat's Name	ITEM – NORMAL VALUE - UNIT RBC 4.6-10 (10*12/L)	Hb 9.3-15.3 g/dL	HCT 28-49 %	PLT 100-514 10*9/L
1	Tole	1.49	8	7.3	583
2	Bardy	2.23	15	12	739
3	White	3.48	56	18.6	537
4	Snowi	2.89	42	15.7	614
5	Miki	3.49	52	19.9	528
6	Cilik	3.25	82	18.2	181
7	Temon	3.55	67	18.2	559
8	Mici	3.01	51	16.5	597
9	Tape	2.33	22	11.9	748
10	Jono	2.87	31	18.3	466
11	Sekawan	2.71	50	15.5	637
12	Chicky	2.92	46	14.5	529
13	Uli	2.2	15	11.8	559
14	Tejo	2.85	30	15	517
15	Buwarung	2.22	28	13.7	422
16	Cimong	2.06	26	11.9	565
17	Mimi	1.86	27	10.4	897
18	Sajat	3.03	55	17.1	768
19	Melook	3.15	40	15.7	742
20	Cooky	2.25	52	12.2	770
21	Joni	2.99	66	17.5	537
22	Rachma	2.07	30	11.1	607
23	Lea	2.64	39	14.1	318
24	Jeny	3.24	82	18.7	116
25	Kiki	1.85	23	7.2	187

***High** ***Low**

BUN (Blood Urea Nitrogen) and creatinine are components of the end products of metabolism that we can get from the results of blood chemistry tests used to assess kidney function. Blood Urea Nitrogen (BUN) is an indicator of reduced kidney excretory function because 85% of urea, which is the end

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product of protein metabolism and the urea cycle, must be excreted through urine. Meanwhile, serum creatinine, which is the end product of creatine and creatine phosphate catabolism, is often used as an examination of glomerular filtration function and an indicator of the estimated Glomerular Filtration Rate (GFR) (Gounden et al, 2024; Kusuma et al, 2023). The results of the study (Adawiyah, 2024) explained that cases of CKD (Chronic Kidney Disease) with anemia complications often occur, and the prevalence reaches 13.6% as one of the causes of death in domestic cats. The results of the study of 100 domestic cats showed that 46 cats had low erythrocyte counts, with a group of abnormal BUN and creatinine conditions of 14 (14%). In addition, from the analysis of simple linear regression tests and correlation tests between erythrocytes and BUN showed a significant negative relationship, where when erythrocytes decreased, the BUN value would increase. The two studies above indicate that anemia is associated with systemic diseases of internal organs, such as kidney failure. There are other cases involving other organs, such as the digestive tract, which can cause anemia in cats. Iron and cobalamin (vitamin B12) deficiencies as a result of chronic gastrointestinal disease can cause anemia and increased morbidity of chronic enteropathy in cats (Hunt & Jugan, 2020).

In this result, it was also obtained from 25 samples that there were 23 blood samples with hemoglobin abnormalities, 1 low, and 22 other samples were higher than normal. The normal hemoglobin (Hb) value in cats is 9.3-15.3 g/dL. Even though the results obtained showed only one was low and the average hemoglobin was high, the average red blood cell (RBC) and hematocrit (HCT) values were low, which indicates anemia (Turner et al, 2023). Low hemoglobin values can occur due to factors that have been discussed previously, following low erythrocytes and hematocrit. Meanwhile, high hemoglobin needs attention too, because high hemoglobin can indicate metabolic disorders and also increase the risk of heart disease (Tapio et al, 2021). High hemoglobin in cats or other animals is not widely discussed, but several studies explain that stress can affect hemoglobin values in the blood (Stankiewicz, 2014).

19 samples had thrombocytosis (76%). Thrombocytosis is a condition with a high or excessive number of platelets (PLT), which can be caused by various factors such as iron deficiency, infection, inflammation, and even malignancy (Altomare & Kessler, 2019). The normal platelet value in cats is 100 – 514 10*9/L. The study results stated that there were 51 cats experiencing thrombocytosis, and no relationship was found between thrombocytosis and the patient's gender or breed. Thrombocytosis patients were most commonly found in patients with gastrointestinal disorders, and secondly in patients with endocrine disorders. In addition, cases of thrombocytosis are also often associated with inflammatory and infectious conditions (Rizzo et al, 2007). Extreme thrombocytosis can occur in young cats, too, 7 7-month-old with platelet values 3.448 x 109/L. The cat had clinical symptoms of fever, gingivitis and oral ulceration. It was diagnosed as positive for feline panleukopenia virus (FPV) and feline calicivirus (FCV) (Hooijberg, 2011).

Table 2. Solution of dedication

Problem	Solution	Output
Ignorance and a lack of understanding of the importance of blood tests to reduce the risk factors for hemodynamic disorders in cat health.	Increasing public knowledge about the importance of blood components in the form of erythrocytes and platelets, which also have the same influence on cat health, just as in humans, through personal education during hematology examination results discussion sessions.	Improving awareness and knowledge of pet owners, especially cat's owners (100% cat's owner in this program have received education)
The high-risk factors for hemodynamic disorders affect the health and standard of living of animals.	Increasing public education regarding cat care which affects the health of cats and the prevention of dangerous systemic diseases through a blood test	Decreased risk factors for hemodynamic disorders (Decrease the risk because of early treatment after abnormal results are known)
Public ignorance& lack of information that there is an Animal Hospital in Surabaya with complete facilities, that is the Weka Animal Hospital (RSHP Weka)	Introducing Weka Animal Hospital as a collaborative partner in this community service program and publicizing this activity in various platforms, such as print/online media articles, social media, etc.	electronic media articles https://www.suaranasional.id/2024/07/kolaborasi-fkh-uwks-rshp-weka-edukasi-risiko-gangguan-hemodinamik-dan-cek-darah-gratis-pada-kucing.html

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Evaluation

Evaluation of the implementation of the program from the results of hematology examinations, focusing on the components of erythrocyte and platelet results. Then, discussed with the animal owner through good communication with consultation techniques to determine the risk factors for hemodynamic disorders in the animal, so that it affects the general condition of the cat and allows early detection of systemic diseases in the animal. In addition, discussions were held on solutions regarding further actions and handling related to the results and conditions of the animal. Next, additional education will be provided to pet owners to help them understand that hemodynamic problems in cats should not be ignored, just like in humans. Continuous care and monitoring are needed to prevent and minimize the dangers of systemic diseases that attack cats.

As an evaluation in this program, the program will explain in detail to the pet owner regarding the condition of his cat based on the blood results. In addition, we can provide deeper education regarding treatment and various possibilities. In certain conditions, with the consent of the pet owner, it is possible to have other supporting diagnoses and provide treatment to be able to return to normal and stable conditions, so as to prevent hemodynamic disorders and improve the health of the cat. So, from this community service activity, there are points of achievement, problem-solving, and benefits that arise both for the general public, especially cat owners, and for partners who contribute. It's explained in Table 2.

CONCLUSION

Almost all cats participating in this program had abnormal erythrocyte and platelet counts. This indicates that these cats were experiencing hemodynamic disturbances without significant symptoms. Of the 25 cats, 19 had thrombocytosis (76%), and all cats had anemia (100%), with erythrocyte and hematocrit values below normal. Through this program, all cat owners have been educated and are aware of the current conditions related to hemodynamic disturbances through the hematology results of their pet cats. In addition, owners can also determine the following steps to improve the health and quality of life of their cats. Therefore, it can be concluded that this community service program runs well and efficiently, because the achievements and benefits of this program have been implemented well. This community service program still has shortcomings, such as the limited quota of cats that can participate in the program, resulting in only a few cats around Surabaya due to limited internal funding. It is hoped that this program will be able to obtain an external grant so that this community service program can be sustainable and developed, so that the benefits felt by the community of cat owners are also wider.

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REFERENCES

Adawiyah, S. (2024). Korelasi Jumlah Eritrosit terhadap Parameter BUN dan Kreatinin pada Kucing Domestik (*Felis domesticus*) di Wilayah DKI Jakarta. *Skripsi*. Jakarta: Fakultas Biologi dan Pertanian. Universitas Nasional. https://repository.unas.ac.id/id/eprint/10148/

Altomare, I., & Kessler, C. M. (2019). Thrombocytosis. In C. S. Kitchens, C. M. Kessler, B. A. Konkle, M. B. Streiff, & D. A. B. T.-C. H. and T. (Fourth E. Garcia (Eds.), *Consultative Hemostasis and Thrombosis* (pp. 346–373). Elsevier. https://doi.org/10.1016/B978-0-323-46202-0.00019-4

Aridya, N. D., & Yuniarti, E. (2023). The Differences Erythrocyte and Hemoglobin Levels of Biology Students and Sports Students Universitas Negeri Padang. *Jurnal Serambi Biologi*, *8*(1), 38-43.. https://serambibiologi.ppj.unp.ac.id/index.php/srmb/article/view/167

Bararah, A. S., Ernawati, D. A., & Andreswari, D. (2017). Implementasi Case Based Reasoning untuk diagnosa penyakit berdasarkan gejala klinis dan hasil pemeriksaan hematologi dengan probabilitas Bayes (Studi Kasus: RSUD Rejang Lebong). *Jurnal Rekursif*, *5*(1), 2303-0755. https://ejournal.unib.ac.id/index.php/rekursif/article/view/1074

Bijanti. R., Gandul, A.Y., & Retno, S.W. (2010). *Buku Ajar Patologi Klinik Veteriner*. Surabaya: Universitas Airlangga. https://repository.unair.ac.id/131761/1/Buku%20Ajar%20Patologi%20Klinik%20Veteriner%20Hematologi.pdf

Desiandura, K., Rahmawati, I., & Solfaine, R. (2023). Status Kesehatan Kucing Peliharaan di Masyarakat Melalui Pemeriksaan Calicivirus dan Uji Hematologi Pada Kucing Di Surabaya. *Martabe: Jurnal Pengabdian Kepada Masyarakat*, 6(10), 3620-3628. https://jurnal.um-tapsel.ac.id/index.php/martabe/article/view/13017

Gounden, V., Bhatt, H., & Jialal, I. (2024). *Renal Function Tests*. Treasure Island (FL): StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK507821/

Hoffbrand, A. (2016). *Kapita Selekta Hematologi*. Jakarta: Penerbit Buku Kedokteran EGC. https://www.egcmedbooks.com/buku/detail/2332/kapita-selekta-hematologi-edisi-7

Hunt, A., & Jugan, M. C. (2021). Anemia, iron deficiency, and cobalamin deficiency in cats with chronic gastrointestinal disease. *Journal of veterinary internal medicine*, *35*(1), 172-178. https://doi.org/10.1111/jvim.15962

Hooijberg, E., Leidinger, E., Kirtz, G., & Pichler, M. (2011). Extreme thrombocytosis in a young cat. *Comparative clinical pathology*, *20*(6), 579-584. https://doi.org/10.1007/s00580-010-1036-z

Kurnia, K., Anggoro, D., Budhi, S., & Priyowidodo, D. (2020). Perawatan Ehrlichiosis pada kucing yang mengalami anemia dan indikasi gagal ginjal. *ARSHI Veterinary Letters*, *4*(2), 23-24. http://dx.doi.org/10.29244/avl.4.2.23-24

Kusuma, I. F., Masita, N. F. I. R., & Adji, N. K. (2023). Differences of BUN and Serum Creatinine Values in Severity of Diabetic Ketoacidosis Patients at RSD dr. Seobandi Jember. *Journal of Agromedicine and Medical Sciences*, 9(2), 110-115. https://doi.org/10.19184/ams.v9i2.33947

Mahmood, N. H., & Mansor, M. A. (2012). Red blood cells estimation using Hough transform technique. *Signal & Image Processing*, *3*(2), 53-64. http://dx.doi.org/10.5121/sipij.2012.3204

Marks, S.L. (2018). *Anemia in Cats*. MSD Manual Veterinary Manual. https://www.msdvetmanual.com/cat-owners/blood-disorders-of-cats/anemia-in-cats

Mozos, I. (2015). Mechanisms linking red blood cell disorders and cardiovascular diseases. *BioMed research international*, *2015*(1), 682054. https://doi.org/10.1155/2015/682054

Mus, R., Thaslifa, T., Abbas, M., & Sunaidi, Y. (2021). Studi literatur: Tinjauan pemeriksaan laboratorium pada pasien COVID-19. *Jurnal Kesehatan Vokasional*, *5*(4), 242-252. https://doi.org/10.22146/jkesvo.58741

Lobang, E. W. N., Putri, I.M., Hanafi, Z., & Widhiyastuti, E. (2020). Review: Potensi Daun Pepaya (*Carica papaya L.*) dan Propolis terhadap Peningkatan Trombosit. *Jurnal Ilmu Keperawatan*, 13(2), 1–9. https://jurnal.usahidsolo.ac.id/index.php/JIKI/article/view/647

Rizzo, F., Tappin, S. W., & Tasker, S. (2007). Thrombocytosis in cats: a retrospective study of 51 cases (2000–2005). *Journal of Feline Medicine & Surgery*, *9*(4), 319-325. https://doi.org/10.1016/j.jfms.2007.01.008

Satriawan, I., & Octaviani, D.I.D.A. (2021). Haemobartonellosis in a Domestic Cat in Indonesia: a Case Study. *Veterinary Biomedical and Clinical Journal,* 3(2), 23-26. https://doi.org/10.21776/10.21776/ub.VetBioClinJ.2021.003.02.3

Saxena, H., & Srivastava, S. (2021). Review on Complete Blood Count Parameters of Animals-A Formidable Aid in Veterinary Disease Diagnosis. *Acta Scientific Veterinary Sciences*, *3*(10), 80 – 96. https://actascientific.com/ASVS/ASVS-03-0229.php

Stankiewicz, A.M., Goscik, J., Swiergiel, A.H., Majewska, A., Wieczorek, M., Juszczak, G.R., & Lisowski. P. (2014). Social Stress Increases Expression of Hemoglobin Genes in Mouse Prefrontal Cortex. *BMC Neurosci*, 4(15), 130. https://doi.org/10.1186%2Fs12868-014-0130-6

Tapio, J., Vähänikkilä, H., Kesäniemi, Y.A., Ukkola, O., & Koivunen, P. (2021). Higher hemoglobin levels are an independent risk factor for adverse metabolism and higher mortality in a 20-year follow-up. *Scientific Reports,* 11, 19936. https://doi.org/10.1038/s41598-021-99217-9

Turner, J., Parsi, M., & Badireddy, M. (2023). *Anemia*. Treasure Island (FL): StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK499994/

Wuhan, Y.O.P. (2019). Diagnosa Klinis, Hematologi, Molekuler Ehrlichiosis dan Karakterisasi Gen gltа *Ehrlichia canis* pada Pasien Anjing di Yogyakarta. *Thesis*. Yogyakarta: Fakultas Kedokteran Hewan. Universitas Gadjah Mada. https://etd.repository.ugm.ac.id/penelitian/detail/170773