

# Improve Vo2max And Arm Strength Of Handball Athletes

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**Abstract.** This study aims to increase Vo2Max and hand strength of handball athletes. This research is a pretest and posttest experimental research. The population in this study was the men's handball team of Lampung Province, totaling 18 athlete. The sample in this study used total sampling. The data obtained were then analyzed using SPSS (Version 21) to assess differences in physical conditions before and after treatment. The significant level at 0.05. High intensity interval training (HIIT) & Sprint Interval Training (SIT) workouts significantly increase VO2Max endurance. Body weight training exercises significantly increase hand strength endurance. The coach has to pay attention to two things: first, whether the measurement test is by the characteristics of the handball. Second, the athlete's performance in this research must improve by the treatment. There needs to be a particular measurement test instrument for handball athletes. Various treatments to improve athlete performance need to study in much literature.

**Key words:** Vo2Max1; Arm Strenght, Handball

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## INTRODUCTION

Handball is a team sport characterized by high-intensity play both in defense and attack. In addition, handball has many movements, such as sprinting, turning, throwing, blocking, pushing, grabbing, and jumping (Fernández et al., 2017; Iacono et al., 2015; Karcher & Buchheit, 2014; Ortega-Becerra et al., 2017). Handball athletes must have a high level of physical condition toward peak performance.

Achievement is one of the efforts developed in coaching. Sports achievement is sports coaching through aspects of training, namely physical, technical, tactical, and mental aspects (Capranica & Millard-Stafford, 2011; Harsono, 2016). The aspect of physical condition is an essential aspect but has a crucial role in supporting the exercise aspect (Iwasaki et al., 2003). Factors of quality and physical condition are demands of every sport, especially handball.

Good physical quality will directly support the quality of motion displayed (Wilson et al., 2012). Physical condition training is an exercise process to develop physical mobility abilities systematically and progressively improve to

Introduction Include: The important issues in general and specifically encountered, Research that has been done as the references and what has not been done (research gap), The solution offered, the importance of research conducted, The research purposes, The research benefits to

maintain or increase the degree of physical fitness to achieve work abilities with the expected goals tailored to each sport's needs (Bray et al., 2009; Faigenbaum et al., 2001). In addition, physical fitness is an essential thing that shows the health condition of young and adult athletes (Ortega-Becerra et al., 2017). Thus, in the past decade, several countries have promoted the improvement of the physical fitness of young athletes (Mayorga-Vega et al., 2013). *Physical fitness* is a set of attributes related to a person's ability to perform physical activities, such as cardiorespiratory endurance, strength, flexibility, speed, and power (Lee et al., 2018). Physical quality, physical condition, and fitness are the most important factors supporting athlete achievement.

Based on the results of previous research (Bhakti & Adi S, 2022), the physical condition of male handball athletes is in the "less" category. Some items that are lacking are VO2Max endurance and Hand Strength Endurance. This study aims to provide treatment to increase the less variable based on these results.

the science/society.

## METHODS

This research is an experimental study with a pretest-posttest design. This design uses only one experimental group and no control group. This

study looked at the treatment's effectiveness and the differences between the pretest and posttest. The population in this study was the men's handball team of Lampung Province, totaling 18 people. The sample in this study used total

sampling. The treatment is four times a week until five weeks or 18 meetings, including the pretest and posttest. All participants did the exercise in the morning by warming up before doing the treatment. Treatment in the following table:

**Table 1.** Treatment Description

Item	Treatment	Duration
Warm Up	Proprioceptive Neuromuscular facilitation (PNF)	3 Minute
VO2Max	HIIT (Burpee, Mountain Climber, step over, Jumping jack) & Fartlek	5-25 Minute
Endurance	Push Up, Tricep Dip, Punches, Shoulder Tap	15 reps x 3-5 set
Cool Down	Stretching	3 Minute

The interventions are hybrid (Offline and online). Several interventions to the trainer's training program and several stakeholders agreed to the treatment.

**Tabel 2.** Treatment Details

Session	Description	Duration
1	Physical Conditioning Pre-test	One Day
2-4	Warmup	3 Minute
	HIIT (Burpee, Mountain Climber, step over, Jumping Jack)	5 Minute
	Fartlek	5 Minute
	Push Up, Tricep Dip, Punches, Shoulder Tap	15 x 3 Set (Rest 90 Sec)
5-7	Colling Down	3 Minute
	Warmup	3 Minute
	HIIT (Burpee, Mountain Climber, step over, Jumping Jack)	10 Minute
	Fartlek	7 Minute
	Push Up, Tricep Dip, Punches, Shoulder Tap	15 x 3 Set (Rest 1 Min)
8-10	Colling Down	3 Minute
	Warmup	3 Minute
	HIIT (Burpee, Mountain Climber, step over, Jumping Jack)	15 Minute
	Fartlek	7 Minute
	Push Up, Tricep Dip, Punches, Shoulder Tap	15 x 4 Set (Rest 1 min)
11-13	Colling Down	3 Minute
	Warmup	3 Minute
	HIIT (Burpee, Mountain Climber, step over, Jumping Jack)	20 Minute
	Fartlek	9 Minute
	Push Up, Tricep Dip, Punches, Shoulder Tap	15 x 4 Set (Rest 45 Sec)
14-17	Colling Down	3 Minute
	Warmup	3 Minute
	HIIT (Burpee, Mountain Climber, step over, Jumping Jack)	11 Minute
	Push Up, Tricep Dip, Punches, Shoulder Tap	15 x 5 Set (Rest 45 Sec)
	Colling Down	3 Minute
18	Physical Conditioning Post-test	One Day

The data was processed based on each norm unit. The data is on a scale of 1-5. Posttest does at the 18th meeting.

**Table 3.** Handball Test Norms

Component	Method	Very Poor (1)	Poor (2)	Average (3)	Good (4)	Excelent (5)
Strenght Endurance	Push Up	<25	25-32	33-40	41-50	>50
Aerobic Endurance (VO2 Max)	3000 M Run	>19	17.01-19	15.01-17	13.46-15	<13.46

The data obtained were then analyzed using SPSS (Version 21) to assess differences in physical conditions before and after treatment.

The significant level at 0.05.

## RESULTS AND DISCUSSION

**Table 4.** Test Results for the Physical Condition of Handball Athletes

Item	Pre		Pos		P Value
	M	SD	M	SD	
Daya Tahan VO2Max	1.17	0.51	2.78	0.54	0.000
Daya Tahan Kekuatan Tangan	1.94	0.63	3.33	0.48	0.000

The table shows the difference in results before and after treatment on the two variables of  $0.000 < 0.05$ ; this treatment significantly increased VO2Max endurance and Handed Strength Endurance. VO2Max endurance with HIIT treatment (Burpee, Mountain Climber, Speed Squat, Jumping jack) & Fartlek significantly increased VO2Max endurance. Several studies of HIIT (High-Intensity Interval Training) (McRae et al., 2012) stated that most of the research focused on HIIT, which was primarily aerobic because cycling and treadmill running allowed more accurate job assessments to describe the training stimulus. Another prominent HIIT style developed for cardiac patients incorporates multiple 4-minute intervals separated by easy recovery of the same duration (Wisløff et al., 2009).

The results of these studies generally indicate superior cardiovascular benefits of HIIT compared to standard aerobic exercise training (Wisløff et al., 2009). One of the essential variables to consider when providing exercise is the intensity at which an athlete trains, as this metric strongly influences adaptation physiological and performance (Londeree, 1997). The distribution of exercise intensity in training programs has sparked great interest over the last decade (Seiler & Kjerland, 2006). Interval training can be very complex because performance improvements can be affected by manipulating several programming variables, including exercise mode, duration, intensity, recovery, number of intervals, and the frequency and distribution of interval training (Buchheit &

Laursen, 2013a, 2013b). Programming a specific training session specification, population characteristics such as age, gender, status, and training background can also affect performance gains (Buchheit & Laursen, 2013a, 2013b). Two forms of interval training commonly discussed in the literature are high-intensity interval training (HIIT) and Sprint interval training (SIT). HIIT consists of repeated bouts of exercise occurring at power output or speed in the severe intensity domain (Gaesser & Poole, 1996), occurring between the second ventilation threshold (VT2) and maximal oxygen consumption (VO2max) (Billat, 2001).

In cases where individual VO2max cannot be determined through exercise testing, peak oxygen consumption (VO2max) is used to indicate the upper limit of the domain. SIT is power output or speed above that associated with VO2max (Gibala et al., 2012). As such, it can be considered complete in intense training. This study combines HIIT and SIT. VO2max affects performance outcomes (Russell et al., 2004). An alternative measure, time-trial performance (TT), has shown a high correlation with endurance performance and can directly simulate the physiological response required during the competition (Russell et al., 2004). The advantage of such training is that it includes functional exercises that engage multiple muscle groups, which also help improve balance, prior perception, and flexibility (Pedersen et al., 2021).

Analysis of the subject's body composition revealed that the 10-week weight training program had caused a slight increase in body

mass (1.16%) and body fat percentage (2.43%). In contrast, muscle mass and body water percentage did not increase. Changed. These results may indicate that the training period is too short to cause positive changes in body composition determined by diet (about 80%) (Hoyos et al., 2011; Kerksick et al., 2009) Push-up exercises, tricep dips, punches, and shoulder taps increase hand strength endurance. Body weight training is another popular variant of HIIT adopted by many practitioners (Thompson, 2019), but limited research has examined the efficacy of simple body weight training on CRF (Islam et al., 2020; McRae et al., 2012; Schaun et al., 2018; Scott et al., 2019). Submaximal protocols that do not require a very high level of effort.

Other literature states that exercise during lockdown can also increase immunity and anti-inflammatory effects (reduce the risk of disease) in response to respiratory pathogens such as seasonal influenza (Ravalli & Musumeci, 2020). However, the lockdown related to this pandemic can have harmful physical consequences, including a reduction in maximum oxygen consumption, endurance capacity, muscle strength, and muscle mass. A worldwide study in handball recently reported a reduction in physical activity and an increase in sedentary behavior, regardless of the athlete's competitive level (Hermassi et al., 2021). During the early phase of the pandemic, "return to sport" considerations were focused on high-level athletes (Meyer et al., 2020; Washif et al., 2020). These studies provide valuable insights into training and competition safety during the pandemic but do not meet evidence-based guidelines for athletes at all competitive levels.

Regardless of the athlete's classification, changes (i.e., reduced) in some exercise variables can compromise the functional performance of athletes, primarily if exercise intensity is not maintained (McMaster et al., 2013; Spiering et al., 2021). Physical activity must be maintained to maintain physical condition.

## CONCLUSION

Vo2Max and hand strength of handball athletes are increased. HIIT & SIT workouts significantly increase VO2Max endurance. Body weight training exercises significantly increase hand strength endurance. The coach has to pay attention to two things: whether the measurement test follows the handball's characteristics. Second, the athlete's performance on these items

must do some treatment. There needs to be a unique measurement test instrument for handball athletes. Various treatments to improve athlete performance need to study in much literature.

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