Original Article

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Implementation of aquatic exercise in improving v02max of indoor hockey athletes

Daffa Ahmad Noor RS [1ABCDE] Irwan Hermawan[2. CDE,] , Alam Hadi Kosasih[3BCDE]

[1] Universitas Garut
[2] Universitas Garut
[3] Universitas Garut

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Abstract: This study aims to determine the effect of aquatic exercise training on increasing VO_2max of indoor hockey athletes in Garut Regency. The research method used is quantitative with a quasi-experimental design using a one-group pretest–posttest design. The study sample consisted of 15 athletes selected using a total sampling technique. The aquatic exercise training program was carried out for 1 month with a frequency of 3 times a week. VO_2max measurements were carried out using the Bleep Test before (pre-test) and after (post-test) training. The results showed that the average value of VO_2max athletes in the pre-test was 42.07 ml/kg/minute, increasing to 45.73 ml/kg/minute in the post-test. In addition, there was an increase in the category of VO_2max athletes from the category of sufficient to good and very good after participating in the training program. Based on the results of the study, it can be concluded that aquatic exercise training can increase VO_2max or aerobic capacity of indoor hockey athletes in Garut Regency. Training in water provides resistance that helps improve muscle work and the cardiovascular system so that the body is more efficient in using oxygen during physical activity.

Keywords: Aquatic, Exercise, VO_2max, Hockey, Training

Corresponding author: Daffa Ahmad Noor Rs, daffaahmadnoorrs@gmail.com

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INTRODUCTION

Athletes in various sports, especially team sports that are highly intense and last for long durations, require a high level of aerobic fitness. VO_2max, or maximal oxygen consumption, is the main indicator of aerobic fitness and is directly related to the cardiorespiratory capacity and endurance of athletes in performing sports activities that require high stamina. Aerobic training, interval training, and high-intensity exercise have long been used to improve VO_2max (Attamimi et al., 2024).

The term 'Aquatic Therapy' refers to water-based exercise or therapy aimed at therapeutic purposes, particularly for relaxation, strength improvement, and physical conditioning. The body is influenced by the physical properties of water such as buoyancy, hydrostatic pressure, viscosity, and surface tension (Kurniawati & Widayati, 2021). However, exercise in a water environment, also known as aquatic exercise, has begun to be considered as an alternative or complementary form of land-based training.

Exercise in water is different because water provides resistance, which strengthens the heart and muscles without placing excessive stress on the joints. Previous studies have shown that water-based exercise can improve cardiovascular function and VO_2max in individuals with certain conditions (Alikhajeh et al., 2025).

Aquatic exercise has been proven to improve cardiovascular function through increased cardiac output, efficiency of oxygen utilization, and adaptation of the respiratory system (Gobbi et al., 2020). There is evidence that aquatic exercise training can increase VO_2max through improvements in cardiac output and cardiovascular responses. However, most research on aquatic exercise has focused on the general population or clinical groups.

Indoor hockey involves frequent and intense changes of direction and speed; therefore, good aerobic capacity is essential for athletes. VO_2max greatly influences an athlete's ability to maintain game intensity, perform repeated sprints, accelerate recovery between substitutions and periods, and maintain technical and tactical performance during matches (Azhar, 2021). Increasing VO_2max can help athletes maintain game intensity, accelerate recovery between periods, and reduce fatigue (Tohari et al., 2025).

MATERIAL AND METHODS

This study used a quantitative research method with a quasi-experimental design. The design used was a one-group pretest–posttest design, in which one group of subjects was given an initial test (pretest), then given treatment in the form of an aquatic exercise program, and then given a final test (posttest). Subject selection was carried out using a total sampling technique based on inclusion criteria, namely athletes who were willing to participate in the program. Aquatic Axersie training was carried out three times per week for one month at the Augusta pool, Garut. VO_2max measurements were carried out using the Bleep Test before and after implementing the Aquatic Axersie Training program. This design was chosen because it allows researchers to systematically determine changes and improvements in athletes' VO_2max before and after being given aquatic exercise treatment (Abraham & Supriyati, 2022).

RESULTS

This study was conducted in April 2026 at the Augusta swimming pool used for aquatic exercise training programs in Garut Regency. The subjects in this study were indoor hockey athletes from Garut Regency who actively participated in regular training. The number of samples in this study was 10 athletes who met the research inclusion criteria. The initial test (pre-test) was conducted in May before the aquatic exercise training program was given, while the final test (post-test) was conducted in April after the training program was completed. The data obtained from this study were data from the results of VO_2max measurements of athletes that described the conditions before and after being given treatment in the form of aquatic exercise training.

Tabel 1. Research Data

	N	Minimum	Maximum	Mean	Std. Deviation
FREETEST	15	37	49	42,07	3,826
POSTTEST	15	40	55	45,73	4,832
Valid N (listwise)	15				

Based on Table 1 Descriptive Statistics, the number of samples in this study was 15 athletes. The pretest results showed a minimum score of 37 and a maximum of 49, with an average score (mean) of 42.07 and a standard deviation of 3.826. After being given treatment, the posttest results showed a minimum score of 40 and a maximum of 55, with an average

(mean) of 45.73 and a standard deviation of 4.832. Based on these average values, it can be seen that there was an increase in the average from 42.07 in the pretest to 45.73 in the posttest, which indicates an increase in results after being given treatment in the study.

Table 2. Pre-Test Results Based on VO_2Max Category

Pree Test		
Kategori	Rentang Vo2Max (ml / kg/ min)	Jumlah Atlet
Sangat Bagus sekali	>55	
Sangat Bagus	51-55	
Bagus	46-50	3
Cukup	41-45	12
Kurang Sekali	<41	
Total		15

The results of the VO_2max pre-test of indoor hockey athletes in Garut Regency showed that out of a total of 15 athletes, most were in the sufficient category with a VO_2max range of 41–45 ml/kg/minute, namely 12 athletes. Meanwhile, there were 3 athletes who were in the good category with a VO_2max range of 46–50 ml/kg/minute. There were no athletes who were in the very good category (>55 ml/kg/minute), very good (51–55 ml/kg/minute), or very poor (<41 ml/kg/minute). Based on this distribution, it can be seen that the level of aerobic fitness of athletes before being given aquatic exercise treatment was still dominated by the sufficient category, so a training program is needed that can increase the athlete's VO_2max capacity.

Table 3. Post-Test Results Based on VO_2Max Category

Post Test		
Kategori	Rentang Vo2Max (ml / kg/ min)	Jumlah Atlet
Sangat Bagus sekali	>55	
Sangat Bagus	51-55	3
Bagus	46-50	5
Cukup	41-45	7
Kurang Sekali	<41	
Total		15

The post-test results of the VO_2max of indoor hockey athletes in Garut Regency showed a more varied distribution of fitness categories after being given aquatic exercise treatment. Of the 15 athletes, 7 athletes were in the sufficient category with a VO_2max range of 41–45 ml/kg/minute. Furthermore, 5 athletes were in the good category with a range of 46–50 ml/kg/minute, and 3 athletes were in the very good category with a range of 51–55 ml/kg/minute. There were no athletes included in the very good category (>55 ml/kg/minute) or very poor (<41 ml/kg/minute). Based on these results, it can be seen that after being given the aquatic exercise training program, there was an increase in the VO_2max category in several athletes who were previously in the lower category, thus indicating an increase in the athletes' aerobic fitness capacity.

Tabel 5. Normality Test Result Data

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1,177E-013	,000		,000	1,000
	FREETEST	1,000	,000	,452	37636255,347	,000
	POSTTEST	1,000	,000	,571	47536773,979	,000
a. Dependent Variable: TOTAL						

Based on the Normality table, the pretest and posttest variables significantly influenced the total variable, with a significance value of 0.000 (<0.05). Standardized Coefficients (Beta) values indicate that the posttest (0.571) had a greater influence than the pretest (0.452). This indicates that the posttest results made a stronger contribution to increasing the total score.

Tabel 6. Hypothesis Test Result Data

	N	Minimum	Maximum	Mean	Std. Deviation
FREETEST	15	37	49	42,07	3,826
POSTTEST	15	40	55	45,73	4,832
Valid N (listwise)	15				

Based on Table 6 of the hypothesis test results, it can be explained that the average (mean) pretest value of 15 athletes was 42.07 with a minimum value of 37, a maximum of 49, and a standard deviation of 3.826. Meanwhile, in the posttest, the average value was 45.73 with a minimum value of 40, a maximum of 55, and a standard deviation of 4.832. These results indicate that there was an increase in the average VO_2max value of athletes after being given aquatic exercise training, from 42.07 in the pretest to 45.73 in the posttest.

DISCUSSION

This study was conducted on 15 indoor hockey athletes from Garut Regency. VO_2max was measured using the Bleep Test (pre-test) and after a one-month aquatic exercise program, three times a week, (post-test).

The results showed that the average VO_2max in the pre-test was 42.07 ml/kg/minute, with a minimum score of 37 and a maximum score of 49. After aquatic exercise, the average post-test score increased to 45.73 ml/kg/minute, with a minimum score of 40 and a maximum score of 55. This indicates an increase in VO_2max after the training program.

In terms of VO_2max, the majority of athletes were in the fair (12 athletes) and good (3 athletes) categories in the pre-test. After training, there was an increase in the post-test categories, with 7 athletes in the fair category, 5 athletes in the good category, and 3 athletes in the very good category.

This increase in VO_2max indicates that aquatic exercise can improve athletes' aerobic capacity. Training in water provides resistance, which helps improve muscle and cardiovascular function, allowing the body to use oxygen more efficiently during physical activity. By increasing VO_2max, athletes can maintain game intensity and reduce fatigue during matches.

CONCLUSION

Based on the research results, it can be concluded that aquatic exercise training significantly improved the VO_2max of indoor hockey athletes in Garut Regency. This was evident in the increase in the athletes' average VO_2max from 42.07 ml/kg/minute in the pre-test to 45.73 ml/kg/minute in the post-test after participating in the training program for one month.

Furthermore, there was an improvement in the athletes' fitness levels, with several athletes previously in the fair category improving to good and very good. Therefore, aquatic exercise training can be an effective training method for improving athletes' aerobic capacity and endurance.

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