Western European Journal of Medicine and Medical Science
Volume 4, Issue 04, April, 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

BLOOD VISCOSITY AND ITS BIOPHYSICAL SIGNIFICANCE

Maxkamova Muxabbat Batirovna – Senior Lecturer, EMU University
Xakimova Nargiza Batirovna – Student, EMU University

Abstract

This article scientifically analyzes blood viscosity, its physical nature, its role in hemodynamic processes in the body, and its clinical significance. Blood viscosity is the property of blood to resist flow, and it directly affects the functioning of the cardiovascular system, microcirculation, oxygen supply to tissues, and metabolic processes. The article highlights the main factors influencing blood viscosity, including hematocrit level, plasma proteins, erythrocyte deformability, temperature, and pathological conditions. In addition, the physiological and pathophysiological consequences of increased or decreased blood viscosity are discussed.

Keywords: Blood, viscosity, biophysics, hematocrit, erythrocyte, rheology, hemodynamics, viscosity.

Introduction

Blood is a complex biological fluid that performs vital functions in the human body. It delivers oxygen, nutrients, hormones, enzymes, and other essential substances to cells and transports metabolic waste products to excretory organs. In addition, blood plays an important role in immune defense, thermoregulation, and maintenance of homeostasis.

The effective performance of these functions depends on the physical and chemical properties of blood. One of the most important indicators is blood viscosity. Viscosity is the resistance of a fluid to flow and determines the efficiency of the circulatory system. Changes in blood viscosity may disrupt cardiac workload, blood flow velocity, capillary exchange processes, and oxygen supply to tissues.

Today, the increasing prevalence of cardiovascular diseases, diabetes mellitus, hematological disorders, and metabolic syndrome requires a deeper study of blood rheological properties. Therefore, the study of blood viscosity and its biophysical significance is one of the urgent directions of modern medicine.

Materials and Methods

To prepare this article, local and foreign scientific sources in the fields of biophysics, physiology, pathophysiology, hematology, and clinical medicine were analyzed. The following methods were used during the study:

- analysis of scientific literature;
- comparative method;
- theoretical generalization;
- interpretation of physiological indicators;
- analysis of statistical data.

The factors affecting blood viscosity were systematized, and their effects on body functioning were scientifically explained.

Results

Concept of Blood Viscosity

Western European Journal of Medicine and Medical Science
Volume 4, Issue 04, April, 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

Blood viscosity is the resistance generated by internal friction forces during blood movement through vessels. Unlike ordinary fluids, blood is a multicomponent biological system consisting of plasma and formed elements. Therefore, blood is characterized as a non-Newtonian fluid.

This means that blood viscosity changes depending on flow velocity. When the flow velocity in vessels increases, blood viscosity decreases, while when flow slows down, viscosity increases.

Factors Affecting Blood Viscosity

1. Hematocrit Level

Hematocrit reflects the volumetric proportion of erythrocytes in blood. It is the most significant factor affecting blood viscosity.

- normal in men: 40–45%
- normal in women: 36–42%

When hematocrit increases, blood becomes thicker; when it decreases, blood becomes diluted.

2. Erythrocyte Deformability

Healthy erythrocytes are elastic and easily pass through narrow capillaries. When their shape is altered or membrane rigidity increases, blood flow becomes difficult.

3. Plasma Proteins

An increase in fibrinogen, globulins, and other large proteins leads to higher blood viscosity. This is especially observed during inflammatory processes.

4. Temperature

As with other fluids, blood viscosity increases when temperature decreases and decreases when temperature rises.

5. Pathological Conditions

Blood viscosity changes in the following diseases:

- anemia;
- polycythemia;
- diabetes mellitus;
- hypertension;
- heart failure;
- dehydration;
- inflammatory diseases.

Discussion

Blood viscosity affects all systems of the body. Its role is especially important in the cardiovascular system.

When Viscosity Increases:

- cardiac workload increases;
- arterial pressure rises;
- blood flow slows down;
- risk of thrombosis increases;
- risk of stroke and myocardial infarction rises.

For example, in polycythemia, the number of erythrocytes increases, causing blood to become excessively thick.

When Viscosity Decreases:

Western European Journal of Medicine and Medical Science
Volume 4, Issue 04, April, 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

- blood flows faster;
- however, oxygen-carrying capacity decreases;
- tissue hypoxia develops;
- weakness, dizziness, and fatigue occur.

This condition is commonly observed in anemia.

Importance in Microcirculation

Blood flow in capillaries is finely regulated. If blood becomes too thick, oxygen and nutrients are delivered to cells more slowly. As a result, kidney, brain, and heart function may be impaired.

Diagnostic Significance

Assessment of blood viscosity is important in the following fields:

- cardiology;
- hematology;
- intensive care;
- sports medicine;
- endocrinology.

For this purpose, viscometers, hematocrit values, hemoglobin levels, and plasma proteins are measured.

Conclusion

Blood viscosity is one of the important biophysical indicators of body functioning. It directly affects the work of the cardiovascular system, blood circulation velocity, oxygen supply to tissues, and overall homeostasis.

Increased blood viscosity raises the risk of thrombosis, hypertension, and heart disease. Decreased viscosity leads to anemia and hypoxia. Therefore, timely monitoring of blood viscosity is of great importance in early diagnosis and prevention of diseases.

Further study of blood rheology will contribute to the development of new diagnostic and treatment methods.

References

1. Bazarboyev M.I. Biophysics. Tashkent: O‘qituvchi, 2018.
2. Mullajonov I. Fundamentals of Medical Biophysics. Tashkent, 2020.
3. Rahimova X.J. Physiology of Biophysical Processes. Tashkent, 2019.
4. Azimov R.Q. Pathophysiology. Tashkent: Fan, 2017.
5. Guyton A.C., Hall J.E. Textbook of Medical Physiology. Moscow, 2021.
6. Ganong W.F. Medical Physiology. New York, 2020.
7. Baskurt O.K. Blood Rheology and Hemodynamics. London, 2019.
8. Chien S. Hemorheology in Clinical Practice. Boston, 2018.
9. Merrill E.W. Rheology of Human Blood. Chicago, 2017.
10. Hoffman R. Hematology Principles. Oxford, 2021.
11. Kumar V. Robbins Basic Pathology. Elsevier, 2020.
12. Tortora G.J. Human Anatomy and Physiology. Pearson, 2019.
13. WHO. Global Report on Anemia. Geneva, 2022.
14. WHO. Cardiovascular Risk Factors Review. Geneva, 2021.
15. Nichols W.W. Vascular Medicine. New York, 2018.