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±1.85
years, 181.6±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 (BF%) resting heart-beats
(RHB), systolic (SBP) and diastolic (DBP) blood pressure,
oxgen saturation (OS), vital capacity (VC), forced vital
capacity (FVC), forced expiratory volume at the 1st second
(FEV1) 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 (m²) whereas body fat percentage was found
through the Green Formula (BF% = 3.64 + total skin-folds
× 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
Benett 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
deply 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)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-Training</th>
<th>Post-Training</th>
<th>Mean</th>
<th>SS</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>Pre-Training</td>
<td>22.16</td>
<td>1.8505</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>18.91</td>
<td>1.8505</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>Pre-Training</td>
<td>181.16</td>
<td>5.1845</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>181.16</td>
<td>5.1845</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Body Weight (kg)</td>
<td>Pre-Training</td>
<td>81.39</td>
<td>11.9078</td>
<td>3.124</td>
<td>0.010*</td>
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</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>81.16</td>
<td>12.1418</td>
<td>3.165</td>
<td>0.009**</td>
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</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>Pre-Training</td>
<td>24.81</td>
<td>3.0747</td>
<td>3.165</td>
<td>0.016*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>24.67</td>
<td>3.0988</td>
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</tr>
<tr>
<td>Body Fat Percentage</td>
<td>Pre-Training</td>
<td>12.08</td>
<td>2.9979</td>
<td>-2.895</td>
<td>0.015*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>11.59</td>
<td>2.4947</td>
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</tbody>
</table>

*P<0.05  **P<0.01

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-Training</th>
<th>Post-Training</th>
<th>Mean</th>
<th>SS</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHB (Atm/dl)</td>
<td>Pre-Training</td>
<td>71.08</td>
<td>8.78</td>
<td>-2.881</td>
<td>0.015*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>71.00</td>
<td>7.45</td>
<td></td>
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<tr>
<td>SBP (mmHg)</td>
<td>Pre-Training</td>
<td>115.00</td>
<td>13.39</td>
<td>-4.213</td>
<td>0.001**</td>
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</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>115.50</td>
<td>6.27</td>
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<tr>
<td>DBP (mmHg)</td>
<td>Pre-Training</td>
<td>67.16</td>
<td>2.72</td>
<td>2.843</td>
<td>0.016*</td>
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<tr>
<td></td>
<td>Post-Training</td>
<td>66.66</td>
<td>1.11</td>
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<tr>
<td>OS (%)</td>
<td>Pre-Training</td>
<td>97.08</td>
<td>0.79</td>
<td>2.636</td>
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<tr>
<td></td>
<td>Post-Training</td>
<td>97.41</td>
<td>0.79</td>
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<td></td>
</tr>
</tbody>
</table>

*P<0.05  **P<0.01

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-Training</th>
<th>Post-Training</th>
<th>Mean</th>
<th>SS</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC (L)</td>
<td>Pre-Training</td>
<td>5.82</td>
<td>0.78</td>
<td>1.921</td>
<td>0.081</td>
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<tr>
<td></td>
<td>Post-Training</td>
<td>6.06</td>
<td>0.77</td>
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<tr>
<td>FVC (L)</td>
<td>Pre-Training</td>
<td>6.17</td>
<td>0.81</td>
<td>0.200</td>
<td>0.845</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>6.43</td>
<td>0.65</td>
<td></td>
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<tr>
<td>FEV₁ (L)</td>
<td>Pre-Training</td>
<td>4.98</td>
<td>0.78</td>
<td>-0.649</td>
<td>0.530</td>
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</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>5.46</td>
<td>0.52</td>
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<tr>
<td>MVV (L/dk)</td>
<td>Pre-Training</td>
<td>207.44</td>
<td>24.28</td>
<td>-0.324</td>
<td>0.752</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-Training</td>
<td>209.50</td>
<td>12.78</td>
<td></td>
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</tr>
</tbody>
</table>

**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 Güray 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 breathing rate 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 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]. İr stated in a study that the macro-term training program had a positive influence on FVC level in terms of increase [29]. Yumrutaş 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.

REFERENCES


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