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Influence of Combined Training Programs on Selected Respiratory and Circulatory Parameters in Male Handball Players

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Abstract: This study was conducted in order to determine the influence of combined training programs on selected respiratory and circulatory parameters in male handball players. 12 male handball players who play handball in the second league participated into the study on voluntary basis. A combined training program based on jumping power and shooting power trainings was administered for four weeks - five days per a week - to the participating handball players. Players who took part in the study were measured for their ages, height, body-weight, body-mass index, resting heart-beats, systolic and diastolic blood pressure, oxygen saturation, vital capacity, forced vital capacity, forced expiratory volume at the 1st second and maximum voluntary ventilation values before and after the training. Measurement results were presented as averages and standard deviations. For a comparison of pre- and post-training values, student t-test for dependant samples was conducted. SPSS 13.0 package software was used for evaluation of data. $P<0.05$ value was accepted as significant. After the training program implemented, it was found that the difference in body-weight, body fat percentage, resting heart-beats, diastolic blood pressure and oxygen saturation values was as significant as 0.05 whereas the difference in body-mass index and systolic blood pressure was as significant as 0.01. As a conclusion, it was observed that the combined training program which was implemented five days a week for four weeks had an influence on circulatory parameters whereas no influence on respiratory parameters.

Key words: Handball Players · Combined Training · Respiratory and Circulatory Parameters

INTRODUCTION

Being successful is the ultimate goal in sports. It is the goal of every athlete to win the title in a competition. Athletes should display a high performance in order to achieve this goal, which results in a tendency among athletes to become stronger, quicker and more resilient to turn up their performance. Handball, with millions of players and spectators both in Turkey and all around the world, has been a sports branch in which winning has widely been the primary goal in recent years [1]. Handball is a quick game played with great enthusiasm by both males and females. As in any team sports, given the limited time and the necessity to play quickly and accurately in handball, basic motor attributes such as strength, pace, stamina, agility and coordination [2] as well as other parameters including technique, tactics and experience are of significant importance for achieving success [3]. When we list such attributes according to the order of importance, strength and pace are ranked first [4]. Success comes in handball through systematic development of these attributes and strengthening parameters such as jumping power and shooting power in which anaerobic capacity is dominant [5-7]. Handball is a team sport played in a quicker manner than other team sports are due to the smaller size of the ball.

Magnitude, duration and frequency of training should be well-organized so that regular trainings might develop and strengthen physiological functions in the organism. Researches have found that training programs with a magnitude of 80-90%, lasting from 20 minutes to 60 minutes and conducted three times a week make positive contribution into physical, physiological and motor attributes [8,9]. Human body has a great deal of potential for structural and functional adaptation to exercises. Ensuring such an adaptation through special exercises aiming at development of special performance skills shows us the importance and relevance of exercise sciences and training programs [10]. Emphasizing that regularly-implemented training programs have a positive

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impact on respiratory and circulatory systems [11], it was stated that there is a parallelism between regular trainings and the development of respiratory and circulatory systems [12]. Some researches suggest that intensive training programs improve respiratory parameters and make them efficient and economic [11-13], whereas some others claim that improvement is in line with the growth depending on the attributes of the age group [14-16].

This study was conducted in order to determine the influence of combined training programs on selected respiratory and circulatory parameters in elite male handball players.

MATERIAL AND METHODS

12 male handball players who play handball in the second league participated into the study on voluntary basis. The average age, height and body weight of the participating handball players are 22,16±1,85 years, 181,16 ±5,18 cm and 81,59±11,99 kg respectively. A combined training program based on jumping power and shooting power trainings was administered for four weeks - five days per a week - to the participating handball players.

The Program Was Structured as Follows:
After the organism got ready for loading (warming-up);

- 30 m sprint along the longer side line of the handball court,
- Vertical Jumping Movement (three times) on the junction point of the long side line and short side line (on the right winger's position),
- Stepping Forward and Securing Movement (three times) on between the goal field and free-kick line (3-meter distance),
- Vertical Jumping Movement (three times) on the 7 m penalty shot line),
- Stepping Forward and Securing Movement (three times) on between the goal field and free-kick line (3-meter distance),
- Vertical Jumping Movement (three times) on the junction point of the long side line and short side line (on the left winger's position),
- Sprinting from free-kick line up until the midfield line,
- With the balls on the mid-field, 3 jump-shots per each from left play-maker's, mid-play-maker' and right play-maker's position,

Conclusion of the training by running to leave the goal line,

For implementation of the maximal capacity, movements are made versus time.

Three repetitions are conducted for each training round. The resting interval has been defined as the time that passes from when a given player concludes his own round and switches into active resting until other players end their own rounds and our player re-start

Players who took part in the study were measured for their ages, height, body-weight, body-mass index (BMI), body fat percentage (BFP) resting heart-beats (RHB), systolic (SBP) and diastolic (DBP) blood pressure, oxygen saturation (OS), vital capacity (VC), forced vital capacity (FVC), forced expiratory volume at the 1st second (FEV_1) and maximum voluntary ventilation (MVV) values before and after the training.

ID information was taken as basis to define the ages of players. Their heights were measured with a meter in cm terms while their body weights were measured with an electronic weighing machine in kg terms. The body-mass index was calculated through the formula of body-weight (kg) / length (m^2) whereas body fat percentage was found through the Green Formula (BFP = 3,64 + total skin-folds x 0,097) [17].

In order to measure the resting heart-beats and systolic and diastolic blood pressures of the subjects, the an apparatus called Microlife BP 3 AS; and Nellcor Puritan Bennet NPB-40 pulse oximeter was utilized to find oxygen saturation of the subjects [18]. Respiratory parameters were measured with a Cosmed spirometer [19]. During the measurement, subjects were standing as the funnel of the spirometer in their mouths and their noses blocked with a clip to avoid any air-leakage. Subjects were asked to deeply inspire and then to strongly expire so that respiratory measurements might easily be carried out. These procedures were repeated thrice and best values were recorded.

Measurement results were presented as averages and standard deviations. For a comparison of pre- and post-training values, student t-test for dependant samples was conducted. SPSS 13.0 package software was used for evaluation of data. $P<0.05$ value was accepted as significant.

Findings: An analysis of the tables would show that body-weight, body fat percentage and circulatory parameters have changed due to the implemented training program and this change was statistically significant.

Table 1: Pre- and Post-Training Physical Attributes of Handball Players (n=12)

Variables	Pre -Training Post -Training	Mean	SS	t	p
Age (year)	Pre-Training	22,16	1,8505	-	-
	Post-Training	22,16	1,8505		
Height (cm)	Pre-Training	181,16	5,1845	-	-
	Post-Training	181,16	5,1845		
Body Weight (kg)	Pre-Training	81,59	11,9978	3,124	0,010*
	Post-Training	81,16	12,1418		
BMI (kg/(m)^2)	Pre-Training	24,81	3,0747	3,165	0,009**
	Post-Training	24,67	3,0988		
Body Fat Percentage (%)	Pre-Training	12,08	2,9979	-2,895	0,015*
	Post-Training	11,59	2,4947		

*P<0.05 **p<0.01

Table 2: Pre- and Post-Training Circulatory Parameters of Handball Players (n=12)

Variables	Pre -Training Post -Training	Mean	SS	t	p
RHB (Atm/dak)	Pre-Training	71,08	8,78	-2,881	0,015*
	Post-Training	71,00	7,45		
SBP (mmHg)	Pre-Training	115,00	13,39	-4,213	0,001**
	Post-Training	115,50	6,27		
DBP (mmHG)	Pre-Training	67,16	2,72	2,843	0,016*
	Post-Training	66,66	4,11		
OS (%)	Pre-Training	97,08	0,79	2,636	0,023*
	Post-Training	97,41	0,79		

*P<0.05 **p<0.01

Table 3: Pre- and Post-Training Respiratory Parameters of Handball Players (n=12)

Variables	Pre -Training Post -Training	Mean	SS	t	p
VC (L)	Pre-Training	5,82	0,78	1,921	0,081
	Post-Training	6,06	0,77		
FVC (L)	Pre-Training	6,17	0,81	0,200	0,845
	Post-Training	6,43	0,65		
FEV_1 (L)	Pre-Training	4,98	0,78	-0,649	0,530
	Post-Training	5,46	0,52		
MVV (L/dk)	Pre-Training	207,44	24,28	-0,324	0,752
	Post-Training	209,50	12,78		

DISCUSSION

In this study which was conducted in order to determine the influence of combined training programs that was administered five times a week for four weeks on selected respiratory and circulatory parameters in male handball players, the administered training program had an influence on circulatory parameters whereas no influence on respiratory parameters. When we compare the findings obtained with the existing literature, we can see both similarities and differences.

In our study, decreases in body-weight, body mass index and body fat percentage values before and after the training were found to be statistically significant. Gökdemir and Koç stated in their study that body weight and body fat percentage decreased significantly after an overall resilience training which lasted for eight weeks and three days a week [20] and Koç and Günay stated that body fat percentage decreased significantly after the overall pace training which lasted for eight weeks and three days a week [21]. Gökdemir and Koç expressed that body fat percentage decreased significantly after the overall stamina training which lasted for eight weeks and three days a week [22] while Kürkçü *et al* found out in their study on wrestlers that the change in the body-weight was significant [23]. Gökdemir *et al*. found out that the aerobic training program which was implemented thrice a week for eight weeks had a positive influence on body weight and body fat percentage values [24]. The findings that we obtained in our study are in line with the

literature. These researches have shown that, as a result of the quick metabolism which occurs during training, significant decrease took place in body mass and body fat percentage values [25,26,27]. It is stated that the decrease in body mass and body fat percentage values stem from utilization of fats as a source for energy through oxidation in during trainings [28].

When we look at the findings of our study, we see that the changes in pre- and post-training circulatory parameter values are statistically significant. Gökdemir and Koç stated in their study that, after an overall resilience training that was implemented thrice a week for eight weeks, the decrease in resting heart-beats was significant while the changes in systolic and diastolic blood pressure were insignificant [20]. Koç and Günay expressed that, after an overall pace training that was implemented thrice a week for eight weeks, changes in resting heart-beats and systolic-diastolic blood pressure values were insignificant [21]. Gökdemir and Koç reported that an overall stamina training that was implemented thrice a week for eight weeks had had an influence on the changes in resting heart-beats and systolic blood pressure values [22]. Kürkçü *et al.* stated that, after an overall pre-season training that was implemented thrice a week for eight weeks, the changes in systolic and diastolic blood pressure values were significant [23]. Gökdemir *et al.* found out that an overall aerobic training that was implemented thrice a week for eight weeks had influence on systolic and diastolic blood pressure values [24]. Information in the literature mostly supports our findings except for those conducted by Koç and Günay.

It was observed in our study that the changes in pre- and post-training respiratory parameters were statistically insignificant. Gökdemir and Koç found out in their study that, after an overall resilience training that was implemented thrice a week for eight weeks, the increase in the vital capacity, forced vital capacity and the forced expiratory volume at the 1st second was significant [20]. Koç and Günay found that, after an overall pace training that was implemented thrice a week for eight weeks, the increase in vital capacity and the forced expiratory volume at the 1st second was significant while the increase in the forced vital capacity was insignificant [21]. Gökdemir and Koç stated that, after an overall stamina training that was implemented thrice a week for eight weeks, the decrease in the forced expiratory volume at the 1st second and the increase in the vital capacity were insignificant [22]. Kürkçü *et al.* stated in the study which they conducted to determine the influence of overall 8-week pre-season training that the changes in respiratory function values were insignificant [23]. Gökdemir *et al.* found out that an overall aerobic training that was implemented thrice a week for eight weeks had a positive influence on vital capacity and forced vital capacity values [24]. Çakmakçı *et al* stated in their study which they conducted in order to determine the influence of a four-week camp period on some respiratory parameters that FVC and MVV values exhibited a significant increase whereas there was not any significant difference in vital capacity values after the four-week camp [12]. Iri stated in a study that the macro-term training program had a positive influence on FVC level in terms of increase [29]. Yumruta° found that FVC and MVV values in football players were statistically-significantly higher than those who do not play football [30]. The literature seems not to be supportive of our findings.

CONCLUSION

As a conclusion, it was seen that the combined training program which was implemented five days a week for four weeks had an influence on body-weight, body-mass index, body fat percentage and circulatory parameters whereas no influence on respiratory parameters. When we analyze our findings and the literature, we think that respiratory parameters cannot be changed by short-term training programs but long-term training programs.

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