Hematocrit Levels In High Work-Intensity Individuals: Study In Construction Workers

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A BSTRACT

Background: Physical activity carried out by humans causes the muscles to contract and a heat response arises in the body which is activated by the anterior hypothalamus resulting in skin vasodilation and sweating. The heat response also causes changes in the circulation of the heart and respiratory system so that the rate of metabolism in the muscles increases. This increases the dilation of blood vessels resulting in a decrease in plasma (intravascular fluid) which causes hemoconcentration and increases hematocrit levels. Construction workers have strenuous physical activity so it is possible to have a higher hematocrit level than others. Objective: This study aims were to determine the level of hematocrit in construction project workers. Method: It was descriptive analysis. The number of samples were 30 people, male sex. The sample used is blood. Hematocrit levels were analyzed with an automatic hematology analyzer. Result: 93,4% (24/30) of respondents aged 26-35 years. The result of measuring hematocrit levels found that 80% (24/30) had normal hematocrit levels, while 20% (6/30) had low hematocrit levels (hemodilution) and found no hemoconcentration. Conclusion: There is no increase in hematocrit levels in construction workers who are affected by physical activity.

KEYWORDS Physical Activity, Hematocrit Levels, Construction Workers

INTRODUCTION

In life, humans spend most of their time (approximately 85-90%) doing activities. Increased oxygen during physical exercise causes major changes in the blood circulation and respiratory systems. Blood flow can also increase during activity or even before doing activity. The increase can be mediated by nerve stimulation. During physical activity, muscle contractions occur, because of the muscle contraction, there is heat in the body. Heat from within the body is expelled through the evaporation of water in the airways and

skin. The response activated by heat is activated by the anterior hypothalamus, the stimulus causes vasodilation of the skin and sweating. The heat response also causes changes in the circulation of the heart and respiratory system. Changes in circulation will increase the metabolic rate in the muscles (Mondal and Lotfollahzadeh, 2023).

In active muscles, the temperature will increase and this adds to the dilation of blood vessels so that there is a decrease in plasma (intravascular fluid) which can cause hemoconcentration. This increases blood cells so that hematocrit levels increase (Ganong, 2012). Hematocrit or also known as erythrocyte volume fraction (PCV) measures the percentage of blood that consists of red blood cells. Hematocrit values are also used to calculate average erythrocyte values. Usually the hematocrit value is determined by capillary blood or venous blood. Hematocrit measurement is very important because it provides information about the total oxygen-carrying capacity of the patient (Kiswari, 2014).

Physical activity performed by construction workers is usually directly exposed to sunlight which makes the muscles start to contract. Muscle contractions will trigger other body systems and require the body's metabolic system to provide more energy, in addition to that the work of the cardiovascular system will also increase to provide oxygen needs and distribute the rest of the metabolism. Simultaneously the respiratory system will also improve its performance by increasing the breathing rate to increase the amount of air ventilation (Tiara et al., 2016).

In this study, the blood samples were taken from construction workers with a group of workers or commonly called field workers consisting of several craftsmen who have certain skills, such as: carpenters, blacksmiths, sand handlifters, cement mixers, bricklayers, aluminum workers and painters. In carrying out their work, they usually work from 8 am to 9 pm and rest at 12 noon so that physical activities carried out by building project workers can be classified as high intensity activities.

RESEARCH METHOD

The type of research used is descriptive research. The research subject was taken by a total sampling method of 30 workers of the factory construction project in Tanjung Village, Juwiring District, Klaten Regency. All workers are male. The specimen used was venous blood. Venous blood collection was carried out at noon at 12.30 when workers had been doing heavy activities for five hours. Blood was taken as much as 3 ml and given EDTA preservatives. The blood in the vacutainer tube is taken to a laboratory to check its hematocrit levels. The examination is carried out automatically using a hematology analyzer. The results of the examination were analyzed descriptively.

RESULTS AND DISCUSSION

Hematocrit is the volume of erythrocytes in 100 ml of blood expressed in a percentage of blood volume. Generally, hematocrit increases if a person is dehydrated due to increased physical activity, but this condition can also occur in individuals with lung disease, tumors, bone marrow disorders (polycythemia vera), congenital heart disease and abuse of the drug erythropoietin by athletes for doping.

Hematocrit level analysis is carried out automatically using a hematology analyzer. Researchers used a standard reference from Tintinalli (2011) in the classification of hemodilution, normal and hemoconcentration hematocrit levels. Normal hematocrit levels are 42% - 54%. If the hematocrit level is less than 42%, it is called hemodilution, while more than 54% is called hemoconcentration.

Hematocrit levels were measured in construction workers who were assumed to have heavy activity and were exposed to direct sunlight so that they were likely to be dehydrated. The respondents were construction project workers in Tanjung Village, Juwiring District, Klaten Regency, totaling 30 people with male gender. The average duration of work in a day is 8-10 hours every day from Monday to Saturday. They were grouped by their age as shown at Table 1.

Table 1. Characteristics of respondents by age

Aged (years)	N	Percentage (%)
17-25	3	3,3%
26-35	24	93,4%
36-45	3	3,3%
Total	30	100%

Based on Table 1. It can be seen that most of the respondents (93.4%) are 26-35 years old who belong to the early adult age group according to the classification of the Ministry of Health of the Republic of Indonesia (2009).

Table 2. Frequency Distribution by Hematocrit Levels

Hematocrit level	N	Percentage (%)
Hemodilution	6	20,0%
Normal	24	80,0%
Hemoconcentration	0	0 %
Total	30	100%

The results of measuring hematocrit levels by automatic method using hematology analyzers showed that as many as 80% (24/30) of respondents had normal hematocrit levels. As many as 20% (6/30) had hematocrit levels lower than the normal reference value (hemodilution), which was less than the normal value of 42% and no hemoconcentration was found. Hematocrit levels are influenced by many factors, including age, dehydration, gender, pregnancy, smoking, and obesity (Kiswari, 2014). Hematocrit levels in construction workers that are within normal limits may be affected by nutritional intake, lifestyle and health conditions in each individual.

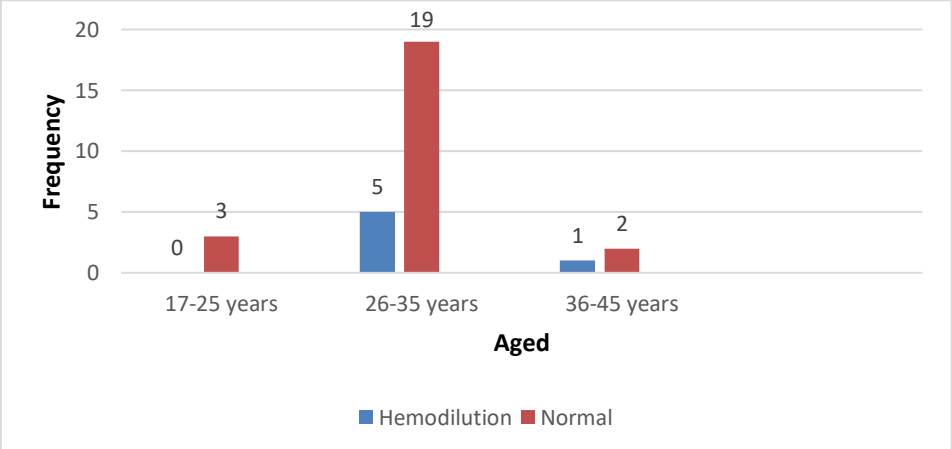

Figure 1. Hematocrit level based on aged

Based on Figure 1, it can be seen that as many as 5 probands (16.7%) aged 26-35 years have low hematocrit levels (hemodilution), on the other hand, in this age range the proportion of respondents with normal hematocrit is also greater than the age under 26 years and over 35 years, which is 63.3%. Hemodilution in respondents may be caused by

anemia conditions experienced by workers due to insufficient iron intake and iron loss through sweat. Rasyidi et al. (2021) and Laluyan et al. (2016) found that approximately 3% of construction project workers experience iron deficiency anemia with more than seven clinical signs. According to Sihombing and Riyadina (2009), the variable age of respondents under the age of 40 years has a risk of anemia by 1.7 times compared to those over 40 years old. In this study, there were 2 respondents of construction workers who had hemoglobin levels less than normal so it can be confirmed that those who experience hemodilution also suffer from anemia.

The results of this study are in line with Harianja and Garini (2021), Putra et al. (2017), Nerisandi (2021), Mukarromah (2010) and Anggraini and Wirjatmadi (2019) who found no difference in hematocrit levels in individuals before and after being given physical exercise, both in light, moderate and high intensity exercise. This can be affected because exercise and physical activity can cause physiological responses in the body and produce a number of chemical (hormonal) and cellular changes, in addition to physical changes such as increased blood pressure, body temperature, and oxygen intake. The change depends on a number of factors such as the type and duration of exercise, climate, physical body status, and nutrition (Ashadi, 2014). When exercising, hematocrit values can increase due to decreased plasma because there are body fluids that come out through sweat and breathing which can cause an increase in blood cells. Dehydration causes a decrease in blood volume which leads to an increase in blood viscosity and decreases venous return. In the condition of dehydration resulting in a falsely high hematocrit, the hematocrit value will be normal when the balance has returned (Astuti, 2019).

Ginting and Liben (2016) stated that hematocrit levels in respondents who were given physical exercise would increase if measured immediately after physical activity was stopped and return to normal if examined after respondents were given a 60-minute break. This is in accordance with the results of this study which found that the hematocrit levels of building project workers were in the normal range because blood specimens were taken during the respondents' lunch break (between 12-13 o'clock). The limitation in this study is that the researcher did not conduct a thorough health screening, did not dig up information in detail through interview or questionnaire. Also, we did not determine the physical activity that might affect so that the physical activity of the workers who were respondents varied from light, moderate and severe so that it could affect the results of hematocrit examination in construction workers.

CONCLUSION

Hematocrit levels in construction workers were in the normal range with a percentage of 80% (24/30), while 20% had hematocrit levels below normal (hemodilution). Physical activity carried out by construction workers has no effect on hematocrit levels. Suggestions to researchers further need to be carried out further research on the effect of physical exercise on hematocrit levels by paying attention to internal factors (age, gender, weight) and external factors (nutritional intake, nutritional status, anemia conditions) that affect hematocrit levels. It is necessary to conduct research involving a larger number of samples

REFERENCES

Anggraeni, L. and Wirjatmadi, R, B. (2019). Status Hemoglobin, Kebiasaan Merokok dan Daya Tahan Kardiorespirasi (VO_2max) pada Atlet Unit Kegiatan Mahasiswa Bola Basket. *Media Gizi Indonesia*, 14(1), pp: 27-34. https://doi.org/10.20473/mgi.v14i1.27-34.

Ashadi, K. (2014). Implementasi Fisiologi Olahraga pada Olahraga Prestasi. *Pertemuan ilmiah Ilmu Keolahragaan Nasional Universitas Negeri Malang*. Malang

Astuti, R. W. (2019). Hematokrit dan Kadar Hemoglobin dengan Konsumsi Oksigen Maksimal (VO_2Maks) pada Atlet Remaja. *Medika Respati: Jurnal Ilmiah Kesehatan*, 14(2), pp: 151-161. https://doi.org/10.35842/mr.v14i2.250.

Ginting, A. A., Liben, P. (2016). Kadar Hemoglobin, Hematokrit dan Malondialdehyde (MDA) Eritrosit pada Aktivitas Submaksimal. *Jurnal Ilmu Keolahragaan.*11 (1), 53-54.

Kiswari, R. (2014). *Hematologi dan Tranfusi*. Jakarta : Penerbit Erlangga

Laluyan, R.E., Assa, Y.A., Paruntu, M.E. (2016). Gambaran Kadar Besi Darah Pada Pekerja Bangunan. *Jurnal e-Biomedik*, 4(2). https://doi.org/10.35790/ebm.v4i2.14614.

Mondal, H and Lotfollahzadeh, S. (2023). *Hematocrit*. New York: StatPearls Publishing.

Mukarromah, S.B. (2010). Pengaruh Senam Aerobik Intensitas Sedang Terhadap Kadar Eritrosit dan Hematokrit Darah. *Prosiding Seminar Nasional Universitas Muhammadiyah Semarang 2010*.

Nerisandi, N. R. (2021). Perbandingan Kadar Hematokrit Sebelum dan Sesudah Melakukan Aktifitas Fisik. *KTI*. Palembang. Palembang.Poltekkes Kemenkes Palembang.

Putra, K, P., Al Ardha, M, A., Kinasih, A.,dan Aji, R, S. (2017). Korelasi Perubahan Nilai VO2max, Eritrosit, Hemoglobin dan Hematokrit setelah Latihan High Intensity Interval Taining. *Jurnal Keolahragaan*. 5(2), pp: 161-170. http://dx.doi.org/10.21831/jk.v5i2.14875.

Rasyidi, M.F., Mahmudiono, T., and Rachmah, Q. (2021). Hubungan antara Status Gizi, Risiko Anemia, dan Ketahanan Pangan dengan Produktivitas Pekerja Bangunan. *Media Gizi Kesmas*,10(1),40-47. https://doi.org/10.20473/mgk.v10i1.2021.40-46.

Sihombing, M. and Riyadina, W. (2009). Faktor-Faktor yang Berhubungan dengan Anemia Pada Pekerja di Kawasan Industri Pulo Gadung Jakarta. *Media Peneliti dan Pengembang Kesehatan*. 19(3), pp:116-122.

Tiara, D., Tiho, M., and Mewo, Y.M. (2016). Gambaran Kadar Limfosit pada Pekerja Bangunan. *Jurnal e-Biomedik*, 4(2), pp:2-7

Tintinalli, J.,E. (2011). *Tintinalli's Emergency Medicine : a Comprehensive Study Guide*. New York