**Interval Training Specific to Handball and Training Programme Designs**

*Murat Bilge*

Department of Coaching Education, the School of Physical Education and Sport, Kırıkkale University, Kırıkkale, Turkey

Submitted: Sep 14, 2013; Accepted: Oct 19, 2013; Published: Oct 25, 2013

**Abstract:** This present study aimed to understand about the condition trainings for handball must contain the nature of this branch. The branches’ nature has to determine according to game duration, heart rate, working loads, running profiles, running distances and the specificities for the playing positions. The interval training programme examples given in this text applied to the young and the senior female / male handball players playing in their top divisions.

**Key words:** Interval · Team Handball · Intermittent

**INTRODUCTION**

In many team sports strength, quickness, speed, agility, cardio respiratory fitness and repeated sprint ability have been shown to be important factors determining success, in addition to sport-specific technical and tactical skills [1].

Team Handball is one of today’s fastest and the most endurance required team sports and is epitomized by special maneuvers such as jump shot under pressure, faking against hard defense players and attempting fast breaks despite all the fatigue [2, 3]. Competitive team handball is an intermittent high intensity body contact team sports that requires a combination of aerobic and anaerobic fitness to performa sequence of well-coordinated activities [4, 5, 6, 7, 8]. Team handball places a heavy emphasis on sprinting, jumping and throwing [9]. Motor ability, sprinting, jumping, flexibility and throwing velocity represent physical activities that are considered as important aspects of the game and contribute to the high performance of the team [10].

When we look at the running profile of the handballers in a regular game, it was defined that the movement patterns and the sum of distance of these categories as standing still (0 km/h), walking (4 km/h), jogging (8 km/h), running (13 km/h), fast running (17 km/h), sprinting (24 km/h), sideways movement (10km/h), and backwards running (10 km/h) [11].

Effort during team handball is often described as long-term acyclical work, with an interval character, where energy is obtained both aerobically and anaerobically [12].

Max VO2 improvements generally occur when a high percentage of VO2peak is elicited during exercise, the general goal of interval conditioning is to accumulate a greater training stimulus at high intensities compared to what can be tolerated in a single bout of continuous exercise [13]. The prescription of interval training is based on five variables: work interval intensity and duration, recovery interval intensity and duration and totall work duration. These variables can be manipulated to generate a large range of interval training prescriptions designed to primarily stress aerobic and/or anaerobic energy metabolism. Sufficient physiological data are now available to classify different types of aerobic interval training, ranging in intensity from %85 to %130 of the power or velocity associated with VO2peak [14].

When we look at the relationship between team handball physiological nature and interval training (both aerobic and/or anaerobic), we can see the importance of interval training is the one of the most important conditional factor in handball [15].

---

*This study was presented in the 3rd Module of European Handball Federation Master Coach and Licensing Course, held in 03-09 December 2012, Belgrade, Serbia.

**Corresponding Author:** Murat Bilge, Department of Coaching Education, The School of Physical Education and Sport, Kırıkkale University, Kırıkkale, Turkey.
The aim of this review was to describe the effects of high-intensity training on performance and to design interval training exercise examples (both aerobic and/or anaerobic) specific to team handball according to the literature.

**MATERIALS AND METHODS**

Interval training is a type of discontinuous physical training that involves a series of low- to high-intensity exercise workouts interspersed with rest or relief periods. Because of the intermittent nature of this form of training, the exercise intensity and the total amount of work performed can be greater than with continuous training, making discontinuous training a versatile method that is widely used by athletes, as well as individuals with low cardiorespiratory fitness. This method is popular among athletes because it allows the athlete to exercise at higher relative intensities during the work interval than are possible with longer duration, continuous training. Interval training programs also can be designed to improve speed and anaerobic endurance, simply by means of modifications in the exercise intensity and length of the work and relief intervals [16].

We can define as the interval training specific to handball in five parts:

- **Athletic performance** must be taken under team handball requirements.
- **The loadings** must be defined for the purpose of development of motor skills especially for handball performance.
- **Physiological changes** must not turn back to normal levels between the repetitions.
- **Different recovery types** must be used in the different loads (aerobic and/or anaerobic, extensive or intensive).
- **Load intensity – Work duration – Rest duration – Repetition** and also total work must be designed according to the simulation of the handball match [16, 17, 18].

As the requirements of the athletic performance in the game, team handball is a complex intermittent sport game which requires players to have well developed aerobic and anaerobic capacities [7, 9]. Several motor abilities such as sprinting, jumping, flexibility and different technical competences like passing, shooting, dribbling, faking, defending or saving balls are considered as important aspects of the game that contribute to the high performance of the team [19, 20, 21, 22]. Zapartidis pointed that the importance of VO2max in terms of distinguishing young handball players according to their level. Depending on the level of competition and the playing position, players usually cover a distance between 4.5 – 6.5 km/h and require high level of aerobic capacity to aid recovery after high intensity periods of activity. On the other hand, he stated that a number of differences in anthropometric and physical fitness characteristics exist between playing position [10].

When we look at the nature of handball’s energy consumption, the metabolic demands of modern handball involve the aerobic and anaerobic energy pathways. As a supportive evidence, during a Handball match, players perform 190 rhythm variations, 279 change of direction, 16 jumps and also an handball players performs a total of 485 high-intensity movements in 60 minutes [23].

These studies support the idea of Handball as an intermittent activity. This intermittent activity is determined by high-intensity motion (with energy mostly furnished by ATP-PC and anaerobic pathways) and low intensity motion (in which the aerobic pathways have the function of active recovery).

About 170 players were monitored with cameras from the top of the sport halls during nine games of the 2007 Men’s World Cup in Germany using a computer based match analysis system. The recorded player trajectories delivered information about total distances covered and individual motion velocities of the players. By defining four categories of intensity (walking: 0 - 1.5 m/s, slow running: 1.6 - 4.0 m/s, fast running: 4.1 - 6.0 m/s and sprinting: > 6 m/s), we were able to analyze a differentiated motion profile according to player position (LUIG, 2008). Mean time of player’s action was 32.11 ± 15.34 min. Wing players (37.37 ± 2.37 min) and goalkeepers (37.11 ± 3.28 min) had significantly higher shares (p < 0.05) of playing time than backcourt players (29.16 ± 1.70 min) and pivot players (29.37 ± 2.70 min). Mean distance that players covered was 2938.5 ± 1403.9 m per match (range: 234 - 6490 m). According to player position wing players (3710.6 ± 210.2 m) covered a highly significant greater total distance (p < 0.01) than backcourt players (2839.9 ± 150.6 m) and pivot players (2786.9 ± 238.8 m), whereas goalkeepers (2058.1 ± 290.2 m) covered the lowest total distance as compared to all other groups (p < 0.01). The total distances covered by field players during a match consisted of 34.3 ± 4.9% walking, 44.7 ± 5.1% slow running, 17.9 ± 3.5% fast running and 3.0 ± 2.2% sprinting [24].
As a result for women handball, Mean HR during the match was about 86% of HRmax. For more than 90% of playing time it was higher than 85% of HRmax in 25 elite handball players from Germany (n=11) and Norway (n=14) of different positions (3 goalkeepers (GK), 12 back, 10 wing and pivot (field players - FP) agreed to participate (age: 25.2±2.8 years; height: 175.2±6.3 cm; weight: 67.8±4.9 kg.; VO2max: 53.1±4.8 ml/min/kg; HRmax: 194.8±5.2 l/min, V4: 3.62±0.25 m/s). During the 1st half of the matches, players stayed in higher intensities with mean heart rates higher than 95% of HRmax for a longer time period as compared to the 2nd half of the match. Mean run distance during the match was 4614 m and varied widely between 2066 m (GK) and 5251 m (FP). Accordingly, also mean run distance per minute varied in a remarkable manner between 31.3 m/min (GK) and 69.7 m/min (FP). Differences in acceleration categories among some field players might indicate some position-specific patterns. Especially wing players had a high variability in their movement patterns. Individual endurance capacity (VO2max and V4) determined the individual demands during the matches: players with a higher VO2max were able to execute activities with a higher velocity as compared to players with a lower level of VO2max, with the same level of cardiac load (no differences in HR and % HRmax). At the same time, players with a higher VO2max mainly stayed in aerobic metabolic intensity categories during the match [25].

When we compare the same parameter’s results of this two study [24, 25], we can see a difference between men and women’s running distance per game.

Additionally to women handball, to determine the physical demands in a handball match for Danish female elite players as well as to clarify any possible differences arising from different playing positions, 24 Danish female elite handball field-players (25.7±3.3 years, 174.9±5.7 cm and 70.3±7.4 kg) were examined over a four-year period from 2002 to 2006. The players were divided into three categories for both attack and defence, namely wing players (WP), circle runners (CR) and backs (B). In addition, the heart rate was continuously monitored. A treadmill test was carried out in order to find the individual correlation between heart rate frequency and oxygen uptake. Furthermore, a Yo-Yo intermittent recovery test was performed on a separate day. The average maximal aerobic power for female elite handball players was 47.5 ml O2/min/kg. The average physical load during match play was found to be 79% of VO2-max. A mean total distance of 4.0 km was covered per match and up to 700 changes of activity were observed on the basis of eight categories of the locomotive analysis. The high, intense work of quick runs (0.7 %) and sprints (0.1 %) constituted a total of approximately 1 % of effective playing time. Each player had an average of 27 high intense play actions per match. There were a number of marked differences in both the locomotive and the technical analysis and in the practical, physical test between the various playing positions. A mean total distance of 4.0 km was covered per match with an average physical load during match play corresponding to 79 % of VO2-max. A game consists of up to 700 activity changes with an average of 27 high intense play actions per match. There are distinct differences in the physical demands in the various playing positions, where wing players do more high intense work, cover a greater running distance and do less tackles compared to backs [26].

After all these data’s from handball literature, we can improve some interval training programme examples especially for handball.

**Literature Examples for All Sports:**

- Interval training is necessary to enhance speed or anaerobic endurance.
- Sprint activities of a few seconds require a higher power output than longer duration sprints of 1 to 2 minutes.
- Trainings need to be related to both the distance and the duration of the activity performed in the particular sport.
- It is important to differentiate between “quality” sprint training for maximal speed and “quantity” sprint conditioning for speed endurance and improvement of lactic acid buffering capacity.
- Interval training workouts should be performed 1 to 5 days per week depending on the sport and the training cycle [27].
Table 2: General Guidelines for Interval Training [27]

<table>
<thead>
<tr>
<th>Exercise Duration (min:s)</th>
<th>% Intensity</th>
<th>Recover (min:s)</th>
<th>Number of Intervals</th>
<th>Sessions Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:05</td>
<td>100</td>
<td>0:05</td>
<td>20-30</td>
<td>2-4</td>
</tr>
<tr>
<td>0:10</td>
<td>100</td>
<td>0:10</td>
<td>20-30</td>
<td>2-4</td>
</tr>
<tr>
<td>0:20</td>
<td>100</td>
<td>0:15</td>
<td>10-20</td>
<td>2-4</td>
</tr>
<tr>
<td>0:30</td>
<td>100</td>
<td>1:00 - 2:00</td>
<td>8-18</td>
<td>2-4</td>
</tr>
<tr>
<td>1:00</td>
<td>95-100</td>
<td>3:00 - 5:00</td>
<td>5-15</td>
<td>2-4</td>
</tr>
<tr>
<td>2:00</td>
<td>95-100</td>
<td>5:00 - 15:00</td>
<td>4-10</td>
<td>2-4</td>
</tr>
<tr>
<td>3:00</td>
<td>80-90</td>
<td>5:00 - 15:00</td>
<td>3-8</td>
<td>2-4</td>
</tr>
</tbody>
</table>

Fig. 1: An Anaerobic Interval Training Design [27]

Stone et al., classified the interval trainings as follows [18]:

**Extensive Interval Training:**
- Relative intensity: low – medium (% 60-80 competitive speed / power)
- Duration / distance: short – medium (e.g., 14-180 s over 100-1000 m running distance for advanced athletes; 17 – 100 s over 100-400 m running distance for novices).
- Volume: large (e.g., 8-40 reps for advanced athletes; 5-12 reps for novices)
- Session density: high; short incomplete relief interval allowing heart rate to recover to 110-120 bpm (e.g., 90-180 s for advanced athletes, 120 – 240 s for novices)- advanced athletes can use “intermittent exercise” (e.g., 10 s max effort followed by 15 s of submax at %50 effort, performed in sets) [18].

**Intensive Interval Training:**
- Relative intensity: high (% 80-90 competitive speed / power)
- Duration / distance: short (e.g., 13-180 s over 100-1000 m running distance for advanced athletes; 14 – 95 s over 100-400 m running distance for novices)
- Volume: small (e.g., 4-12 reps for advanced athletes; 4-8 reps for novices)
- Session density: medium; longer but still incomplete relief interval allowing heart rate to recover to 110-120 bpm (e.g., 90-180 s for advanced athletes, 120 – 240 s for novices)- advanced athletes can use “intermittent exercise” (e.g., 10 s max effort followed by 15 s of submax at %50 effort, performed in sets) [18].

The principle of repetition is used in all methods except the method of continuous training. The principle of summation is used in the interval method and the method of intermittent training. The ratio determines the main energy mechanism, influenced by the interval method (Table 3).

The area of the action of the principle of duration is not only the method of continuous training, but also the method of intermittent training, the interval method. A way of using the principle of duration is performance of exercise up to exhaustion. In these exercise intensity is usually prescribed. In cases of so called tempo training not only the exercise intensity, but also the distance or performance time is prescribed [28].

**Literature Examples for Handball:** Pori et al., analyzed response of the players in some physiological and loading variables on different intense interval “fast-break and quick retreat” exercise in Team handball. They found that the physiological response of players during the interval “Fast-break with quick retreat” 3 versus 3 is the most closely related with the results of similar studies, made on the sample of the team handball players during the handball matches (Figure 2) [29].
Table 3: Variant for the interval method for influence of Different Energy Mechanism in Athletes [28]

<table>
<thead>
<tr>
<th>Main mechanism for ATP resynthesis</th>
<th>Time of each running set</th>
<th>Repetitions per training sessions</th>
<th>Sets per training sessions</th>
<th>Reps per set</th>
<th>Running to rest (relief) ratio</th>
<th>Type of relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC Mechanism</td>
<td>10 s</td>
<td>50</td>
<td>5</td>
<td>10</td>
<td>1:3</td>
<td>Rest relief</td>
</tr>
<tr>
<td></td>
<td>15 s</td>
<td>45</td>
<td>5</td>
<td>9</td>
<td></td>
<td>Walking</td>
</tr>
<tr>
<td></td>
<td>20 s</td>
<td>40</td>
<td>4</td>
<td>10</td>
<td></td>
<td>Flexing</td>
</tr>
<tr>
<td></td>
<td>25 s</td>
<td>32</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC + Anaerobic Glycogenolysis</td>
<td>30 s</td>
<td>25</td>
<td>5</td>
<td>5</td>
<td>1:3</td>
<td>Work relief</td>
</tr>
<tr>
<td></td>
<td>40-50 s</td>
<td>20</td>
<td>5</td>
<td>5</td>
<td>1:3</td>
<td>(Light to mild jogging)</td>
</tr>
<tr>
<td></td>
<td>60-70 s</td>
<td>15</td>
<td>3</td>
<td>5</td>
<td>1:2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>80 s</td>
<td>10</td>
<td>2</td>
<td>5</td>
<td>1:2</td>
<td></td>
</tr>
<tr>
<td>Anaer. Gly. + oxidative phosphorylation</td>
<td>1:30-2 min</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>1:2</td>
<td>Work relief</td>
</tr>
<tr>
<td></td>
<td>2:10-2:40 min</td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>1:1</td>
<td>Rest relief</td>
</tr>
<tr>
<td></td>
<td>2:50-3 min</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1:1</td>
<td></td>
</tr>
<tr>
<td>Oxidative phosphorylation</td>
<td>3-4 min</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1:1</td>
<td>Rest relief</td>
</tr>
<tr>
<td></td>
<td>4-5 min</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1:1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2: Fastbreak drills with quick retreat 1 versus 1, 2 versus 2 and 3 versus 3 [29]
Buchheit et al., compared the effects of speed/agility (S/A) training with sprint interval training (SIT) on acceleration and repeated sprint ability (RSA) in well-trained male handball players. They found that S/A training produced a very likely greater improvement in 10-m sprint (+4.6%, 90% CL 1.2 to 7.8), best (+2.7%, 90% CL 0.1 to 5.2) and mean (+2.2%, 90% CL –0.2 to 4.5) RSA times than SIT (all effect sizes [ES] greater than 0.79). In contrast, SIT resulted in an almost certain greater improvement in VIFT compared with S/A (+5.2%, 90% CL 3.5 to 6.9, with ES = –0.83). As their result in well-trained handball players, 4 week of SIT is likely to have a moderate impact on intermittent endurance capacity only, whereas S/A training is likely to improve acceleration and repeated sprint performance [6]. Table 4 shows their training programme according to the study.

Meckel et al., worked on 20 elite handball players and they evaluated the effect of different types of sprint interval sessions. Exercise consisted of increasing distance (100 m, 200 m, 300 m, 400 m) and decreasing distance (400 m, 300 m, 200 m, 100 m) sprint interval runs on a treadmill (at random order), at a constant work rate of 80% of the personal maximal speed (calculated from the maximal speed of a 100 m run). The total rest period between the runs in the different interval sessions were similar (Figure 3). Their results suggest that despite the fact that running distance, running speed and rest periods were similar in both training protocols, the metabolic demands and the anabolic response to the decreasing distance protocol is significantly greater compared with the increasing distance protocol. These data should raise the awareness of coaches and athletes that different types of interval training lead to different metabolic demands and hormonal responses and as a consequence to the need of adapting specific modes of recovery to each type of training [30].

After 20 m shuttle run test, a new test considered as more effective especially in team sports, 30-15 intermittent fitness test (30-15IFT) was used since 2000. 30-15IFT consists of 30 s shuttle runs interspersed with 15 s passive recovery periods. Velocity is increased by 0.5 km/h every 45 s stage thereafter. The 30-15IFT is performed over a 40 m shuttle distance (handball court), within which the athlete has to run back and forth at a pace governed by a prerecorded beep, so that each short beep sound the athlete should be within 3 m zones at each extremity or in the middle of the court. During the 15 s recovery period, athletes walk in the forward direction to join the closest line from where they will start the next stage from a standing position. Exhaustion is defined as the inability to match the covered distance with the audio signal on three consecutive occasions [1, 5].
Table 5: 30-15IFT applied in different branches in different countries [1]

<table>
<thead>
<tr>
<th>EVENT</th>
<th>COUNTRY</th>
<th>TEAMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>UK, Italy, Germany, Belgium, Qatar, Canada, USA, Australia</td>
<td>- UEFA - National Centre in Capriangione - All other clubs in affiliations - Strasbourg F.C. - Nancy FC - MFC - Man French National Team</td>
</tr>
<tr>
<td>Baseball</td>
<td>USA, Taiwan</td>
<td>- USA - Taiwan - France, USA, Taiwan</td>
</tr>
<tr>
<td>Handball</td>
<td>France (men categories, mixed, women and females)</td>
<td>- France, Italy, Germany, Belgium, Sweden, Denmark, Greece, Croatia, Romania, Poland</td>
</tr>
<tr>
<td>Tennis</td>
<td></td>
<td>- USCCP - ESBPM - La Galettean - T.M.</td>
</tr>
<tr>
<td>Rugby</td>
<td>Australia, UK, Ireland</td>
<td>- Australia - UK - Ireland - France - New Zealand</td>
</tr>
<tr>
<td>AFL</td>
<td>Australia</td>
<td>- Australia - New Zealand</td>
</tr>
<tr>
<td>Netball</td>
<td>Australia</td>
<td>- Australia - New Zealand</td>
</tr>
<tr>
<td>Field Hockey</td>
<td></td>
<td>- England National Teams, French training center in Strasbourg</td>
</tr>
<tr>
<td>Judo</td>
<td>France</td>
<td>- France - French training center in Strasbourg</td>
</tr>
<tr>
<td>Squash</td>
<td></td>
<td>- France - French training center in Strasbourg</td>
</tr>
<tr>
<td>Futsal</td>
<td></td>
<td>- Because of intermittent nature, French training center for youth and adults, eased parent involvement in younger population</td>
</tr>
</tbody>
</table>

Fig. 4: 30-15IFT applied in males [1]

Fig. 5: 30-15IFT applied in females [1]

30-15IFT applied in different branches in different countries, also both women and men (Table 5, Figure 4-5).
Interval Training Designs:

**Low Intensity Interval Training** [31] (Figure 6): 60 s jumping rope + 30 s isometric strength + 30 s dynamic strength (core training) 12 repetition = 24 min

**Low Intensity Interval Training** [31]:
- WARMING UP (AGILITY LADDER)
- 12 repetitions (20 s – 80 m tempo) – 40 s rest
- 12 repetitions (18 s – 80 m tempo) – 42 s rest

**Middle Intensity Interval Training** (Murat Bilge)
- 12 repetitions (16 s – 80 m tempo) – 44 s rest
- TOTALLY 40 min

3. Middle Intensity Interval Training (Murat Bilge)
4. Middle Intensity Interval Training (Murat Bilge)
5. Middle Intensity Interval Training (Murat Bilge)

All players are in three groups and they stand on the 6 m lines (2 of them stand on one side with the ball, one of them stand on the other side, Figure 9) (Murat Bilge).
High Intensity Interval Training (Murat Bilge):

- WARMING UP (AGILITY LADDER).
- 30-15sRT to the 14th level (to the ~5 m/s speed).
- 12 repetitions (20 s – 80 m tempo) – 40 s rest (4 m/s speed).

High Intensity Interval Training (Murat Bilge):

- 6 m line to the other 6 m line
- 60 s dribbling
- 60 s 3 times dribble and basic pass to partner
- 60 s 2 times dribble and basic pass to partner
- 60 s 1 times dribble and basic pass to partner
- 90 s put the ball to the 6 m line, run to the middle and receive the ball from the partner, the pas the ball to the other partner.
- Totally 7 min x 2 or 3 sets
- 1 / 3 load / rest ratio

High Intensity Interval Training (Murat Bilge):

- 6 m line to the other 6 m line
- 8 repetition 28 m passing and change
- 5 repetition 84 m (28 m x 3 times) passing and change
- 3 repetition 140 m (28 m x 5 times) passing and change
- 5 repetition 84 m (28 m x 3 times) passing and change
- 8 repetition 28 m passing and change
- ~ 14-17 min loading x 2/or 3 sets Anaerobic Interval Training (Murat Bilge)
- 1 / 3 load / rest ratio

High Intensity Interval Training (Murat Bilge):

- WARMING UP (AGILITY LADDER).
- Sprinting front and backward between 6 m – 9 m (a)
- 16 times
- 3 m side stepping with tempo (e) 16 times
- Sprinting front and backward between 6 m – 12 m (b)
- 12 times
- 6 m side stepping with tempo (f) 8 times
Table 6: HIIT Sample 9 30-15IFT (Level - Duration - Speed) (Murat Bilge)

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>DURATION</td>
<td>15 s</td>
<td>1.30</td>
<td>2.15</td>
<td>3.00</td>
<td>4.30</td>
<td>5.15</td>
<td>6.00</td>
<td>6.15</td>
<td>7.30</td>
<td>8.15</td>
<td>9.15</td>
<td>10.15</td>
<td>11.15</td>
<td>12.00</td>
<td>13.15</td>
<td>14.15</td>
<td>15.15</td>
<td>16.15</td>
<td>17.15</td>
<td></td>
</tr>
<tr>
<td>SPEED</td>
<td>8 km/h</td>
<td>8.5 km/h</td>
<td>9 km/h</td>
<td>9.5 km/h</td>
<td>10 km/h</td>
<td>10.5 km/h</td>
<td>11 km/h</td>
<td>11.5 km/h</td>
<td>12 km/h</td>
<td>12.5 km/h</td>
<td>13 km/h</td>
<td>13.5 km/h</td>
<td>14 km/h</td>
<td>14.5 km/h</td>
<td>15 km/h</td>
<td>15.5 km/h</td>
<td>16 km/h</td>
<td>16.5 km/h</td>
<td>17 km/h</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: HIIT Sample 9 Running Sets (Distance - Speed - Total Load) (Murat Bilge)

<table>
<thead>
<tr>
<th>Set</th>
<th>Distance (m)</th>
<th>Speed (m/s)</th>
<th>Total Load (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200 m</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>300 m</td>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>400 m</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td>4</td>
<td>500 m</td>
<td>5</td>
<td>250</td>
</tr>
<tr>
<td>5</td>
<td>600 m</td>
<td>5</td>
<td>300</td>
</tr>
<tr>
<td>6</td>
<td>700 m</td>
<td>5</td>
<td>350</td>
</tr>
<tr>
<td>7</td>
<td>800 m</td>
<td>5</td>
<td>400</td>
</tr>
</tbody>
</table>

High Intensity Interval Training With Handball Techniques According to the Playing Positions (Murat Bilge):

- Sprinting front and backward between 6 m – center (c) 8 times
- 3 m side stepping with tempo (e) 16 times
- Sprinting front and backward between 6 m – 6 m (28 m) (d) 4 times
- 6 m side stepping with tempo (f) 8 times
- ~ 20 min x 2 set (the program can be performed pyramidal)
- Between drills players can jog as resting.

- 30-15 to the 7th level with dribbling (for young / amateur players) or 30-15 to the 10th level with dribbling (for senior / professional players) (Figure 12)
- 30-15 to the 7 – 14th level with basic passing (for young / amateur players) or 30-15 to the 20th level with dribbling (for senior / professional players) (Table 6)
- 10 handball court (400 m) with 5 m / s speed tempo (Totally 100 s) for wing and line players. (Table 7) 20 semi handball court (400 m) with 5 m / s speed tempo (Totally 100 s) for back court players. (Figure 12) Goalkeepers get ready for shooting while the court players running.
- 10 jumping shoot from 6 m by faking after double pass (for wing and line players) (Figure 13). 10 jumping shoot from 9 m by faking after double pass (for back court players) (Figure 13).
• 8 handball court (320 m) with 4.5 m / s speed tempo (Totally 72 s) for wing and line players. (Table 7) 16 semi handball court (320 m) with 4.5 m / s speed tempo (Totally 72 s) for back court players. (Figure 12)

• 8 jumping shoot from 6 m by faking from other side after double pass (for wing and line players) (Figure 13). 8 jumping shoot from 9 m by faking from other side after double pass (for back court players) (Figure 13).

• 6 handball court (240 m) with 4 m / s speed tempo (Totally 48 s) for wing and line players. (Table 7) 12 semi handball court (240 m) with 4 m / s speed tempo (Totally 48 s) for back court players. (Figure 12)

• 6 jumping shoot from 6 m by reversing after double pass (for wing and line players) (Figure 13). 6 standing shoot from 9 m by faking after double pass (for back court players) (Figure 13).

• 4 handball court (160 m) with 3.5 m / s speed tempo (Totally 28 s) for wing and line players. (Table 7) 8 semi handball court (160 m) with 3.5 m / s speed tempo (Totally 28 s) for back court players. (Figure 12)

• 4 jumping shoot from 6 m by reversing from other side after double pass (for wing and line players) (Figure 13). 4 standing shoot from 9 m by faking from other side after double pass (for back court players) (Figure 13).

• 2 handball court (80 m) with 3 m / s speed tempo (Totally 12 s) for wing and line players. (Table 7) 4 semi handball court (80 m) with 3 m / s speed tempo (Totally 12 s) for back court players. (Figure 12)

• 2 fast break shoot after long running (for wing and line players). 2 fast break shoot after short running (for back court players).

• Cool Down

• ~ 60 min Anaerobic Interval Training With Handball Techniques According to the Playing Positions (Murat Bilge)

In conclusion as the trainers we have to design the condition training programmes according to the handball’s specificities. Game duration, heart rate, working loads, running profiles, running distances and the specificities for the playing positions have to shape the training plans.

The interval training examples in the present study suggest that a handball specific interval training methods have more effect on game performance.

REFERENCES


24. Luig, P., et al., 2008. Motion characteristics according to playing position in international men’s team handball. 13. Annual Congress of the ECSS, Estoril/Portugal.