INDONESIAN JOURNAL OF SPORT MANAGEMENT
Department of Physical Education, Universitas Majalengka, Indonesia
ISSN 2776-706X.

Contribution of Hemoglobin Levels and Lung Capacity to Maximum Oxygen Uptake Ability

Haripah Lawanis[1A-C], Yogi Setiawan[2BD], Hilmainur Syampurma[3AB], Ali Mardius[4D], Yuni Astuti[5D]

[1234]Faculty of Sports Sciences, Padang State University, Indonesia
[4]Physical Education Study Program, Universitas Bung Hatta, Indonesia

ABSTRACT

The problem in this study is based on field observations; the ability of West Sumatra Hockey athletes to take oxygen could be much higher. Internal factors and external factors of the athlete influence this. One of these internal factors is the physical condition related to the ability to take oxygen optimally. This study aims to determine the contribution of hemoglobin levels and vital lung capacity to the maximum oxygen uptake ability (VO2 max) of West Sumatran Hockey athletes. This research method is a quantitative method using a correlational research design. The population in this study is West Sumatran Hockey. In contrast, the sample in this study was taken using a total sampling technique, namely West Sumatran Hockey, who will participate in the 20222 National Championship, totaling 24 people. The instrument for collecting data for hemoglobin levels was a spectrophotometer and a rotary spirometer for vital lung capacity, while for VO2 max, an intermittent recovery test was used. The data was analyzed using correlation analysis techniques, simple regression, correlation, and multiple regression. The results of data analysis showed that: (1) Hemoglobin contributed to the VO2 max ability of West Sumatra Hockey by 21.73%. (2) Lung vital capacity contributes to West Sumatra's VO2 max Hockey ability by 16.46%. And (4) Hemoglobin and vital lung capacity jointly contribute to the ability of VO2 max by 25%.

Keywords: Hemoglobin; Vital Lung Capacity; VO2Max

Corresponding author:
*Haripah Lawanis, Faculty of Sports Sciences, Padang State University, Indonesia
Email: hilmainursyam@fik.unp.ac.id

Article History:
Submitted: March, 2024
Accepted: April, 2024
Published: May, 2024

Authors' contribution:
A) Conception and design of the study;
B) Acquisition of data;
C) Analysis and interpretation of data;
D) Manuscript preparation;
E) Obtaining funding.

Cite this article:
Lawanis, H., Setiawan, Y., Syampurma, H., Mardius, A., & Astuti, Y. (2024). Contribution of Hemoglobin Levels and Lung Capacity to Maximum Oxygen Uptake Ability. *Indonesian Journal of Sport Management*, 4(2), 232-238. https://doi.org/10.31949/ijsm.9908

INTRODUCTION

Indonesia is a country that has long participated in developing the sport of Hockey. Hockey has been competed nationally since December 1950. Until now, the national level hockey sports championship has been contested every year while various international championships have been participated in by the Indonesian Hockey Team recently, including the Men's and Women's Junior AHF Cup, which will be held in Oman and Kazakhstan in early 2023 and late 2022.

West Sumatra is one of the 15 provinces that plays an active role in efforts to improve the achievements of the sport of hockey. However, West Sumatra's accomplishments at the national level are in the low category, possibly due to several factors, including the need for more competent human resources in their fields. Skilled human resources are the initial capital needed to improve achievement. With their expertise, it is hoped that the development of sports and achievements in Indonesia will increase.

Two (2) factors support the realization of an achievement: (1) Athlete Internal Factors and (2) Athlete External Factors. The athlete's internal supporting factors in achieving achievements are (1) Technique, (2) Tactics, (3) Mental, and (4) Physical Condition. The relationship between these four factors that come from within the athlete is what will produce brilliant achievements. However, if one of these is fulfilled by an athlete, then sports achievements will be easier. In hockey games, especially field hockey, it takes 60 minutes to complete a match.

A good hockey player must have good physical condition and be well-trained. Denise Jenning (Taverner 2004), the physical preparation coordinator at the Victoria Institute of Sport and a former elite hockey player, explained that speed, aerobic and anaerobic abilities, and agility significantly contribute to the game of hockey. All field players need a solid aerobic base to develop other skills. Strong aerobic ability allows players to run throughout the game and provides the best opportunity for recovery.

Based on the results of researchers' observations, West Sumatra hockey athletes could not maintain their physical condition during the match, especially their endurance or aerobic ability. West Sumatra hockey athletes have yet to be able to keep up with the games of opponents from all over Indonesia.

This decrease in performance could be caused by several factors, including poor physical condition, in this case, the aerobic endurance ability, which is also thought to be influenced by the hemoglobin level in the athlete's blood, vital lung capacity, and the athlete's maximum oxygen uptake ability (Vo2 Mak). Very low hockey, which is thought to cause low aerobic ability or endurance of the athlete himself

This research is one of the leading research plans of Padang State University regarding the development of media, modules, and instruments, as well as the development of training programs in sports. The results of this research can contribute positively to coaches in creating training programs so that the goal of improving the performance of West Sumatra Hockey athletes is achieved.

The activity stages and steps are presented in the following activity roadmap:

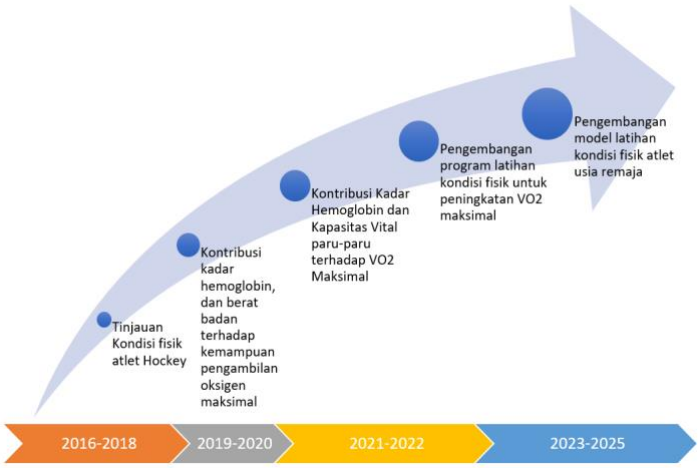

Figure 1. Research Road Map

A search of relevant research will show the state of the art. From various research results regarding maximum oxygen uptake capacity (VO2Max), researchers found several differences in training requirements and scientific stages. The following research is relevant to the research that will be carried out: The relationship between vital lung capacity and hemoglobin levels with VO2Mak in people who do yoga (M

Mumtaz: 2014). Profile of maximum oxygen volume levels and hemoglobin levels in Yongmoodo Tangerang Military Academy athletes (Rismayanti: 2016). Analysis of conventional and electric smokers' vital lung capacity, hemoglobin levels, and oxygen saturation (Ariyanto: 2019). Contribution of Hemoglobin to the VO2 Value of SMA N 3 Sidoarjo Students (Jannah: 2020). Physical Condition of West Sumatra Hockey Athletes (Haripah: 2019). The position of this research and the research that the researchers will carry out is to look at the relationship between one of the research variables and the Maximum Oxygen Uptake Ability (Maximum VO2). However, the difference here is that the researcher will focus this research on how far two interrelated variables simultaneously contribute to the Maximum Oxygen Uptake Ability (Maximum VO2) in West Sumatran hockey athletes.

METHOD

This research is classified as quantitative research using correlational and regression analysis techniques to reveal the relationship and contribution of two independent variables to the dependent variable.

In line with correlational research, this research reveals the relationship between variables according to the actual situation. The analysis continues by calculating the contribution of the independent variable to the dependent variable through the determination index, namely r2 x 100%. The independent variables in this study are hemoglobin levels and vital lung capacity; the dependent variable is West Sumatra hockey athletes' maximum oxygen capacity (Maximum VO2).

This research was carried out in October – November 2021 at Campus II UNP Lubuk Buaya, Padang City. The instrument used in this research was the Hemoglobin Level Instrument using a Spectrophotometer (Dameuli: 2018). The Lung Vital Capacity Instrument uses a Rotary Spirometer (Bi, C., Zhang: 2020), and the maximum VO2 instrument uses a Multistage Running Test (MFT). (Davies, R. C.: 2008). The results of measuring the amount of maximum oxygen uptake are recorded based on the shuttle level achieved by the hockey athlete using the MFT Calculation Form.

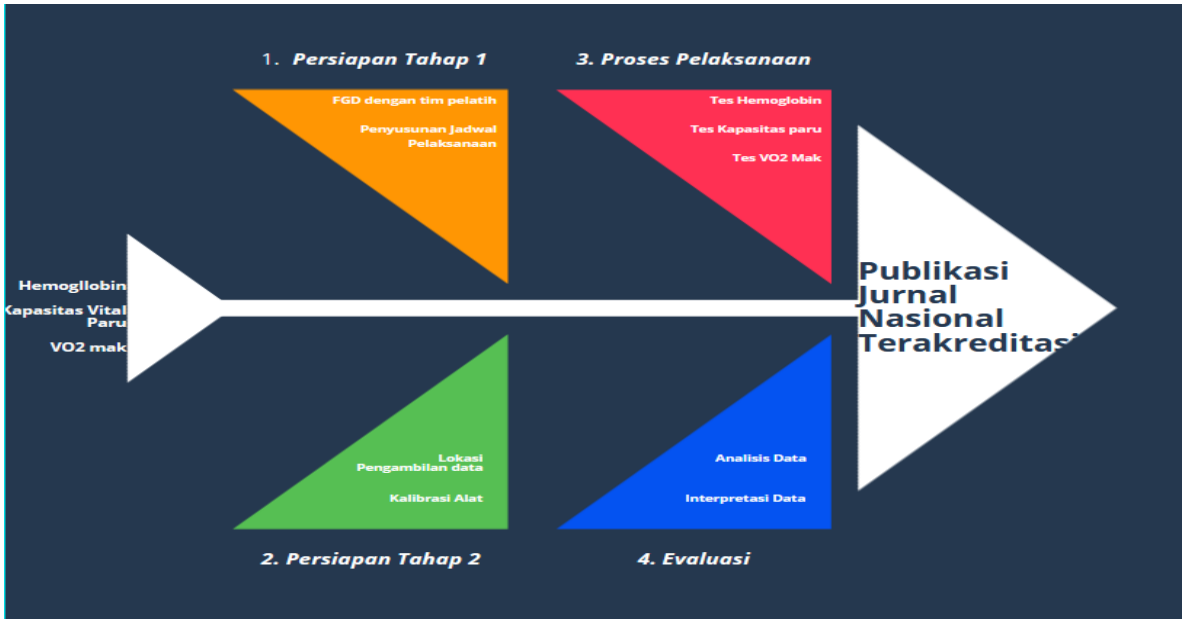

Figure 2. Fishbone

The flow of implementation of research activities is in fishbone broken down into a flow diagram according to the sequence of activity implementation. For more details, please see figure 2:

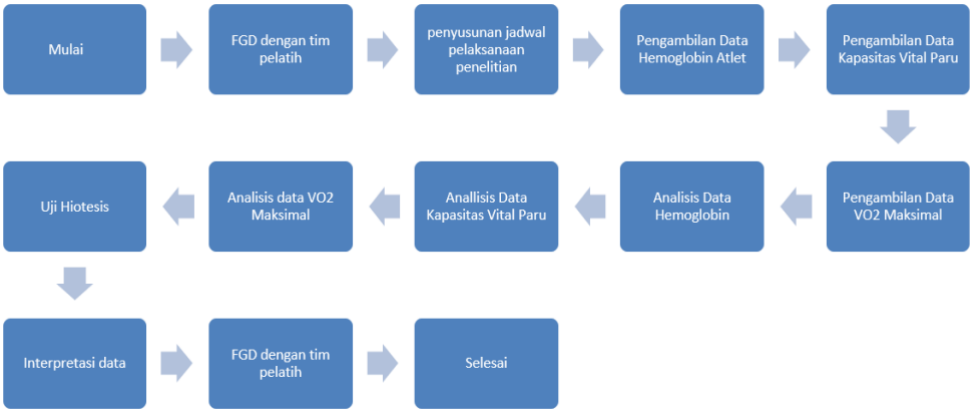

Figure 3. Flow diagram of research implementation

RESULTS

In this section, a description of the data will be presented consisting of: Hemoglobin (X1) and Vital Lung Capacity (X2) as independent variables and VO2 max as the dependent variable (Y)

Analysis of the Hemoglobin variable, obtained average = 13.95, standard deviation = 0.78, highest value 15.9, and lowest value 12.4. The details can be seen in the table:

Table 1. Hemoglobin Frequency Distribution (X1)

No	Interval class	Frequency	
		Absolute	Relative (%)
1	12,40 – 12,98	2	8.33
2	12,99 – 13,57	5	20.83
3	13,58 – 14,16	8	33.33
4	14,17 – 14,75	6	25.00
5	14,76 – 15,34	2	8.33
6	15,35 – 15,93	1	4.17
	Total	24	100

The table above shows that there are two people (8.33%) in the 12.40 – 12.98 group, five people (20.83%) are in the 12.99 – 13.57 group, eight people (33.33%) are in the 13 groups. .58 – 14.16, 6 people (25.00%) are in the 14.17 – 14.75 group, two people (8.33%) are in the 14.76 – 15.34 group, and one person (4.17%) is in the 15.35 – 15.93 group.

Analysis of the Vital Lung Capacity variable, obtained average = 4469.25, standard deviation = 692.55, highest value 5986, and lowest value = 3542. For more details, see table 2.

Table 2. Frequency Distribution of Vital Lung Capacity (X2)

No	Interval class	Frequency	
		Absolute	Relative (%)
1	3542 – 3949	5	20.83
2	3950 – 4357	8	33.33
3	4358 – 4765	5	20.83
4	4766 – 5173	3	12.50
5	5174 – 5581	0	0.00
6	5582 - 5989	3	12.50
Total		24	100

The table above shows that five people (20.83%) are in the 3542 - 3949 group, eight people (33.33%) are in the 3950 - 4357 group, five people (20.83%) are in the 4358 - 4765 group, three people (12.50%) are in the 4766 - 5173 group, three people (12.50%) are in the 5582 - 5989 group, and none have a vital lung capacity range in the 5174 - 5581 range.

Analysis of the VO2max variable, obtained average = 45.00, standard deviation 3.01, highest value 51.86, and lowest value 39.424. For more details, see table 4.

Table 3. VO2 max Data Frequency Distribution Table (Y)

No	Interval class	Frequency	
		Absolute	Relative (%)
1	39,42 – 41,57	3	12.50
2	41,58 – 43,73	6	25.00
3	43,74 – 45,75	4	16.67
4	45,76 – 47,91	8	33.33
5	47,92 – 50,07	2	8.33
6	50,08 – 52,23	1	4.17
Total		24	100

The table above shows that there are three people (12.50%) in the 39.42 – 41.57 group, six people (25.00%) in the 41.58 – 43.73 group, four people (16.67%) %) are in the 43.74 – 45.75 group, eight people (33.33%) are in the 45.76 – 47.91 group, two people (8.33%) are in the 47.92 – 50.07 group, and one person (4.17%) are in the 50.08 – 52.23 group.

Figure 2. Measuring hemoglobin levels

Figure 3. Lung Vital Capacity Measurement

Figure 4. VO2 Max Measurement

CONCLUSION

Based on the results of data analysis, the following conclusions can be drawn: Hemoglobin contributes to the VO2 max ability of UNP football athletes by 21.73%. Vital lung capacity contributes to the VO2 max ability of UNP football athletes by 16.46%. Hemoglobin and vital lung capacity contribute to VO2 max capacity by 25%.

CONFLICT OF INTEREST

All authors declare that this manuscript has no conflict of interest with any party.

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