Original article

The Correlation between Hemoglobin Levels and Physical Fitness in Teenage Taekwondo Athletes

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Abstract

Background:Taekwondo is a sport which focused on endurance and strengths. In a taekwondo competition, an athlete with low level of physical fitness can cause fatigue due to decreased concentration in athletes during the match and will affectthe athlete's performance. One of factor which affect the physical fitness of athletes is hemoglobin levels. Low hemoglobin levels in athletes will inflict sports anemia because of lacking of oxygen binding ability and will interfere the oxygen transportation in every part of the cells inside the body. ***Objective:*** this study analyze the correlation between hemoglobin levels with physical fitness in teenage taekwondo athletes. ***Material and Methods:*** the study was used cross sectional design. The total of samples were 61 respondents and samples randomly selected. The data had collected which hemoglobin levels use cynameth blood test and physical fitness data using MFT (multistage fitness test) running test. Data analysis conducted by using bivariateanalysislike Spearman rank correlation test. ***Result and Discussion:*** the result has showed, there is a correlation between hemoglobin levels and physical fitness in taekwondo athletes for teenagers (p=00,27). The r value is 0,431 meansindicatethe strengthofcorrelationbetweenvariablesispositive. ***Conclusion:*** there is a correlation between hemoglobin levels and physical fitness in teenage taekwondo athletes.

Keywords : Hemoglobin Level, Physical Fitness, Taekwondo Athlete

International Journal of Human and Health Sciences Vol. 06 No. 02 April'22 Page : 204-207
DOI: http://dx.doi.org/10.31344/ijhhs.v6i2.447

Introduction

Taekwondo has developed into a modern olympic fighthing sport, the physical and physiological training of modern taekwondo competition required a competent athletes in several aspects of fitness[1]. Taekwondo is a sport which focused onenduranceand strength[2]. In taekwondo competition, foranathleteswho has a low levels of physical fitness will affect a fatiguebecauseofthere is a decreasing in concentration level among athlete sduringmatchesandwillbe affecting athletes performance[3]. The form factor whom affect the physical fitness for the athletes are nutritional status, hemoglobin levels, physical activity, age, gender, genetic, food and smoking habits[3]. However physiologically and low hemoglobin levels for an athlete will have caused sport anemia because of lack of ability to bind oxygen so it willinterfere the oxygen transportation in every part of the cells inside the body[4].

The effect of oxygen transportation inside the cell, it will be affected with VO_{2max}, it means the aerobic endurance described capabilityof heart, lungs and blood circulation and the body's metabolic needs. The adequacyofoxygenitdepends from the ability of hemoglobin tobindoxygen, because 97% ofoxygenistransportedby hemoglobin and will be affecting the

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amountofoxygentransportationandVO_{2max} levels[5].

Hemoglobin is an oxygen-carrying system inside the body who has a huge contribution for VO_{2max}[7]. During the process of transporting oxygen in hemoglobin, if there is a lack of oxygen supplier inside the body, it will be disrupted of energy metabolism because every muscle needs an oxygen to burn the glycogen, and the lack of oxygen caused the body to produced lactic acid. The more lactic acid supplied, it will be stockpiled in the muscles resulting in muscle fatigue[1]. An athletes who have frequently tired, was a sign of their level of physical fitness was low[7].The research was conducted by Priambodo[8] stated that 93,24% of taekwondo athletes in Sukoharjo regency have a poor physical fitness. In this study, the reseacher intended to conduct research about relationship between hemoglobin levels and physical fitness in teenage taekwondo athletes.

Material and Methods

This study was used a cross-sectional design with the research subjects are teenagers who are the taekwondo athletes. The population were 120 teenagers whichplacedat Sukoharjo taekwondo trainingcenter, CentralJava. Sampling was obtained by systematic random sampling with sample about 61 taekwondo athletes. This research has been done on May 2021 at the training center of the taekwondo club, Mahameru Sukoharjo, Central Java, Indonesia. The inclusion criteria were athletes between 10-18 years old, did not experience any kind of physical injury and were willing to participate in the study. The exclusion criteria were menstruating female athletes. The independent variable is a hemoglobin levels and the dependent variable is a physical fitness.

Hemoglobin levels data have obtained by taking blood samples and being tested using a spectrofotometer with a cyanmethhemoglobin method. The measurement result of hemoglobin levels with measuring scale for male > 13,0 gr/dl and female >12,0 gr/dl from WHO 2010.Physical fitness data collection techniques in this study usedVO_{2Max}measurement test with *Bleep Test* or *multistage running test,*this instrument uses a flat track along 20 meters, rhythm bleep and tape recorder, running barrier, stopwatch, MTF form. First, the subject is in a multi-stage running test to determine of the levels and of back and forth, to saw VO_{2Max} values then entered into the VO_{2Max} assessment norm, then the maximum aerobic endurance estimate for the subject is adjusted according to the assessment norm as follows :

Table 1. VO_{2Max} Assesment and Clasification

Category	VO_{2Max}	
	Male	**Female**
Very bad	<43,40	<39,10
Bad	43,30-49,10	39,20-44,10
Average	49,20-55, 00	44,20-49,20
Very good	55,10-60,90	49,30-54,20
Excellent	>61, 00	>53,30

Source:Perkembangan Olahraga Terkini, Jakarta, 2003

The research has been aproved by health ethics commite if the medical faculty of Muhammadiyah University of Surakarta, number 3566/B.1/KEPK-FKUMS/V/2021.Data analysis has divided into univariate analysis and bivariate analysis. Univariate analyisi in this study were used for describing all research variables. Univariate analysis was analyzed based from the characteristicsof the respondents include sex, age, tea consumption and consumption of supplements. Bivariate analysis were used the Spearman rank test to decribe the relationship between data has been collected and analyzed by using the SPSS 16.0 program like Spearman's rank relationship test, the variable with a p value < 0.05 has declared to be significantly related.

Results

Characteristics of research subjects

Table 1 showed, the data on the caracteristics of respondents based on sex, age, tea consumption and consumption of supplements for 61 respondents.

Table 2. Characteristics of research respondents

Variable	N	%
Sex		
Male	28	45,9
Female	33	54,1
Hemoglobin levels		
Normal	55	90,2
Abnormal	6	9,8
Phisycal Fitness (VO_{2Max})		
Very bad	0	0, 0
Bad	4	6,6
Average	7	11,5
Very Good	14	23,0
Excellent	36	59,0

Table 2 showed, the percentage of respondents

wa male 45,9% and female was 54,1% with range 10 year to 18 years. Respondens who have a normal hemoglobin level of 90,2% and most of the respondents have very good hysical fitness category as many as 59% respondents.

Table 3. The Correlation Between Hemoglobin Level and Physical Fitness

	Phisycal Fitness											
Hemoglobin levels	Very bad		Bad		Average		Good		Very good		P value	R value
	N	%	N	%	N	%	N	%	N	%		
Normal	0	0	4	7,3	6	10,9	12	21,8	33	60	0,027	0,283
Abnormal	0	0	0	0,0	1	16,7	2	33,3	3	50		
Total	0	0	1	6,6	7	11,5	14	23,0	36	59		

[1]*Rank Spearman*

Based on table 3, athletes who have normal hemoglobin levels, it has very good level of physical fitness which about 60%. It was stated there is a correlation between hemoglobin level and physical fitness in taekwondo athletes for teenagers, with p value is 0,027 and the r value is 0,283.

Discussion

There is a correlation between hemoglobin levels and physical fitness in taekwondo athletes for teenagerswith p value 0,027. The r value is 0.283 indicated the strength of the unidirectional correlation, namely the higher thehemoglobin level, and better physical fitness. In line with research conducted by Mahastuti et al, (2018) which stated there was a significant correlation between hemoglobin level and physical fitness level in basketball athletes at Semarang State University[10].

Optimal physical fitness upon athletes could be improving athlete performance and reducing the possibility of injury. The most influential component regards to person's fitness is cardiorespiratory endurance. Cardiorespiratory endurance is the ability of the heart, lungs and the blood vessels to work optimally at rest phase and during exercise phase for taking an oxygen to distribute into active tissues and being needed for the body's metabolic[11].

VO_{2max} is an aerobic endurance which described the ability of the heart, lungs and blood to take in of the circulation and eliminate the body's metabolic needs[12] . VO_{2max} or also called the maximum oxygen capacity of the body to get oxygen during exercise, indicated as a level of physical fitness from an athletes. For an athlete, it might have a greater VO_{2max} than a common person in general, which mean the maximum performance could have been achieved[13]. VO_{2max}has closely related to a person's hemoglobin levelThe adequacy of oxygen is depended from the ability of hemoglobin to bind the oxygen[12].

Hemoglobin is a protein contains an iron were responsible for transporting oxygen from the lungs to the body tissues, if the body has been lacking of the oxygen, it would be cause of shortness of breath[13].Hemoglobin affects the oxygen-carrying capacity in the blood. Every athlete needs more oxygen to burn carbohydrates and producing more energy for training and matches. Energy for metabolism in the body will be disrupted if the oxygen supply in the body was low, because the muscles need oxygen to burn glycogen. The lack of oxygen may cause the body producing some lactic acid could be risking get fatigue and affected the athletes performances[2]. The lack of hemoglobin could be affecting the amount of oxygen which is transported and would affected the VO_{2max}. A women who have a lower hemoglobin level than a men, by means a gender has had an effect between hemoglobin and VO_{2max}level[14].

Conclusion :

The results for this study was highlighted by means the taekwondo athletes for teenagers who have a good hemoglobin level, might be get an opportunity for having an optimal physical fitness. As the wish in the future, Taekwondo athletes could improving their performance by maintaining their physical fitness level by doing

a good lifestyle such as avoid smoking, fulfilled their nutrition status, and proper exercise

Authors' Contribution:

Data gathering and idea owner of this study: Authors 1 Isnanda Putri Nur Istiqomah

Study design: a quantitative observational with a cross sectional design study

Data gathering: The data gathering subjects were taken using the systematic random sampling The data gathering subjects was carried out by author and assisted by two enumerators.

Writing and submitting manuscript: writing manuscript performed by author 1 Isnanda Putri Nur Istiqomah

Editing and approval of final draft: Author 2 AgusKristiyanto and author 3 TonangDwiArdyanto

Conflict of Interest

Authors state no conflict of interest.

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