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Description of Erythrocyte Index Values in Chronic Kidney Disease Patients at Bendan Hospital, Pekalongan City

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ABSTRACT

Background & Objective: Chronic Kidney Disease (CKD) is a condition characterized by the gradual and permanent decline of kidney function, which can lead to various complications, including anemia. Anemia in CKD patients is generally caused by reduced production of the hormone erythropoietin, iron deficiency, and the shortened lifespan of red blood cells due to the hemodialysis process. Erythrocyte index parameters, such as MCV, MCH, and MCHC, play a crucial role in determining the type of anemia in CKD patients. **Method:** This study used a descriptive design with a quantitative approach. The sample consisted of 30 CKD patients undergoing hemodialysis, selected using total sampling technique. Erythrocyte indices were examined automatically using a hematology analyzer. The data were analyzed and presented in the form of a frequency distribution table. **Result:** The examination results showed that the most dominant type of anemia was normochromic normocytic anemia (47%), followed by hypochromic microcytic anemia (37%), normochromic microcytic anemia (10%), and hypochromic normocytic anemia (6%). The average patient hemoglobin level was 8.4 g/dL and the average erythrocyte count was 2.7 million/µL **Conclusion:** The majority of CKD patients at Bendan Hospital, Pekalongan City, experience normochromic normocytic anemia. This finding highlights the importance of regular monitoring of erythrocyte indices to support the diagnosis and management of anemia in CKD patients.

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Introduction

Chronic Kidney Disease (CKD) is a systemic disease characterized by a progressive and significant decline in kidney function. This condition impairs the body's ability to maintain normal metabolism, fluid balance, and electrolyte balance. If not treated promptly, impaired kidney function risks worsening renal damage, which can ultimately lead to death (Irawati et al., 2023). Furthermore, CKD can also cause complications such as hyperkalemia, hypertension, hyperuremia, and anemia (Utami et al., 2020).

One of the most common and significant complications in CKD patients is anemia. In this condition, anemia is primarily caused by reduced production of the hormone erythropoietin by the kidneys, iron deficiency, and the shortened lifespan of erythrocytes, especially in patients undergoing hemodialysis. Decreased hemoglobin levels and erythrocyte count are the primary indicators of anemia, which can be further characterized by examining erythrocyte indices such as Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), and Mean Corpuscular Hemoglobin Concentration (MCHC). These parameters are used to determine the type of anemia, such as normochromic normocytic anemia, hypochromic microcytic anemia, or other forms related to erythropoietic impairment in CKD patients (Yuniarti et al., 2021).

According to World Health Organization (WHO) data, the global prevalence of CKD continues to rise, with over 500 million cases and a mortality rate reaching 850,000 per year. In Indonesia, the 2018 Riskesdas report recorded a CKD prevalence of 0.38%, which is estimated to keep increasing with the aging population (Agustiana, 2023). At Bendan Hospital in Pekalongan City, there was a surge in CKD cases from 362 in 2022 to 657 in 2023, highlighting the urgency to understand the clinical and hematological characteristics of these patients more deeply.

Based on this background, this study aims to describe the erythrocyte index values in CKD patients at Bendan Hospital, Pekalongan City. Understanding these hematological values is expected to contribute to the management of anemia in CKD and serve as a basis for determining appropriate therapy to improve patient prognosis.

Objective

The objective of this research is to determine the description of erythrocyte index values in patients with chronic kidney disease at Bendan Hospital, Pekalongan City.

Method

This study utilized a descriptive qualitative research design aimed at understanding the profile of erythrocyte indices in chronic kidney disease patients at Bendan Hospital, Pekalongan City. The study involved 30 participants selected through total sampling based on specific criteria.

The inclusion criteria were: a) willingness to participate as a respondent; b) diagnosed with Chronic Kidney Disease by a physician; and c) undergoing hemodialysis. The exclusion criteria included: a) withdrawal from the study; b) no longer receiving hemodialysis; and c) not present during sample collection. The research was conducted from January to June 2025 at Bendan Hospital, Pekalongan City. Erythrocyte indices were examined using an automated Hematology Analyzer. Data collection involved both primary and secondary sources: primary data from erythrocyte index examinations and secondary data from the medical records of CKD

patients. The collected data were processed and presented descriptively in tables and narrative form.

Results

The research findings on the profile of erythrocyte index values in chronic kidney disease patients at Bendan Hospital, Pekalongan are as follows:

TABLE 1. Results of Erythrocyte Index Examination in Chronic Kidney Disease Patients at Bendan Hospital, Pekalongan City

Type of Anemia	Number of Patients	%
Normochromic Normocytic	14	47%
Hypochromic Microcytic	11	37%
Normochromic Microcytic	3	10%
Hypochromic Normocytic	2	6%

Based on Table 1, the results of the erythrocyte index examination in chronic kidney disease patients at Bendan Hospital, Pekalongan City, showed the following findings: normochromic normocytic (erythrocytes of normal size and color) in 14 samples (47%), hypochromic microcytic (small and pale-colored erythrocytes) in 11 samples (37%), normochromic microcytic (small but normally colored erythrocytes) in 3 samples (10%), and hypochromic normocytic (normal-sized but pale-colored erythrocytes) in 2 samples (6%).

Discussion

The erythrocyte index examination revealed that patients with normochromic normocytic anemia accounted for 14 samples (47%), hypochromic microcytic anemia for 11 samples (37%), normochromic microcytic anemia for 3 samples (10%), and hypochromic normocytic anemia for 2 samples (6%). Based on these results, the most common type of anemia among the patients was normochromic normocytic anemia. This finding aligns with research conducted by Dhanny (2020), which reported that normochromic normocytic anemia occurred in 24 out of 30 samples (80%) of chronic kidney disease patients.

Normocytic normochromic anemia in chronic kidney disease patients is caused by impaired kidney function, leading to reduced production of the hormone erythropoietin (EPO). Erythropoietin plays a crucial role in stimulating bone marrow to produce red blood cells. A deficiency in this hormone results in decreased erythrocyte production, leading to anemia characterized by normocytic normochromic features. In addition to erythropoietin deficiency, other factors such as iron deficiency, accumulation of uremic toxins, and blood loss during dialysis also contribute to anemia in these patients.

Hypochromic microcytic anemia occurs due to decreased erythropoietin production and impaired iron metabolism in chronic kidney disease patients. Reduced erythropoietin production leads to decreased red blood cell formation and a decline in hematocrit levels. Furthermore, chronic kidney disease is associated with iron deficiency caused by an imbalance in iron release from storage due to increased hepcidin levels, a hormone that inhibits iron absorption and release into the plasma. This condition results in insufficient iron availability for hemoglobin synthesis,

leading to the formation of smaller (microcytic) and paler (hypochromic) red blood cells.

Chronic kidney disease patients generally experience a significant decrease in hemoglobin levels, with average Hb levels ranging between 8–10 g/dL. This condition is caused by reduced erythropoietin production due to kidney damage, which subsequently triggers anemia as one of the main complications of chronic kidney disease.

As observed in previous studies, most chronic kidney disease patients show erythrocyte index values within normal limits, such as stable MCV, MCH, and MCHC levels, despite a decrease in erythrocyte count due to the frequent occurrence of anemia in chronic kidney disease. This anemia is caused by reduced erythropoietin production by the damaged kidneys, resulting in the bone marrow producing fewer erythrocytes. The decrease in erythrocyte count can also be attributed to erythrocyte rupture during hemodialysis, which is influenced by mechanical and chemical factors. During hemodialysis, the patient's blood is circulated through a dialysis machine that uses membranes and pumps, which can cause physical damage to erythrocytes due to mechanical pressure, friction, and turbulent blood flow. Additionally, exposure of blood to foreign materials in the dialysis machine and intoxication by substances such as aluminum can shorten the lifespan of erythrocytes. This hemolysis contributes to the decrease in erythrocyte count after hemodialysis, worsening the pre-existing anemia in chronic kidney disease patients.

Conclusion

Based on the examination of erythrocyte index values in chronic kidney disease patients at Bendan Hospital, Pekalongan City, it can be concluded that chronic kidney disease patients have normal erythrocyte index values but experience anemia. The most common type of anemia observed in this study was normochromic normocytic anemia, affecting 14 patients (47%).

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