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Original Article

The Effect of Ambient Temperature and Air Humidity on The Body's Hematocrit Levels when Exercising

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ABSTRACT

Sport has a crucial role in improving quality of life and health, but the environment including temperature and humidity can affect athletes' performance and health. This study focused on the impact of environmental temperature and humidity on hematocrit levels during exercise in Padang City. Using an ex-post facto design, the study involved 15 football players with pre-test and post-test hematocrit before and after a 10km jog. The results of the study are the body's hematocrit levels when exercising, evidenced by statistical analysis, namely: a). P value < 0.05, 0.034<0.05, b) Hematocrit increase that occurs with a difference of 1.25%, c) t calculate > t table which is 2.331 > 1.753 with α < 0.05. The normality test shows normally distributed data, validating the results of the analysis. Increased hematocrit is related to oxygen demand and dehydration, which can be exacerbated by high temperatures and humidity. The research underscores the importance of a holistic understanding of the sports environment and the implementation of preventive measures, such as adequate fluid intake. Elevated hematocrit levels can be an indicator of dehydration risk, which can affect physical performance and heart health. Therefore, education on the body's adaptation to environmental changes and safe sports practices needs to be introduced to maintain the health and quality of life of people in environments with high temperatures and humidity. It can be concluded that there is a significant difference in the body's hematocrit levels when exercising with a P value of < 0.05.

Keywords : *Ambient Temperature, Air Humidity, Hematocrit Levels.*

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INTRODUCTION

Sport continues to play a vital role in improving quality of life and health [1–3]. Sports also provide physical and mental benefits, improve physical fitness, and provide fun and entertainment [4,5]. Sports can be practiced by anyone, anytime, and anywhere, regardless of gender, ethnicity, or race [6,7]. Physical fitness, involving the body's adaptation to physical loading, plays a key role in improving the quality of life [8,9]. The environment, including air temperature and humidity, greatly affects physical appearance in sports[10]. High temperatures and humidity can affect blood flow and loss of body fluids, impairing appearance and health [11]. In exercise, the body produces heat, and the loss of body fluids and electrolytes is closely related to the surrounding environmental conditions [12]. Loss of body fluids can cause dehydration, affect the work of the heart, and can be fatal[13]. Therefore, an understanding of environmental factors and the role of exercise in maintaining health is the key to improving people's quality of life.

Changes in air temperature can affect air humidity, and both have a significant contribution to sports performance [14]. High relative humidity can inhibit the removal of body fluids, while high temperature and humidity can affect blood flow and blood distribution to muscles [15]. High temperatures and humidity can increase blood flow to the skin and blood distribution to muscles, which can affect the body's physiology [16]. The importance of temperature and humidity in exercise is closely related to the risk of dehydration. Dehydration can affect physical performance, increase the heart's workload, and can be fatal [17,18]. Excessive loss of body fluids can lead to dehydration, which can be indicated by an increase in hematocrit values [19]. The hematocrit reflects the percentage of red blood cells in the blood, and an increase in the hematocrit value can be an indicator of dehydration [20]. Monitoring of ambient temperature, relative humidity, and hematocrit levels is important in maintaining athletes' health and performance, especially in areas with high temperatures and humidity such as Padang City.

Hematocrit is an important parameter in a blood test that measures the volume of erythrocytes in 100ml of blood, expressed in percentage form [21]. The hematocrit value is useful for knowing the average erythrocyte count and detecting health problems. Normal values of hematocrit in men are 40-48%, while in women it is 37-43% [22]. Hematocrit examination can be carried out by macro and micro methods using wintrobe tubes or microcapillaries [23]. Both methods have their own advantages and disadvantages. Factors that affect hematocrit examination results involve in vivo and in vitro conditions, such as erythrocyte count, blood viscosity, and anticoagulant use. Dehydration can increase hematocrit values due to hemoconcentration due to a decrease in fluid volume and an increase in the number of erythrocytes [24]. Therefore, an understanding of the factors affecting hematocrit, as well as its relationship with dehydrated conditions, becomes important in the interpretation of blood test results. This study highlights the impact of environmental temperature on health when doing sports activities. High temperatures can cause heat exhaustion, dehydration, and other health problems [25]. The variation in air temperature in Padang City reaches 12°C - 30°C, with the highest temperature concentrated in urban areas. High population density and urban activity can increase local temperatures, affecting people's health and comfort. This study aims to explore the effects of ambient temperature and air humidity on hematocrit levels when exercising in environments with high temperature and humidity conditions.

Based on the background and observations of researchers, there has been no research, especially in Padang City, which has a high enough temperature and humidity in calculating hematocrit levels when exercising as an indicator of someone being dehydrated and there is no one's examination test to be able to determine hematological changes when doing sports activities in hot climates without consuming fluids. And there is still no education on how to maintain hematocrit levels in normal circumstances when doing sports. Researchers are interested in conducting research on the Effects of Environmental Temperature and Air Humidity on Hematocrit Levels in the Body When Doing Exercise, because body fluid loss (dehydration) and hematocrit levels are closely related to environmental conditions, especially air temperature and humidity. The hope is that this study can provide deep insight into the relationship between the environment and athletes' health, as well as become the basis for education on how to maintain hematocrit levels in normal conditions when exercising in challenging environments.

This study aims to fill a crucial gap in the literature by investigating the specific impact of environmental temperature and humidity on hematocrit levels during exercise in Padang City, shedding light on the potential risks of dehydration and oxygen demand for athletes. The research objectives include assessing the magnitude of hematocrit changes, analyzing statistical significance, and emphasizing the need for holistic measures, such as adequate fluid intake, to mitigate these effects and safeguard athletes' health and performance in high-temperature and high-humidity environments.

METHOD

This study uses quantitative research methods with an ex-post facto design, which aims to examine events that have occurred and see the factors that can give rise to these events.

The research design chosen was a pre-test post-test, where the research sample conducted an initial test (pre-test) to check hematocrit levels before jogging 10 km, and a final test (post-test) to check hematocrit levels after jogging. The independent (free) variables in this study were ambient temperature and air humidity, while the dependent variable (bound) was hematocrit levels during exercise. The study population consisted of soccer players in Padang City, with a sample of 15 people who met certain criteria, such as aged 16-25 years, male, able-bodied, not injured, and actively training and playing football.

Research instruments involve tools such as EDTA tubes, hematocrit centrifuges, 3 cc syringes, hematocrit tubes, and digital thermohygrometers. The research procedure includes blood sampling before and after jogging, hematocrit examination using micro (capillary) methods, as well as data collection and analysis. The data obtained will be analyzed using a t-test with a significance level of 5%. Previously, data normality tests were carried out to ensure the data matched with the normal distribution. Population homogeneity is also tested to ensure similarity of variance between groups. The results of data analysis will be presented in the form of tables and graphs to illustrate changes in hematocrit levels before and after jogging. This research is expected to contribute to the understanding of the influence of environmental temperature and air humidity on hematocrit levels when doing sports, especially jogging as far as 10 km.

RESULTS

In accordance with the objectives that have been stated previously and the research hypothesis, the data will be described. Based on the results of measurements carried out, namely

A. Test Analysis Requirements

Paired sample t-Test is a difference test between two paired samples. Paired samples were the same subjects, but subjected to different treatments. This difference test model is used to analyze the research model before and after. The requirements must be met i.e. the data is normally distributed. The Shapiro Wilk test was used to test the normality of the data in this study at the significance level $\alpha = 0.05$ assisted by the SPSS program. Here's the breakdown:

hematocrit levels, preliminary data were obtained pre-test (attachment of own contents) and post-test (attachment of sendri contents). Here's a full description of the data:

Table 1. Description of Research Data

	N	Mean ± Std. Deviation	Minimum	Maximum
Pre-Test	16	43.38 ± 2.125	40	47
Post-Test	16	44.63 ± 2.705		49
Total Duration	16	59.02 ± 1.687	55.50	60.13

Based on table 1 described above, it can be seen, the average pre-test is 43.38 with the lowest value of 40 and the highest value of 47. The post-test average was 44.63 with a low score of 40 and a high of 49. The average duration of time traveled was 59.02 minutes with the lowest value of 55.50 minutes and the highest value of 60.13 minutes. So that from the pre-test and post-test data, a difference of 1.25 is obtained with the following diagram:

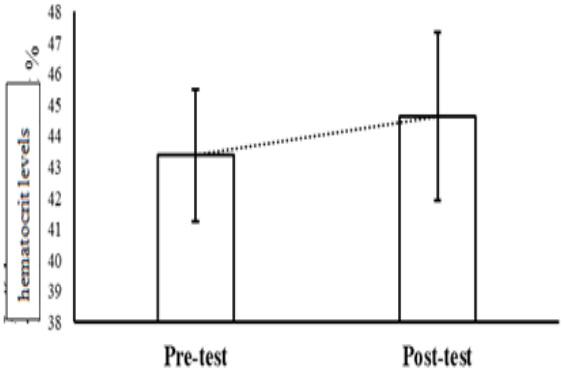

Figure 1. Effects of ambient temperature and humidity on hematocrit levels

Table 2 . Normality Test Results

Tests of Normality (*Shapiro Wilk*)			
Data	**Statistic**	**Df**	**Sig**
Pre Test Hematocrit	0,947	16	0,451
Post Test Hematocrit	0,958		0,625

Based on the results of the normality test P value > 0.05, it can be said to be normal in the data group, namely the pre-test research shows, that the significance level is 0.451 > 0.05 so that it can be concluded that the pre- test data

is normally distributed. In the post-test data, the study showed that the significance level was 0.625 > 0.05 so that it can also be concluded that the post-test data is normally distributed.

B. Test the Hypothesis

Testing the research hypothesis was carried out based on the results of data analysis and interpretation of t-test analysis using paired sample t test. The sequence of hypothesis testing results adjusted to the hypotheses formulated in the table below, as follows:

Table 3. Pre-test and Post-test T Test Results of ambient temperature and air humidity on hematocrit levels

Source	T	df	Sig. 2 tailed
Pair Pre Test Hematokrit - *Post Test* Hematokrit	-2.331	15	.034

From the paired t test results of Table 4 above, it can be seen that the significance value of p value is 0.034 and t value is 2.331. Because the significance value of p value is 0.034 < 0.05, it means that there is an influence of environmental temperature and air humidity on the body's hematocrit levels.

Table 4. Pre-test and Post-test T Test Results of ambient temperature and air humidity on hematocrit levels

Source	N	Decrease	Unchanged	Increased
Hematocrit value	16	18,75%	12,5%	68,75%

Table 4 above, there were 3 people (18.75) who experienced a decrease in hematocrit levels, 2 people (12.5%) did not increase or decrease and 11 people (68.75%) experienced an increase.

Based on the results of the analysis, data obtained in Table 2, Figure 1 and Table 4 show the results of the calculated t value > t table so that the difference that occurs from the results of the difference in the average hematocrit value of pre and post which shows 1.25%. Judging from the value of t, calculate with (-) so that in the table t take the value of 1-tailed 0.05 with df 15, which is 1.753. Judging from the absolute value or absolute value of T calculate > T table, 2,331 > 1.753 which means there is a significant difference in ambient temperature and air humidity to the body's hematocrit levels.

DISCUSSION

Based on hypothesis testing, the results of the data were found by exercising at a temperature of 33, 2 ° C - 35.1 ° C air humidity at the time of carrying out this study between: 50% - 53% had a significant effect, namely p value of 0.034 < 0.05. The average pre-test hematocrit value of 43.38% increased the post-test hematocrit value by 44.63% with an average time of 59.02 minutes. Hematocrit is the percentage of total blood volume containing erythrocytes or red blood cells, that is, the volume of all erythrocytes in 100 ml of blood expressed in % (percent) [26]. When exercising, plasma volume will decrease so that the hematocrit value will increase. Exercising during this time is done only by referring to the signs of changes that appear and are produced by the body, such as differences in pulse levels, the amount of sweat and other signs of fatigue [27]. In addition to these factors, ambient temperature and air humidity have a significant influence on the body when doing sports [28].

Environmental temperature is closely related to the level of air humidity. The higher the ambient temperature, the higher the humidity level of the surrounding air [29]. An area has different temperatures and relative humidity. Indonesia is a tropical region with temperatures ranging from 29-30°C with relative humidity of the air varying depending on various factors such as rainfall, waterlogging, or barren tropics. Environmental temperature is the degree of heat or cold that prevails in the surrounding space [30]. These environmental factors can be classified in the external environment, namely the environment that affects the performance of athletes who come from outside the body [31,32]. In addition, there is also the internal environment, namely things that affect physical appearance in sports activities that originate from within the athlete's body. The division of the environment does not only stand alone, but supports each other. The altitude of the place (physical factors) affects chemical factors, namely the partial pressure of O2, CO2, and CO in the air. Biological environmental factors affect the chemical environment. During the day in arid areas, O2 levels will be lower than in grassy areas or fields and shady plants. While at night the opposite will happen, namely CO2 gas will increase in levels. Exercising will lead to a state of oxygen deprivation or hypoxia. If hypoxia occurs, the

body will compensate by increasing the number of oxygen carriers. One of them is by increasing the secretion of the hormone erythropoietin into the blood by the kidneys which will further stimulate the production of erythropoiesis by the red bone marrow to increase the number of red blood cells in the blood, it causes the percentage of hematocrit to increase.

A decrease in hematocrit levels occurs in states of hypovelemia, dehydration, polycythemia vera, severe diarrhea, diabetic acidosis, pulmonary emphysema, cerebral ischemic and eclampsia. A hot environment can increase the flow of blood vessels in the skin, so it can change cardiovascular function [11]. Increased blood vessel flow in the skin reduces pressure on the central blood vessels and disrupts blood flow in the muscles. Sweating at increased temperature conditions can exceed fluid intake in the body. When dehydration exceeds 3% of total body water (2% of body mass) then aerobic performance can be consistently impaired. Dehydration adds to hyperthermia and a reduction in plasma volume, which combine to accentuate cardiovascular stress. Changes in high blood plasma volume are also caused due to longer duration of exercise (i.e., time periods longer than one hour). This causes the body to compensate by using blood plasma which is the main source of body fluids. As a result, the plasma volume will decrease resulting in blood clotting or hemoconcentration which causes an increase in hematocrit due to the exit of erythrocytes from the spleen. On examination of plasma hematocrit should also be observed for the presence of hemolysis. Physiological or pathophysiological states in plasma can affect hematocrit examination. This is in line with research Sari et al (2023) Hematocrit deficiency can occur due to physical activity that is beyond the limits of maximum ability. Physical activity can affect the increase or decrease in hematocrit levels in the blood. In general, exercise can change hematocrit acutely or chronically in blood plasma, and changes the availability of hematocrit in red blood cells. Volume in blood plasma can decrease after physical activity, resulting in increased pressure, this can occur due to hormonal changes and sweat [34,35].

Based on the explanation above, there are several factors that affect hematocrit, including oxygen demand and dehydration caused by environmental temperature and air humidity. That the use of oxygen and dehydration can decrease with the simultaneous increase in temperature and humidity of air in an area. At high room temperature, the body increases, the body temperature is higher and the cardiovascular pressure is higher, resulting in a higher dehydration process as a form of resistance to the increase in temperature. Based on this, it can affect the hematocrit in a person's body.

CONCLUSION

This study highlights the impact of environmental temperature and air humidity on health and hematocrit levels during exercise, especially in Padang City. The results of the analysis showed a significant influence of environmental temperature and air humidity on the increase in hematocrit levels during activity, with an average increase of 1.25%. Factors such as oxygen demand, dehydration, and the body's adaptation to the environment play an important role in changes in hematocrit levels. Therefore, a holistic understanding of the sports environment, including physical, biological, and social aspects, is crucial to maintaining the health and performance of athletes. A significant increase in hematocrit levels may also be associated with a risk of dehydration that can affect the physical performance and workload of the heart. Preventive measures that can be taken, such as adequate fluid intake and adaptation to environmental changes, need to be implemented to maintain the health and quality of life of people who exercise in environments with high temperatures and humidity.

REFERENCES

1. Tjønndal A, Nilssen M. Innovative sport and leisure approaches to quality of life in the smart city. *World Leis J.* 2019;61(3):228-240. doi:10.1080/16078055.2019.1639922
2. Gonçalves Galdino da Costa B, Souto Barreto P, Magno da Silveira P, Aragoni da Silva J, Samara Silva K. The association between practicing sport and non-sport physical activities and health-related quality of life of Brazilian adolescents: A cross-sectional study. *Sci Sport.* 2020;35(4):e109-e119. doi:10.1016/j.scispo.2020.02.003
3. Badru B. The Feasibility of ’BEYB’ Attacking Tactic Training in Futsal

Game. *JPI (Jurnal Pendidik Indones*. 2021;10(3):555. doi:10.23887/jpi-undiksha.v10i3.29359
4. Destriana D, Destriani D, Yusfi H. Service Techniques To Improve Volyball GameS. *JPI (Jurnal Pendidik Indones*. 2020;9(4):597. doi:10.23887/jpi-undiksha.v9i4.21906
5. Hammami A, Harrabi B, Mohr M, Krustrup P. Physical activity and coronavirus disease 2019 (COVID-19): specific recommendations for home-based physical training. *Manag Sport Leis*. 2022;27(1-2):26-31. doi:10.1080/23750472.2020.1757494
6. Nunn C, Spaaij R, Luguetti C. Beyond integration: football as a mobile, transnational sphere of belonging for refugee-background young people. *Leis Stud*. 2022;41(1):42-55. doi:10.1080/02614367.2021.1962393
7. Fox B, Paradies Y. Youth sport and community segregation: a study of kids' participation in Australian rules football and soccer clubs in an Australian community. *Race Ethn Educ*. 2020;23(5):732-746. doi:10.1080/13613324.2019.1679755
8. El Hajj A, Wardy N, Haidar S, et al. Menopausal symptoms, physical activity level and quality of life of women living in the Mediterranean region. *PLoS One*. 2020;15(3):1-16. doi:10.1371/journal.pone.0230515
9. Blegur J, Lumba AJF. Teaching Skills of the Prospective Physical Education Teachers Based on Group Learning Commitment. *JPI (Jurnal Pendidik Indones*. 2022;11(1):107-116. doi:10.23887/jpi-undiksha.v11i1.34739
10. Draper G, Wright MD, Ishida A, Chesterton P, Portas M, Atkinson G. Do environmental temperatures and altitudes affect physical outputs of elite football athletes in match conditions? A systematic review of the 'real world' studies. *Sci Med Footb*. 2023;7(1):81-92. doi:10.1080/24733938.2022.2033823
11. Apriantono T, Herman I, Juniarsyah AD, et al. Pengaruh suhu dan kelembaban terhadap vo2max pada atlet PPLP se-Pulau Jawa, Indonesia. *J Sport J Penelit Pembelajaran*. 2020;6(1):59-68. doi:10.29407/js_unpgri.v6i1.13872
12. McCubbin AJ, Allanson BA, Caldwell Odgers JN, et al. Sports Dietitians Australia position statement: Nutrition for exercise in hot environments. *Int J Sport Nutr Exerc Metab*. 2020;30(1):83-98. doi:10.1123/ijsnem.2019-0300
13. Barley OR, Chapman DW, Abbiss CR. Reviewing the current methods of assessing hydration in athletes. *J Int Soc Sports Nutr*. 2020;17:1-13.
14. Gatterer H, Dünnwald T, Turner R, et al. Practicing sport in cold environments: Practical recommendations to improve sport performance and reduce negative health outcomes. *Int J Environ Res Public Health*. 2021;18(18). doi:10.3390/ijerph18189700
15. Zubac D, Stella AB, Morrison SA. Up in the air: Evidence of dehydration risk and long-haul flight on athletic performance. *Nutrients*. 2020;12(9):1-15. doi:10.3390/nu12092574
16. Travers G, Kippelen P, Trangmar SJ, González-Alonso J. Physiological Function during Exercise and Environmental Stress in Humans—An Integrative View of Body Systems and Homeostasis. *Cells*. 2022;11(3). doi:10.3390/cells11030383
17. Nye NS, Grubic T, Kim M, O'Connor F, Deuster PA. Universal Training Precautions: A Review of Evidence and Recommendations for Prevention of Exercise-Related Injury, Illness, and Death in Warfighters and Athletes. *J Athl Train*. 2023;58(3):232-243. doi:10.4085/1062-6050-0400.21
18. Blanchard A. Faktor Determinan Status Hidrasi Atlet Bela Diri Di Pusat Pelatihan Olahraga Pelajar. *Soins Aides - Soignantes*. 2014;11(56):26-27.
19. Alhowikan AM, Al-Hazzaa HM. Impact of running race in warm weather on hematological and biochemical parameters. *Eur Rev Med Pharmacol Sci*. 2022;26(7):2288-2291. doi:10.26355/eurrev_202204_28458
20. Li L, Wu W, Yin M. Effect of Hematocrit Injury on the Survival Rate of Advanced Malignant Tumors and Its Clinical Significance. *Comput Math*

Methods Med. 2022;2022. doi:10.1155/2022/4968754
21. Quinn JG, Tansey EA, Johnson CD, Roe SM, Montgomery LEA. Blood: Tests used to assess the physiological and immunological properties of blood. *Adv Physiol Educ*. 2016;40(2):165-175. doi:10.1152/advan.00079.2015
22. Meilanie ADR. Different of Hematocrit Value Microhematocrit Methods and Automatic Methods in Dengue Hemorrhagic Patients With Hemoconcentration. *J Vocat Heal Stud*. 2019;3(2):67. doi:10.20473/jvhs.v3.i2.2019.67-71
23. Livshits L, Bilu T, Peretz S, et al. Back to the "Gold Standard": How Precise is Hematocrit Detection Today? *Mediterr J Hematol Infect Dis*. 2022;14(1):1-12. doi:10.4084/MJHID.2022.049
24. Putri APH. Nilai Hematokrit pada Pasien Diare. *Lab Medis*. 2021;03(02):120-126.
25. Ebi KL, Capon A, Berry P, et al. Hot weather and heat extremes: health risks. *Lancet*. 2021;398(10301):698-708. doi:10.1016/S0140-6736(21)01208-3
26. Rashidi Y, Simionato G, Zhou Q, et al. Red blood cell lingering modulates hematocrit distribution in the microcirculation. *Biophys J*. 2023;122(8):1526-1537. doi:10.1016/j.bpj.2023.03.020
27. Kishimoto S, Maruhashi T, Kajikawa M, et al. Hematocrit, hemoglobin and red blood cells are associated with vascular function and vascular structure in men. *Sci Rep*. 2020;10(1):1-9. doi:10.1038/s41598-020-68319-1
28. Mintarto E, Fattahilah M. Efek Suhu Lingkungan Terhadap Fisiologi Tubuh pada saat Melakukan Latihan Olahraga. *JSES J Sport Exerc Sci*. 2019;2(1):9. doi:10.26740/jses.v2n1.p9-13
29. Park JE, Son WS, Ryu Y, Choi SB, Kwon O, Ahn I. Effects of temperature, humidity, and diurnal temperature range on influenza incidence in a temperate region. *Influenza Other Respi Viruses*. 2020;14(1):11-18. doi:10.1111/irv.12682
30. Sandi IN, Ashadi K, Womsiwor D. Pembagian Lingkungan Olahraga. *J Pendidik Kesehat Rekreasi*. 2021;7(1):174-185.
31. Bafirman B, Wahyuri AS, Vellya V, Zarya F, Munir A. Comparison of VO2Max Capacity and Lung Vital Capacity of Junior High School Students: Highlands and Lowlands. *JOSSAE (Journal Sport Sci Educ*. 2023;8(1):69-76. doi:10.26740/jossae.v8n1.p69-76
32. HB B, Wahyuri AS, Zarya F, Sabillah MI, Annasai F. Revitalizing student physical fitness: The vital role of post?pandemic physical activity programs. *Fizjoterapia Pol / Polish J Physiother*. 2023;23(4):226-232. doi:10.56984/8ZG20A4D3
33. Sari AF, Yuniarti E, Atifah Y, Farma SA. Perbedaan Kadar Hematokrit dan Trombosit Mahasiswa Biologi dengan Mahasiswa Olahraga Universitas Negeri Padang. *Serambi Biol*. 2023;8(1):44-49.
34. Anjarsari DRP, Hanan A, Widiani E. Perpaduan Isometric Exercise dan Latihan Pernafasan Yoga Terhadap Penurunan Tekanan Darah pada Pasien Hipertensi di Desa Mojojajar Wilayah Kerja Puskesmas Kedungsari Kabupaten Mojokerto. *J Kesehat Andalas*. 2021;10(1):8. doi:10.25077/jka.v10i1.1601
35. Jesuthasan A, Ali A, Lee JKW, Rutherfurd-Markwick K. Assessment of Changes in Physiological Markers in Different Body Fluids at Rest and after Exercise. *Nutrients*. 2022;14(21):4685.