THE IMPACT OF ATMOSPHERIC PRESSURE ON CARDIOVASCULAR REACTIVITY

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Abstract: *The article provides information on the causes and effects of changes in the human cardiovascular system under the influence of atmospheric pressure.*

Keywords: *Hyperbaric environment, hypobaric environment, reactivity, vasoconstriction, vasodilation, hypoxia, erythrocyte, tachycardia, pressure.*

Objective: To assess the effects of atmospheric pressure on the human cardiovascular system, including the causes and consequences.

Relevance of the Topic: It is well known that atmospheric pressure plays a crucial role in regulating the function of the cardiovascular system and maintaining the overall health of the body. Cardiovascular reactivity, that is, the response of the heart and blood vessels to changes in the external environment, is manifested through several different mechanisms in response to changes in atmospheric pressure. Understanding and evaluating the principles of changes in the internal environment of the body in response to pressure changes allow for the prevention of various physiological disorders that may occur in the body.

According to Dr. Bennett's research, an increase in heart rate and blood pressure and a narrowing of blood vessels under high-pressure conditions, leading to an increased workload on the heart, have been observed in a hyperbaric environment. Dr.

John R. Sutton's studies have shown that in hypobaric environments, particularly in high-altitude conditions with hypoxia and low atmospheric pressure, cardiovascular system reactions are intensified. His research indicates that hypoxia occurs in a hypobaric environment, leading to an increase in heart rate, a decrease in blood pressure, and changes in the circulatory system. According to Dr. Christian, an increase in workload and vasoconstriction leads to an increase in the load on the cardiovascular system. Being in a high-pressure environment, such as underwater, is referred to as a hyperbaric environment. In this environment, the following effects on the cardiovascular system can be observed.

Increase in Blood Pressure: Under high-pressure conditions, blood pressure may rise. This condition leads to increased pressure on the body's circulatory system. In a high atmospheric pressure environment, the heart tries to beat faster, which increases the workload on the heart.

Hypobaric Environment: In a low atmospheric pressure environment (e.g., in high mountains or aircraft), the following effects can be observed:

Hypoxia: In low-pressure conditions, the amount of oxygen in the air decreases, leading to a state of hypoxia. This increases the demand for oxygen by the heart and blood vessels. A low atmospheric pressure environment can lower blood pressure. This results in less pressure on the body's circulatory system, which may cause the heart rate to increase as the body tries to intake more oxygen.

The Body's Response to Atmospheric Pressure Changes: The body's response to changes in atmospheric pressure is carried out through various adaptation mechanisms, including:

Vasoconstriction and Vasodilation: The narrowing or widening of blood vessels allows the body to regulate the load on the circulatory system.

Heart Rate Adjustments: The body can alter blood flow by increasing or decreasing the heart rate.

Additionally, prolonged exposure to a hypobaric environment may accelerate erythropoiesis, increasing the number of erythrocytes, which in turn improves the blood's oxygen-carrying capacity.

Adaptation Mechanisms: The mechanisms by which the body adapts to high and low atmospheric pressure are crucial for human health and performance. These mechanisms involve various physiological and biochemical processes.

For example, Gas Concentrations in the Blood: In a high-pressure environment, the amount of oxygen entering the blood increases, which may raise the level of dissolved oxygen in the blood. In high-pressure conditions, nitrogen concentration in the blood may rise, which can affect the central nervous system and lead to nitrogen narcosis.

Hormonal and Nephrogenic Mechanisms: In a hyperbaric environment, the body regulates chronic changes through hormones and kidneys to control blood pressure. Baroreceptors in blood vessels detect pressure changes and manage the appropriate response. In a hypobaric environment, prolonged breathing can lead to hyperventilation. The body tries to intake more oxygen through hyperventilation in a low atmospheric pressure environment.

Oxygen and Carbon Dioxide Levels in the Blood: Due to reduced oxygen intake in a hypobaric environment, the body increases the exhalation of carbon dioxide. The adaptation of blood pressure is manifested through hormonal and nephrogenic mechanisms, meaning that in a hypobaric environment, the body regulates chronic systems through hormones and kidneys to control blood pressure. For instance, in low atmospheric pressure conditions, the body increases erythropoiesis, i.e., the production of erythrocytes (blood cells). This improves the oxygen-carrying capacity of the blood.

General Adaptation Mechanisms: In response to changes in atmospheric pressure, the body produces various hormones, which affect different organs and tissues. The nervous system, in turn, detects pressure changes and manages the adaptation response. Specifically, the body adapts to changes in atmospheric pressure by altering metabolism. Moreover, changes in atmospheric pressure can influence the blood coagulation process. Blood coagulation (hemostasis) is the body's mechanism for stopping bleeding and maintaining stability in the blood flow. The following effects can be observed in conditions of high or low atmospheric pressure.

In a hyperbaric environment, particularly underwater at high atmospheric pressure, blood viscosity can increase. This raises the concentration of erythrocytes and plasma components in the blood, which may accelerate the blood clotting process. During hyperbaric oxygenation, the amount of oxygen in the blood increases. This can affect the activity of blood clotting factors and platelets, leading to an increase in the clotting process. The increased blood clotting process under high atmospheric pressure conditions may heighten the risk of thrombosis. This is especially significant during prolonged stays in hyperbaric chambers or underwater environments.

Now, if we analyze the low-pressure environment, i.e., the hypobaric environment, blood dilution may occur at low atmospheric pressure. In this case, the concentration of plasma and cells in the blood may decrease, which can slow down or normalize the clotting process. In low-pressure conditions, oxygen deficiency (hypoxia) occurs. Hypoxia can affect the blood clotting process. The body manages various physiological changes to adapt to hypoxia. For example, fibrinolysis — the process of breaking down blood clots — may increase in the blood in a hypobaric environment. This helps the body adapt to hypoxia and prevents the formation of clots in blood vessels.

The factors involved in the blood clotting process respond differently to changes in atmospheric pressure. The interaction of these processes significantly impacts the blood clotting process. Changes in atmospheric pressure can affect the blood supply to tissues. These changes influence the speed and efficiency of the blood clotting process. Atmospheric pressure changes have a complex effect on the blood clotting process, and the body employs various mechanisms to adapt to these changes.

Conclusion

Overall, understanding how these factors influence the body's physiological state during prolonged exposure to high or low atmospheric pressure and the mechanisms of protective reactions developed by the body is crucial. This understanding is essential for ensuring that humans can live and function effectively under conditions of high and low atmospheric pressure.

References

1. CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL) A EUROPEAN OVERVIEW M Rakhimova Science and innovation 2 (B3), 497-499 2023

https://cyberleninka.ru/article/n/content-and-language-integrated-learning-clil-a-european-overview/viewer

2. Causes,Forms,Complications and Tretment of Menstrual Cyclr Disorders
RM Mannonovna Scholastic:Journal of Natural and medical Education, 121-127 2023
https://scholar.google.com/citations?view_op=view_citation&hl=ru&user=AE7ViW0AAAAJ&citation_for_view=AE7ViW0AAAAJ:ufrVoPGSRksC

3. PEDAGOGICAL MODEL OF INTERACTION OF PRESCHOOL EDUCATION AND FAMILY BASED ON INNOVATIVE APPROACHES
M Rakhimova Science and innovation 3 (B2), 20-23 2024
https://cyberleninka.ru/article/n/pedagogical-model-of-interaction-of-preschool-education-and-family-based-on-innovative-approaches-1/viewer

4. Gestosis During Pregnancy RM Mannonovna Central Asian Journal of Medical and Natural Science 4 (4), 59-61 2023
https://cajmns.centralasianstudies.org/index.php/CAJMNS/article/view/1661

5. Cytomegalovirus Infection in Obstetrics and Gynecology
RM Mannonovna Univer Publishing 2023
https://dspace.umsida.ac.id/items/dca45fb3-aa42-48c5-aa94-26c0ddd1d4ea

6. TORCH INFECTION: DANGER FOR PREGNANT WOMEN, PERIOD OF EXAMINATION M Rakhimova Science and innovation 2 (D10), 57-58 2023
https://scientists.uz/view.php?id=3772

7. DISORDER OF THE MENSTRUAL CYCLE CAUSES, SYMPTOMS, CLASSIFICATION, TREATMENT METHODS M Rakhimova Science and innovation 2 (D2), 31-37 2023
https://cyberleninka.ru/article/n/disorder-of-the-menstrual-cycle-causessymptoms-classification-treatment-methods/viewer

8. Infertility in women classification, symptoms, causes and factors, recommendations for women M Rakhimova Science and innovation 1 (D7), 245-250 2022
https://cyberleninka.ru/article/n/infertility-in-women-classification-symptoms-causes-and-factors-recommendations-for-women/viewer

9. Stem rot disease in sweet pepper in Andijan Region D Aznabakieva, M Rasulova, M Rakhimova Science and innovation 2 (D5), 162-164 2023
https://cyberleninka.ru/article/n/stem-rot-disease-in-sweet-pepper-in-andijan-region/viewer

10. Xudjanova M.A., Bobosherov X. X., Qorako‘l qo‘zilarining ayrim fiziologik ko‘rsatkichlariga gelmintozlarning ta'siri. Vol. 28 No. 4 (2023): «TADQIQOTLAR» jahon ilmiy-metodik jurnali. 28(4), 16–20. Retrieved from
http://tadqiqotlar.uz/index.php/new/article/view/1367

11. Xudjanova M.A., Bobosherov X. X., Современные методы диагностики и лечения гельминтозов. Vol. 28/No. 4 (2023): «TADQIQOTLAR» jahon ilmiy-metodik jurnali. 28(4), 2531.
http://tadqiqotlar.uz/index.php/new/article/view/1369.

12.Xudjanova M.A., Abdiganiyeva S.N. Influence of different parasitic factors on hematological indicators of animal organisms. Proceedings of International Educators Conference,3(1),377–383.Retrievedfrom. https://econferenceseries.com/index.php/iec/article/view/3749.

13. Khudzhanova M.A., Shonazarov S.I. The influence of helmintoses on some physiological indicators of korakul lambs.Proceedings of International Conference on Educational Discoveries and Humanities. Article Sidebar.Published: Jan 25, 2024/Том.3.№.2.Стр.94-99.

https://econferenceseries.com/index.php/icedh/article/view/3752.