

Effect of Hyperbaric Oxygen on Cardiovascular Endurance in Basketball Players

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Abstract. Competitive sports have become more professional, health technologies namely hyperbaric oxygen can help provide improved physical fitness. The purpose of this study was to determine the effect of hyperbaric oxygen on cardiovascular endurance. The type of research was quasi-experimental with a randomized controlled group pretest-posttest design. Cardiovascular endurance was measured by Multistage fitness test (MFT). Based on the results of data analysis it can be concluded that hyperbaric oxygen affects the cardiovascular endurance increase. Hyperbaric oxygen is more effective than the control group for increased cardiovascular endurance. Implications in this study for sports people can use hyperbaric oxygen as an alternative in increasing physical fitness.

Keywords: Hyperbaric Oxygen, Cariovaskuler Endurance

1. Introduction

Basketball is a sporting activity that has recently developed so fast. In terms of playing, basketball requires an aerobic energy system [1]. Physical fitness in playing basketball is needed in the circulatory system (heart, blood vessels and lungs), to deliver oxygen to the muscles that are working. Coaching a basketball player's performance requires a variety of exercises. Elements of the physical condition, namely the endurance of the heart, breathing, blood circulation, muscle endurance. Physical ability is needed to support movement of body members and to form skilled movements [2]. Physical fitness is an element of the physical condition that provides a very important role in sports especially in basketball.

Physical fitness is considered as one of the important health markers [3]. The metabolic process in an aerobic energy system takes place in the mitochondria through a series of aerobic glycolysis processes, Krebs cycles and electron transport systems. Metabolism in the aerobic system is very much determined by oxygen levels, if there is a lack of oxygen, the production of ATP as an energy source will be hampered, causing a decrease in strength and speed of contraction or muscle movement.

In improving the physical condition in the training program, it must be carried out carefully, systematically, regularly, and always increasing by following the principles, as well as accurate training methods, so that the program has been established in improving the physical condition of the players. One health technology that can help exercise performance is hyperbaric oxygen. Hyperbaric oxygen is a medical therapy in a room to breathe high pressure oxygen (100%) or

at high barometer pressure, this process is carried out at pressures of 1.5 ATA to 3.0 ATA for 60-120 minutes [4]. The average time for giving hyperbaric oxygen is for 60-90 minutes [5]. Hyperbaric oxygen has an important role in overcoming sports injuries [6].

Unbalanced oxygen needs will cause one's inability to meet their own needs [7]. Someone who has good cardiovascular endurance will be more maximal in using oxygen [8]. Hyperbaric oxygen can accelerate the recovery of tissue wounds [9]. Hyperbaric oxygen has been shown to help wound healing and reduce the risk of amputation. Giving hyperbaric oxygen for 3 sessions of 60 minutes can improve joint repair [6]. Two fundamental important effects on hyperbaric oxygen are: 1) mechanical effects increase environmental pressure which provides the benefit of decreasing the volume of gas or air bubbles such as decompression sufferers due to diving work accidents and gas emboli, which occurs in some home medical measures sick. 2) the effect of increasing oxygen partial pressure in the blood and tissues which provides therapeutic benefits: ostatic bacteria in anaerobic bacterial infections, detoxification in cases of acute ischemia, crush injury, compartment syndrome and cases of chronic ischemia, wounds that do not heal, radiation necrosis, skin graft preparation and burns [10]. Hyperbaric oxygen has long-term benefits by improving blood flow and helping new blood vessels [11].

Some competitive athletes use hyperbaric oxygen as part of the exercise, and in recovery after exercise [12]. Hyperbaric oxygen air pressure is greater than normal atmospheric air which is equal to 1 ATA (Absolute Atmospheric). Giving high pressure oxygen is carried out in the chamber or high pressure air chamber. Some athletes also use hyperbaric space as an alternative to the recovery process due to injury and recovery after training or competition. Hyperbaric oxygen in exercise can be one of the potential methods of increasing endurance for young players in soccer [12]. Important effects of giving hyperbaric oxygen to the health of the human body include hyperbaric oxygen capable of improving oxygen transport to tissue levels, improving the work of the cardiovascular system, improving the quality of training and sports performance [13]. The use of hyperbaric oxygen space for recovery allows athletes to recover faster and be able to improve body health in general, so athletes have greater physical performance. In medicine the sport of hyperbaric oxygen has been shown to be useful for producing energy, for rehabilitation and for injuries during exercise [14]. The purpose of this study was to determine the effect of hyperbaric oxygen on increasing cardiovascular endurance in basketball players. Based on the description above, the researchers were interested in conducting research on "The effect of hyperbaric oxygen on cardiovascular endurance in basketball players".

2. Methods

Randomized Controlled group pretest-posttest design as method of this experiment. To determine the number of samples according to the treatment group, a sampling technique is needed. Placement of samples in each group is done randomly. Those 40 from basketball club, Each group contains 20 players. Procedure study was carried out for 8 weeks with 24 times of meeting or 3 times of meeting each week with the frequency of giving hyperbaric oxygen 3 times. Instrument cardiovascular endurance measurements use the bleep test or Multi stage fitness test (MFT). Data analysis techniques were used to determine the effect of hyperbaric oxygen on cardiovascular endurance, using Analysis of Varians (Anova) models with a significance level of 5%. decision to reject the hypothesis at $\alpha = 0.05$.

3. Results And Discussion

The effect of hyperbaric oxygen on cardiovascular endurance in basketball players

Table 1. Results paired samples test in each group

Paired Samples Test								
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		T	df	Sig. (2-tailed)
				Lower	Upper			
1	-4.19500	4.25472	.95138	-6.18627	-2.20373	-4.409	19	.000
2	-4.73000	3.69368	.82593	-6.45869	-3.00131	-5.727	19	.000

From the 'mean' calculation, it was found that the results of endurance cardiovascular averages after receiving hyperbaric oxygen administration increased significantly. After testing the significance it turned out that the results were significant, it can be said that the administration of hyperbaric oxygen really had a positive effect on endovascular cardiovascular enhancement. Hyperbaric oxygen is a high pressure oxygen administration carried out in a high pressure air chamber. Players breathe high pressure oxygen (100%) or at high barometer pressure, this process is carried out at pressures of 1.5 ATA to 3.0 ATA for 60-120 minutes [4]. Hyperbaric oxygen has long-term benefits by improving blood flow and helping new blood vessels [11]. Giving hyperbaric oxygen into the body through gas exchange is expected so that the cellular matrix in the body gets optimal conditions. Hyperbaric oxygen utilization can be promoted as a method of recovery and increase in physical fitness [15]. Hyperbaric oxygen with pressure of 1.5 ATA and 2.4 ATA can increase maximum aerobic capacity and aerobic resistance.

Table 2. Results analysis of varians (Anova)

Analisis of Varians (Anova)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	63.001	1	63.001	4.861	.034
Within Groups	492.503	38	12.961		
Total	555.504	39			

Testing the hypothesis of the calculation of the analysis of variance F count = 4.861 while the F table at the significance level of 4.098, it can be concluded that there are differences in the different effects between hyperbaric oxygen administration and the control group, on cardiovascular endurance. Giving hyperbaric oxygen can provide better results than the control group, in increasing cardiovascular endurance. From the results of the significance test using analysis of variance (Anova) states that there are significant differences between hyperbaric oxygen administration and the control group, in cardiovascular endurance.

Giving hyperbaric oxygen is still not widely used for basketball players in Indonesia. This hyperbaric oxygen is proven to be an alternative recovery exercise and preparation to improve the player's physical condition. Oxygen chamber with high pressure will allow oxygen to dissolve in the body which increases oxygen levels in the blood plasma. Hyperbaric oxygen is one of the effective methods used by athletes at this time. Hyperbaric oxygen works by stimulating the condition of the athlete's body to the level of the cell and increasing the ability of the body's tissues so that after several muscle exercises it can be repaired and the brain will function better with oxygen sufficiency.

Having good aerobic endurance is an important element that must be possessed by players [15]. Characteristics of basketball are when players are playing basketball, they need anaerobic endurance, but to maintain conditions requires aerobic endurance, efforts to development and aerobic endurance, especially with the use of hyperbaric oxygen methods, can provide maximum results.

Thus, training for giving hyperbaric oxygen is better in increasing cardiovascular endurance. These findings are consistent with the findings of relevant research results. That hyperbaric oxygen administration can improve oxygen transport to tissue levels, improve the work of the cardiovascular system, improve the quality of sports training and performance [13]. Hyperbaric oxygen can be used as a reference for improving physical conditions.

4. Conclusion

Based on the results of research and data analysis, it can be concluded that there is a significant effect on giving hyperbaric oxygen to increase cardiovascular endurance in basketball players. Giving hyperbaric oxygen to basketball players has a better effect than the control group on increasing cardiovascular endurance. The use of hyperbaric oxygen can be promoted as part of the training program as an alternative recovery and in improving the physical condition of the player.

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