

# COMBINED EFFECT OF HIGH INTENSITY INTERMITTENT TRAINING AND WEIGHT TRAINING ON AEROBIC CAPACITY ANAEROBIC CAPACITY AND FATIGUE INDEX OF MALE HANDBALL PLAYERS

N. Seshagiri Rao<sup>a</sup>, P. Johnson<sup>b</sup> and B. Chittibabu<sup>c,\*</sup>

<sup>a</sup>Physical Director, A.S.N. Degree & P. G. College, Tenali, Guntur District, Andhra Pradesh- 522201, India

<sup>b</sup>Assistant Professor, University College of Physical Education & Sports Sciences, Acharya Nagarjuna University, Guntur, Andhra Pradesh- 522201, India

<sup>c</sup>Assistant Professor, Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Annamalai Nagar – 608 002.Tamil Nadu, India

\*Corresponding Author Ph: 09443531508; Email: [b.chitti@hotmail.com](mailto:b.chitti@hotmail.com)

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**Abstract:** The purpose of the present study is to assess the combine effect of high intensity training and weight training on aerobic capacity, anaerobic capacity and fatigue index of male handball players. Thirty six male handball players were randomly selected from Sports Authority of India, Sports Training Centre (STC), Sarunagar, Hyderabad, Andhra Pradesh. These subjects were classified into two groups, namely Group I - Combined training (12) and Group II - Control group (12). The Group I underwent high intensity intermittent training and weight training and Group II acted as control. The selected players had regular practice and took part in competitions. The selected subjects average age, height and weight were 21.55  $\pm$  2.15 years, 170.05  $\pm$  6.98 cm and 64.94  $\pm$  8.50 kg respectively. In the present study we selected aerobic capacity, anaerobic capacity and fatigue index as criterion variable which was assessed by multi stage fitness test and running based anaerobic sprint test. High intensity intermittent training and weight training was performed 4 session per weeks (2 session of high intensity intermittent training and 2 session weight training) for 8 weeks respectively. All the selected subjects anaerobic capacity, fatigue index and aerobic capacity was measured before and after 8 weeks of training to respective groups. ANCOVA was applied to know the changes based on training. The result of the study showed that 8 weeks of combined training significantly improved aerobic capacity ( $F(1,21) = 104.84, p < 0.05$ ), anaerobic capacity ( $F(1,21) = 20.33, p < 0.05$ ) and fatigue index ( $F(1,21) = 21.35, p < 0.05$ ) of the handball players after adjusting the pre test. It is concluded that combined training is efficient enough to improve aerobic capacity, anaerobic capacity and fatigue index of male handball players.

**Keywords:** Maximal aerobic speed, aerobic capacity, multi stage fitness test, handball, players

## Introduction

It is well known that aerobic capacity and muscle strength are important elements of fitness during handball competition, as well as in human daily activities. Fine aerobic capacity and muscle strength are required for handball players, who attempting to optimize their peak performance. In order to improve the aerobic capacity and muscular strength of handball players, coaches prescribe different types of workout which are specific to the game demand.

The coaches presently implement high intensity intermittent training which improves both aerobic and anaerobic capacity whereas continuous training improves only aerobic capacity. The high-intensity work bouts are thought to train both the slow and fast twitch motor units, allowing for improvements in both anaerobic and aerobic systems. This dual system enhancement may also lead to better utilization of both fat and carbohydrates. Interval training has also been associated with improvements in the muscle's ability to buffer lactic acid thus delaying the onset of fatigue brought about by the build up of lactic acid and consequently raising the anaerobic threshold. Similar to strength training, interval training allows for a longer and more effective overload on the heart. This in turn translates to a stronger heart muscle, greater contractility and increased stroke volume. If more total work can be accomplished, then more calories will be utilized; this makes interval training an effective in improving aerobic and anaerobic capacity [1].

The American College of Sports Medicine (2000) recently highlighted the importance of strength training, along with aerobic exercises, as key elements to a well rounded training program" for healthy adults. It is well established that strength training benefits both physiologically and psychologically from a strength training program [2-4]. However, despite the benefits associated with strength training, the number of sportsmen who participate in the combined effect of endurance and strength training programs is small. The purpose of the present study is to assess the combined effect of high intensity intermittent training and weight training on aerobic capacity of male handball players.

## Materials and Methods

### Subjects and Variable

Thirty six male handball players were randomly selected from Sports Authority of India, Sports Training Centre (STC), Sarurnagar, Hyderabad, Andhra Pradesh. These subjects were classified into two groups, namely Group I - Combined training (12) and Group II - Control group (12). The Group I underwent high intensity intermittent training and weight training and Group II acted as control. The selected players had regular practice and took part in competitions. The selected subjects average age, height and weight were  $21.55 \pm 2.15$  years,  $170.05 \pm 6.98$  cm and  $64.94 \pm 8.50$  kg respectively. In the present study we selected aerobic capacity, anaerobic capacity and fatigue index as criterion variable which was assessed by multi stage fitness test and running based anaerobic sprint test.

### Training Program

#### High intensity intermittent training

Aerobic training was given for 2 sessions per week for eight weeks. The formula proposed by Gerbeaux *et al.*, (1991) was used to calculate Maximal aerobic speed (MAS). The MAS was used as a criterion velocity to set running paces for high-intensity short intermittent exercises. The MAS of the obese subjects are 4.31 m/s and intensities are fixed from 85 to 110%. Each session was preceded by a standardized warm-up:  $1 \times (10 \times 10s)$ ,  $(7 \times 15s)$ ,  $(5 \times 20s)$  at 100% of MAS (one set of 10 repetitions of 10 s or 7 repetitions of 15s or 5 repetitions of 20 s of running at 100% of MAS, punctuated by 10s, 15s, 20s of recovery). Between each set, the recovery was of 3 min. Exercise time was 30min for each session.

#### Weight training

The weight training group performed whole body linear periodized strength training. The training volume first three weeks was of weight training program 2 sessions per week for 8 weeks. The training intensities were 60 to 80% of the one repetition maximum 2-4 sets, 8-12 repetitions per set with 3 minutes rest between sets. They performed Lat Pull-down, Leg Press, Bench Press, Shoulder Press, Seated row, Leg extension, Leg Curl, Biceps Curl, Triceps push-down and standing heel raise that were performed with the multi gym machine.

### Data Collection

All the selected subjects aerobic capacity was measured before and after 8 weeks of training to respective groups. All tests were conducted in the evening with a standard warm-up and after test proper warm-down was given.

### Statistical analysis

For this study ANCOVA was applied. The proposed hypothesis was tested at 0.05 level of confidence. Beside this mean and standard deviation were also calculated. SPSS statistic software package (SPSS Company, America, version 17.0) was used.

## Results

**Table 1**  
ANCOVA on aerobic capacity and power using pre-test as a covariate

Variables	Source	SS	Df	MS	F	p
Aerobic capacity	Covariate	44.81	1	44.81	26.43	0.000
	Groups	181.08	1	181.08	106.83	0.000
	Error	35.59	21	1.695		
Anaerobic capacity	Covariate	206838.08	1	206838.08	58.61	0.000
	Groups	71746.79	1	71746.79	20.33	0.000
	Error	74098.83	21	3528.51		
Fatigue index	Covariate	7.68	1	7.68	3.79	0.065
	Groups	43.23	1	43.23	21.35	0.000
	Error	42.52	21	2.02		

This study also clearly shows that aerobic capacity ( $F(1,21) = 104.84$ ,  $p = 0.000$ ), anaerobic capacity ( $F(1,21) = 20.33$ ,  $p < 0.05$ ) and fatigue index ( $F(1,21) = 21.35$ ,  $p < 0.05$ ) between the groups was significant after adjusting pre-test scores. The findings of the study prove that aerobic capacity, anaerobic capacity and fatigue index tends to increase as a result of combined training. It is obvious from table 1 that pre test as covariate found significant on aerobic capacity ( $F(1,21) = 26.43$ ,  $p < 0.05$ ), anaerobic capacity ( $F(1,21) = 58.61$  ( $p < 0.05$ ), but fatigue index ( $F(1,21) = 3.79$  ( $p > 0.05$ ) showed no influence. Furthermore, it is found that aerobic capacity increased 13.79%, anaerobic capacity increased 29.80% and fatigue index decreased 40.20% in combined training group.

### Discussion on findings

The major novel finding of this research is that combined effect of high intensity intermittent training and weight training showed significant improvement in aerobic capacity than control group. Combined training group elicited 13.79% of improvement from pre-to post-test. The findings of the current research are compatible with the earlier results [5-7].

The changes in aerobic capacity correspond with changes in stroke volume, cardiac output and expanded a-VO<sub>2</sub> difference [8].

In the present study anaerobic capacity and fatigue index altered considerably.

During repeated sprints depletion of PCr stores and a decrease in intercellular pH may contribute to the decline in power output or the rate of fatigue [9]. As PCr resynthesis primarily occurs by oxidative processes [10] and intercellular acidosis potentially interfere with muscle contractile processes [11] thereby inhibiting force production, the lower rate of fatigue observed in combined training group may be attributed to either an improved aerobic power [12-14] or an increase capacity of muscle to buffer hydrogen ions [9]. Increase in anaerobic capacity and decline in fatigue index was altered due to combined effect of high intensity intermittent training and weight training on male handball players.

### Conclusions

It is concluded that combined effect of high intensity intermittent training and weight training is efficient enough to improve aerobic capacity, anaerobic capacity and reduces the rate of decline in sprint among male handball players.

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