AAMS Internal Medicine & Therapeutics
ISSN: 2834-7102 (Print) | eISSN: 2834-7103 (Online)
Volume 07, Issue 03, Pages 106-120
DOI: 10.4103/aams.0498
ORIGINAL ARTICLE

Comparative Analysis of Red Blood Parameters in Vegetarians and People with a Mixed Diet

Shukurova Dilorom Baxodirovna[1]; Djalolova Shahnoza Amonovna[2];

Department of Physiology, assistant, Samarkand State Medical University[1]; Head teacher of Public Health College named after Siyab Abu Ali ibn Sina[2];

Received: 2026-02-02 · Accepted: 2026-03-30

Abstract

Dietary patterns significantly influence hematological status, particularly parameters related to red blood cells that reflect oxygen transport capacity and overall metabolic health. This study provides an expanded comparative evaluation of erythrocyte indices in individuals adhering to vegetarian diets versus those consuming mixed diets including animal products. Emphasis is placed on hemoglobin concentration, hematocrit levels, red blood cell count, mean corpuscular volume, and iron-related biomarkers. The findings indicate that while vegetarian diets can support adequate hematological status when properly balanced, differences in micronutrient intake—especially iron, vitamin B12, and folate—may affect specific blood parameters. The analysis highlights the importance of dietary planning and monitoring to prevent subclinical deficiencies and maintain optimal physiological function. Dietary patterns exert a direct influence on hematological health, particularly on erythrocyte-related indicators that reflect oxygen transport efficiency and metabolic balance. This expanded overview examines variations in red blood indices among individuals adhering to plant-based nutrition compared to those consuming diets inclusive of animal-derived products. Special attention is given to hemoglobin concentration, erythrocyte count, hematocrit, and indices such as mean corpuscular volume and hemoglobin content. Evidence demonstrates that although plant-based nutrition can sustain adequate hematological function, differences in micronutrient intake—especially iron and cobalamin—may lead to subtle shifts in laboratory values. The findings emphasize the importance of balanced nutrient intake and regular monitoring to ensure physiological stability and prevent latent deficiencies.

Keywords: vegetarian diet, mixed diet, red blood cells, hemoglobin, hematocrit, iron deficiency, vitamin B12, erythrocyte indices, nutrition, hematology

1. Introduction

Nutritional habits play a central role in maintaining normal hematopoiesis and ensuring efficient oxygen delivery throughout the body. Red blood cell parameters serve as key indicators of nutritional status, particularly reflecting the availability of essential micronutrients required for erythropoiesis. Vegetarian diets, which exclude some or all animal-derived products, have gained popularity due to their potential health and environmental benefits. However, such diets may present challenges in obtaining adequate levels of bioavailable iron and vitamin B12, both of which are crucial for red blood cell production. In contrast, mixed diets typically provide a broader range of nutrients, including heme

iron, which is more readily absorbed. Despite these differences, well-planned vegetarian diets can meet physiological requirements if appropriate food combinations or supplementation strategies are employed. Understanding how these dietary patterns influence hematological parameters is essential for evaluating their long-term health implications and guiding nutritional recommendations.
Nutritional composition plays a fundamental role in the regulation of hematopoiesis and the maintenance of systemic oxygen delivery. Erythrocyte parameters serve as sensitive indicators of nutritional sufficiency, particularly reflecting the availability of essential elements required for red cell synthesis. Diets excluding animal products are increasingly adopted due to their potential health benefits and environmental considerations. However, such nutritional patterns may present challenges related to the intake and bioavailability of key micronutrients, notably iron in its highly absorbable form and vitamin B12, which is primarily found in animal-derived sources. In contrast, diets incorporating both plant and animal products typically provide a wider spectrum of readily accessible nutrients. Understanding how these differing dietary approaches influence hematological markers is critical for evaluating their physiological impact and guiding evidence-based dietary recommendations.

2. Materials and Methods

This study utilized a comparative observational design involving two groups of adult participants: individuals following a vegetarian diet for at least two years and individuals consuming a mixed diet. Blood samples were collected under standardized conditions and analyzed using automated hematology analyzers to determine red blood cell count, hemoglobin concentration, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin, and red cell distribution width. Serum ferritin, transferrin saturation, and vitamin B12 levels were also assessed to evaluate iron status and micronutrient availability. Statistical analysis was conducted to identify significant differences between groups, using appropriate parametric and non-parametric tests. Dietary intake was evaluated through structured questionnaires to assess nutrient consumption patterns and correlate them with laboratory findings. This study was designed as a comparative, cross-sectional clinical investigation aimed at evaluating differences in red blood parameters between individuals adhering to a vegetarian diet and those consuming a mixed (omnivorous) diet. The research was conducted over a period of 6–12 months in collaboration with a clinical laboratory and a preventive medicine department. A total of 120–180 participants aged 18–50 years were enrolled and divided into two groups based on dietary patterns: long-term vegetarians (2 years of adherence) and individuals consuming a balanced mixed diet including both plant- and animal-based foods.
Participants were selected according to predefined inclusion criteria, including apparently healthy individuals without chronic systemic diseases, no recent infections, and no history of hematological disorders. Additional inclusion criteria required stable dietary habits for at least two years. Exclusion criteria included pregnancy, lactation, recent blood donation, use of vitamin or iron supplements within the past three months, chronic kidney or liver disease, and any condition known to affect hematopoiesis. A structured dietary questionnaire was used to confirm dietary patterns and assess nutrient intake, particularly iron, vitamin B12, folate, and protein consumption.
All participants underwent a comprehensive clinical assessment, including medical history, anthropometric measurements, and evaluation of general health status. Venous blood samples were collected under standardized conditions in the morning after an overnight fast to minimize physiological variability. Hematological analysis was performed using an automated hematology analyzer to determine key red blood parameters, including hemoglobin concentration, erythrocyte count, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration.
In addition to routine hematological indices, biochemical markers relevant to erythropoiesis were assessed. Serum ferritin levels were measured to evaluate iron stores, while serum iron, total iron-binding capacity, and transferrin saturation were analyzed to assess iron metabolism. Vitamin B12 and folate levels were determined using immunoassay techniques, given their critical role in red blood cell formation and maturation. In selected cases, peripheral blood smears were examined microscopically to identify morphological variations such as anisocytosis or poikilocytosis.
To enhance the accuracy of findings, participants were further stratified by sex and age subgroups, as well as duration and type of vegetarian diet (e.g., lacto-vegetarian, ovo-vegetarian, vegan). This allowed for a more detailed analysis of how dietary patterns influence hematological outcomes.

Lifestyle factors such as physical activity, smoking status, and alcohol consumption were also recorded and controlled for during statistical analysis.

Data were processed using statistical software, with quantitative variables expressed as mean ± standard deviation and categorical variables as percentages. Comparative analysis between the two groups was performed using independent t-tests or non-parametric equivalents depending on data distribution. Correlation analysis was used to examine relationships between dietary intake and hematological parameters, while multivariate regression analysis was conducted to identify independent predictors of red blood cell indices and potential risk factors for subclinical anemia.

The primary outcome measures included differences in hemoglobin levels, erythrocyte indices, and iron status between vegetarians and individuals with a mixed diet. Secondary outcomes focused on the prevalence of iron deficiency, vitamin B12 deficiency, and early hematological alterations associated with dietary patterns.

Ethical considerations were strictly observed throughout the study. The research protocol was approved by the institutional ethics committee, and informed consent was obtained from all participants prior to enrollment. All procedures were conducted in accordance with international standards for biomedical research, ensuring participant confidentiality, data protection, and scientific integrity.

3. Results

The analysis revealed that individuals following vegetarian diets exhibited slightly lower hemoglobin and hematocrit values compared to those consuming mixed diets, although most values remained within normal physiological ranges. Red blood cell counts were generally comparable between groups, indicating preserved erythropoietic function. However, vegetarians demonstrated higher mean corpuscular volume in some cases, potentially reflecting early vitamin B12 insufficiency. Iron-related parameters, including serum ferritin and transferrin saturation, were lower in the vegetarian group, suggesting reduced iron stores despite adequate intake in certain individuals. Participants with mixed diets showed more stable iron and vitamin B12 levels, likely due to the inclusion of animal-derived nutrients. Despite these differences, no severe anemia was observed in either group, indicating that both dietary patterns can sustain adequate hematological health under appropriate conditions. Comparative evaluation reveals that individuals following plant-based dietary regimens tend to exhibit slightly reduced hemoglobin levels and hematocrit values relative to those consuming mixed nutrition, although these parameters generally remain within normal limits. Erythrocyte counts show minimal variation between groups, indicating preserved red cell production capacity. Notable differences are observed in iron-related indicators, with lower ferritin concentrations suggesting diminished iron reserves among plant-based diet adherents. Additionally, certain individuals demonstrate increased mean corpuscular volume, which may reflect early alterations associated with suboptimal vitamin B12 status. Participants consuming mixed diets display more consistent values across measured parameters, likely due to greater availability of bioactive micronutrients. Despite these variations, clinically significant anemia is not prevalent, indicating that both dietary patterns can support adequate hematological function under appropriate nutritional conditions.

4. Discussion

The findings underscore the complex relationship between dietary composition and hematological parameters. While vegetarian diets may lead to lower iron stores due to reduced bioavailability of non-heme iron, adaptive physiological mechanisms such as increased absorption efficiency may help maintain normal red blood cell production. The observed variations in mean corpuscular volume highlight the importance of monitoring vitamin B12 status, as deficiency may develop gradually and remain clinically silent in early stages. Mixed diets provide a nutritional advantage in terms of readily available iron and vitamin B12, contributing to more stable hematological indices. However, excessive reliance on animal products may introduce other health risks, emphasizing the need for balanced dietary approaches. The results support the view that vegetarian diets can be nutritionally adequate when carefully planned, including the use of fortified foods or supplements where necessary. Continuous monitoring of blood parameters is recommended to detect and address potential deficiencies at an early stage. The observed differences highlight the intricate relationship between

dietary composition and hematological outcomes. Reduced iron stores in plant-based nutrition can be attributed to the lower bioavailability of non-heme iron and the presence of absorption inhibitors such as phytates. Nevertheless, adaptive physiological mechanisms, including enhanced intestinal absorption, may partially compensate for these limitations. Variations in erythrocyte indices underscore the importance of adequate vitamin B12 intake, as deficiency may develop gradually and remain asymptomatic in early stages. Mixed dietary patterns provide a more direct source of essential micronutrients, contributing to greater stability in hematological parameters. However, well-structured plant-based diets that incorporate fortified foods or supplementation can effectively mitigate potential deficiencies. These findings reinforce the necessity of individualized nutritional strategies and periodic laboratory assessment to maintain optimal health outcomes.

5. Conclusion

Dietary patterns exert a measurable impact on red blood cell parameters, with vegetarians showing modest differences in iron status and certain erythrocyte indices compared to individuals consuming mixed diets. Despite these variations, both groups can maintain normal hematological function when nutritional intake is properly managed. Ensuring sufficient intake of key micronutrients, particularly iron and vitamin B12, is essential for preventing deficiencies and supporting optimal health. Tailored dietary guidance and регуляр monitoring of blood parameters are crucial for individuals following restrictive diets to maintain long-term physiological balance. Differences in dietary patterns are associated with measurable variations in red blood cell parameters, particularly in relation to iron stores and vitamin B12 status. Despite these distinctions, both plant-based and mixed dietary approaches are capable of supporting normal hematological function when properly balanced. Ensuring adequate intake of critical micronutrients remains essential for preventing deficiencies and sustaining physiological equilibrium. Ongoing monitoring and targeted nutritional guidance play a crucial role in optimizing health outcomes across diverse dietary practices.

References

[1] Pawlak R, Berger J, Hines I. Iron status of vegetarian adults: a review. Am J Lifestyle Med. 2018;12(6):486–498.
[2] Craig WJ. Health effects of vegan diets. Am J Clin Nutr. 2009;89(5):1627S–1633S.
[3] Hunt JR. Bioavailability of iron, zinc, and other trace minerals from vegetarian diets. Am J Clin Nutr. 2003;78(3):633S–639S.
[4] Gibson RS, Heath AL. Population groups at risk of zinc deficiency. Food Nutr Bull. 2011;32(1):S15–S30.
[5] Allen LH. Causes of vitamin B12 deficiency. Food Nutr Bull. 2008;29(2):S20–S34.
[6] O'Leary F, Samman S. Vitamin B12 in health and disease. Nutrients. 2010;2(3):299–316.
[7] WHO. Haemoglobin concentrations for the diagnosis of anaemia. Geneva; 2011.
[8] Wintrobe MM. Clinical Hematology. 12th ed. Lippincott; 2009.
[9] Hoffbrand AV, Moss PAH. Essential Haematology. 7th ed. Wiley-Blackwell; 2016.
[10] McLean E, et al. Worldwide prevalence of anaemia. Public Health Nutr. 2009;12(4):444–454.
[11] Saunders AV, Craig WJ, Baines SK. Iron and vegetarian diets. Med J Aust. 2013;199(S4):S11–S16.
[12] Waldmann A, et al. Dietary intake and hematological status in vegans. Ann Nutr Metab. 2004;48(2):103–108.
[13] Elmadfa I, Singer I. Vitamin B12 and homocysteine status among vegetarians. Ann Nutr Metab. 2009;54(2):83–88.
[14] Haddad EH, et al. Dietary intake and biochemical markers in vegetarians. Am J Clin Nutr. 1999;70(3):586S–593S.
[15] Herrmann W, Geisel J. Vegetarian lifestyle and monitoring of vitamin B12 status. Clin Chim Acta. 2002;326(1-2):47–59.
[16] Larsson CL, Johansson GK. Dietary intake and nutritional status of young vegans. Am J Clin Nutr. 2002;76(1):100–106.
[17] Clarys P, et al. Comparison of nutritional quality of diets. Nutrients. 2014;6(3):1318–1332.
[18] Rizzo NS, et al. Nutrient profiles of vegetarian diets. Nutrients. 2013;5(5):1319–1330.
[19] Med1.uz. Qon tizimi va eritrotsitlar fiziologiyasi. Available from: https://med1.uz/articles/gematologiya/er itrotsitlar
[20] Med1.uz. Temir tanqisligi kamqonligi. Available from: https://med1.uz/articles/gematologiya/an

emiya
[21] Med1.uz. Vitamin B12 yetishmovchiligi. Available from: https://med1.uz/articles/gematologiya/vitamin-b12
[22] Med1.uz. Oziqlanish va sog‘liq. Available from: https://med1.uz/articles/dietologiya/ovq atlanish
[23] Med1.uz. Sog‘lom ovqatlanish tamoyillari. Available from: https://med1.uz/articles/dietologiya/soglom-ovqatlanish

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DOI: 10.4103/aams.0498