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# Evaluation of Physical and Physiological Characteristics of the Olympic Champion Turkish Deaf Men's National Handball Team

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**Abstract**

The aim of this study is to evaluate physical and physiological characteristics of the Olympic Champion Turkish Deaf Men's National Handball Team. A total of 20 athletes participated in the study with age average of 27 ± 6.26 years, sports age average of 11.45±5.35 years, average height of 180.3±6.70 cm and an average body weight of 82.49±10.38 kg. In the evaluation of the data SPSS 19.0 program was used, frequency and distribution is observed, average standard deviation, maximum, and minimum values were taken. The average Body Mass Index (BMI) of the athletes were determined as 25.01±1.48 kg/m2, average Baseline Metabolic Rate (BMD) were 8643±924.06 (kJ), average Body Fat Percentage (%) were 12.86± .79%, average Fat Free Weight (FFM) were 71.59±7.37 kg, Visceral Fat Rating was 2.75±1.39, average right-left handgrip strength were 47.5±7.38-46.6±7.14 kg, average double foot jump with fixed-free hand values were 30.1±3.62 - 36.5±4.45 cm, average right-left hand visual reaction rate were 258.9±17.77 - 261.8±23.04 msec, average pro-agility agility test were 5.22±0.18 sec, and the average flexibility were 11.9±5.22 cm. As a result, physical and physiological characteristics of the Olympic Champion Turkish Deaf Men's National Handball Team is compared to the evaluated literature; While the height, body weight, BMI, reaction speed, agility and body fat ratio values is parallel to other handball players, the flexibility and jumping values were found to be lower than other hearing-impaired athletes and handball players. In particular, grip strength values are higher than other hearing-impaired athletes, and parallel to the values of handball players.

**Keywords:** hearing-impaired (deaf), grip strength, speed

## 1. Introduction

In the case of hearing impairments, sports aims to remove social inequalities, which are also present in other disability groups (Gür, 2001). It is stated that children with disabilities have lower physical fitness levels than healthy children of similar age (Zebrowska et al., 2007) However, children with hearing impairment are not very different in terms of physical capabilities from normal children (Özer, 2004).

People with hearing impairments often participate in sporting activities, and they also participate in races at every level, from local to ParaOlympic Games (Vujkov et al., 2010). Participation of people, to sports activities, who have one or more of physical, emotional, psychological, audiological or visual disabilities due to inheritance or later diseases or accidents is a matter that is particularly emphasized in our country today (İnal, 2011). The achievements of our disabled athletes on the international platforms in the recent years, have been proving this.

With continuous and deliberate work, handball technical skills can be learned, parallel to this the biomedical features, such as durability, speed, skill, flexibility, jump, etc., which is the basics of the game, can be earned too (Çelikbilek, 2006). Players apply many different movements in the direction of desired tactics, such as bouncing, running, changing direction, passing, goal kicks and technical movements, in a very short time (Cardinale, 2001). The handball player's motorsport characteristics were specified as 25% speed, 20% special jump-shoot, 15% endurance, 15% coordination, 15% flexibility and 10% overall force (Taşucu 2002).

Success in sports require superior performance. The research on the field of sports targets how to increase performance and success (Kurudirek, 1998) In general, performance is the level of efficiency that the athlete demonstrates and there

are multiple (physical, physiological, biomotorical, psychological, mental, sociological, technical, tactical, etc.) components (Kılınç 2008). However, research on high-level hearing-impaired athletes is scarce. The target of this study is to evaluate physical and physiological characteristics of the Olympic Champion Turkish Deaf Men's National Handball Team.

## 2. Method

A total of 20 athletes participated in the study with age average of 27±6.26 years, sports age average of 11.45±5.35 years, average height of 180.3±6.70 cm and an average body weight of 82.49 ± 10.38 kg. The athletes who participated in the study have 2nd place in 2011 European Deaf Men's Handball Championship and 2016 World Deaf Men's Championship, and Olympics champion in 2017 Deaf Olympics.

Table 1. Features of the Athletes

| | Age | Sport age (year) | Height (cm) | Weight (kg) | Dominant hand | Position |
|---|---|---|---|---|---|---|
| 1 | 34 | 19 | 198 | 102,3 | right | left play maker |
| 2 | 31 | 15 | 173 | 72,4 | right | left wing |
| 3 | 33 | 15 | 183 | 78,6 | right | center play maker |
| 4 | 30 | 12 | 178 | 76,4 | right | center play maker |
| 5 | 20 | 8 | 174 | 71,6 | right | left wing |
| 6 | 34 | 16 | 178 | 74,1 | right | center play maker |
| 7 | 20 | 5 | 183 | 84,1 | right | left wing |
| 8 | 22 | 15 | 182 | 85.6 | right | left play maker |
| 9 | 19 | 4 | 177 | 85,3 | right | leftplay maker |
| 10 | 23 | 3 | 188 | 91,8 | right | goalkeeper |
| 11 | 21 | 10 | 171 | 78,0 | left | right wing |
| 12 | 26 | 9 | 182 | 93,2 | right | pivot |
| 13 | 38 | 20 | 179 | 91.3 | right | goalkeeper |
| 14 | 20 | 4 | 168 | 66,5 | left | right wing |
| 15 | 33 | 15 | 180 | 84,2 | left | right play maker |
| 16 | 35 | 15 | 178 | 90,2 | right | pivot |
| 17 | 27 | 9 | 189 | 91,2 | right | left play maker |
| 18 | 30 | 19 | 182 | 81,6 | left | left play maker |
| 19 | 19 | 8 | 185 | 79,1 | right | left play maker |
| 20 | 25 | 8 | 178 | 72,4 | right | left wing |
| Mean | 27 | 11.45 | 180.3 | 82.49 | | |
| Std. Dv. | 6.26 | 5.35 | 6.70 | 9.06 | | |

Height measurements were made with the Seca brand digital height gauge and body composition measurements were determined with the Tanita Analyzer BC-418 brand body analyzer. The BMI, Basal Metabolic Rate, Body Fat Percentage, Body Fat Mass, Fat Free Body Mass, Visible Fat Ratio and Impedance of the athletes were assessed.

Handgrip strength measurement was made with Takei grip-D force dynamometer. The athletes were measured by adjusting it according to the hand measurement, without twisting the arm from the elbow, applying the gripping force. Two trials were conducted and the best value was recorded.

The visual reaction time measurements of the athletes were made with the Newtest 2000 instrument. A line was drawn on the desk, 10 cm in front of the measuring area and the participants were asked to position their dominant hand on it. When participants were ready, they were asked to press the buttons immediately when the light stimulants are given. Using the system's random feature, 10 random light stimuli were given in different frequencies and levels. The measurements were made between 16:00 and 18:00 in an environment with sufficient light. In order to record the measurement results, an information form has already been created for each athlete. From each subject, 10 trials were

taken against the light stimuli, the first 5 stimuli were accepted as practice, and the average of the last 5 stimuli was determined as the reaction time.

The vertical jump measurements of the athletes participating in the study were made with the Newtest 2000 instrument. Participants were asked to take positions on the leap mats, so that both feet would be parallel to one another. They were asked to fix their hands on their waist and to come to the half squat position, promptly asked to jump with their double feet without using their arms. At the end of the jump, the point they land vertically is observed. If they land to another point on the mat, the jump was repeated. Best of 3 jumps were recorded as the jump height. Then they were asked to jump when their arms are free. Again, best of 3 jumps were recorded as the jump height.

For the agility test (Pro-Agility), two traffic obstacles are positioned, as shown, at a distance of 5m from the starting line. After the start sign, when the athletes pass the start line, the coaches started their stopwatches. The athlete first touches a traffic obstacle, then touches the other traffic obstacle as soon as possible which is 10 meters behind, passes through the starting line, and the stopwatch is stopped. The average of the timings of two stopwatches were recorded as the performance value of the agility test.

The athletes ran the 20 m at a maximum speed, without touching the starting line. The start and end were determined by the stopwatch and after the first round, they came to the starting line within 30 seconds, resting for the 2nd round. 5 rounds were applied and the value was recorded at the end of each round.

In the evaluation of the data SPSS 19.0 program was used, frequency and distribution is observed, average standard deviation, maximum, and minimum values were taken.

**3. Results**

Table 2. Body Composition Values of Athletes

| | BMI | BMH (kj) | FAT% | FAT MASS (kg) | FFM (kg) | Visceral Fat Rating |
|---|---|---|---|---|---|---|
| 1 | 26,1 | 10996 | 13,2 | 13,5 | 88,8 | 4 |
| 2 | 24,2 | 7648 | 12,7 | 9,2 | 63,2 | 3 |
| 3 | 23,5 | 8376 | 11,9 | 9,4 | 69,3 | 3 |
| 4 | 24,1 | 8150 | 12 | 9,2 | 67,2 | 3 |
| 5 | 23,6 | 7849 | 11,5 | 8,2 | 63,4 | 1 |
| 6 | 23,4 | 7812 | 12,6 | 9,3 | 64,8 | 3 |
| 7 | 25,1 | 9447 | 9,4 | 7,9 | 76,2 | 1 |
| 8 | 26., | 9142 | 11,3 | 10.9 | 74.4 | 2 |
| 9 | 27,2 | 8715 | 18,9 | 16,1 | 69,2 | 4 |
| 10 | 26 | 9552 | 16,5 | 15,2 | 76,7 | 3 |
| 11 | 26,7 | 8255 | 14,7 | 11,5 | 66,5 | 2 |
| 12 | 28,1 | 9715 | 15,9 | 14,8 | 78,4 | 4 |
| 13 | 26.2 | 8319 | 13.9 | 16.7 | 82 | 6 |
| 14 | 23,6 | 7284 | 11,8 | 7,9 | 58,7 | 1 |
| 15 | 26 | 8259 | 16,9 | 16,8 | 67,4 | 6 |
| 16 | 24.3 | 7614 | 14.3 | 15.2 | 74 | 3 |
| 17 | 25,5 | 9899 | 11,8 | 10,9 | 80,4 | 2 |
| 18 | 24,6 | 8878 | 10,4 | 8,5 | 73,1 | 2 |
| 19 | 23,1 | 8791 | 10,5 | 8,3 | 70,8 | 1 |
| 20 | 22,9 | 8171 | 7 | 5,1 | 67,3 | 1 |
| Mean | 25.01 | 8.643 | 12.86 | 11.23 | 71.59 | 2.75 |
| Std. Dv. | 1.48 | 924.06 | 2.79 | 3.51 | 7.37 | 1.51 |

As a result of this study the average BMI of the athletes were determined as 25.01±1.48, the average BMR (KJ) as 8643±924.06, the average body fat percentage (FAT) as 12.86±2.79%, the average fat mass (FFM) as 71.59±7.37 kg, the average metabolic rate as 2.75±1.39, the average impedance as 511.85±37.43 Ω, the average of the speed continuity test on the 1st round as 2.98±0.10 sec, as 2.96±0.12 sec on 2nd round, as 3.0±0.16 sec on 3rd round, as 3.03±0.11 sec on 4th round, as 3.08±0.14 sec on 5th round, the average left and right hand gripping force as 47.5±7.38 kg - 46.6±7.14 kg, the average double leg jump with hands fixed as 30.1±3.62 cm, the average hands-free double leg jump as 36.5±4.45 cm, the average right - left hand visual reaction rate as 258.9±17.77 - 261.8±23.04 msec, the average pro-agility agility test as 5.22±0.18 sec and the average elasticity as 11.9±5.22 cm.

Table 3. Performance Values of Athletes

| Test | | Min | Max | X | SD |
|---|---|---|---|---|---|
| Handgrip strength (kg) | Right hand | 35,1 | 62,2 | 47,5 | 7,38 |
| | Left hand | 36,6 | 62,8 | 46,6 | 7,14 |
| Vertical jump(cm) | Hands fixed | 23 | 36 | 30,1 | 3,62 |
| | Hands free | 28 | 45 | 36,5 | 4,45 |
| Reaction rate (ms) | Right hand | 208,6 | 307,6 | 258,9 | 27,77 |
| | Left hand | 195,8 | 375,6 | 261,8 | 53,04 |
| Pro-agility agility test(sn) | | 4,77 | 5,69 | 5,22 | 0,18 |
| Flexibility (cm) | | 4,3 | 24,6 | 11,9 | 5,22 |

## 4. Discussion

Cengizhan and Günay (2014) determined the hearing-impaired men national team athletes' average B, VA and BMI values as 183±9.1 cm, 76.8±12.6 kg and 22.8±2.7 (kgm/m2), Açak et. al (2012) determined the national hearing-impaired men futsal team athletes' average B, VA, BMI values as (176.5 cm, 74.2kg, 23.81). Alp et. al (2015) determined university team handball players' B and VA averages as 179.6±7.06 cm and 73.56±10.77 kg, Çolak and Kolukısa (2017) determined B and VA of handball players with average age of 21, as 184.57±2.76 cm and 83.85±11.24 kg, Zorba et. al. (2014) determined the average B, VA and BMI of 2nd League handball players as 178.57±3.68 cm, 77.21±3.98 kg, 24.22±1.19 (kgm/m2). Working with hearing impaired volleyball players, Ciğerci et. al. (2011) determined their body fat percentages as 9.05±3.02%, working with hearing impaired basketball players, Aksen and Günay determined their body fat percentages as 10.4±4% where as Açak and et. al determined as 11.14%, working with active sportsmen with hearing impairment, Çağlar et. al. (2013) determined their body fat percentages as13.75±7.58%. High body fat percentage shows a decrease in motor performance, especially muscle strength, speed, and overall endurance (Weineck, 2011). Aksen and Günay (2014) stated that the hearing-impaired basketball players had a right-left hand reaction speed of 231.5±38.5 - 215.8±29.7 msec, Açak stated that the hearing-impaired futsal players had a right-left hand reaction speed of 263.04±35.99 - 271.22±39.66 msec, Zorba et. al. (2014) stated that the 2nd League handball players had a right-left hand reaction speed of 212±0.01 - 217±0.01 msec, and Çağlar et. al. (2013) stated that in the study they conducted with disabled active sportsmen, their right-left hand reaction speed was 341.20±53.24 msec.

Table 4. Comparison of Body Composition Values of Athletes

| | Grip Strength (kg) | | Hands-free | Hands-fixed | Reaction Time (msec) | | Pro-agility | |
|---|---|---|---|---|---|---|---|---|
| | Right | Left | Jump (cm) | Jump (cm) | Right | Left | (sec) | Flexibility (cm) |
| Current Study | 47,5±7,38 | 46.67,387.14 | 36.5±4.45 | 30.1±3.62 | 258.9±27.77 | 261.8±53.04 | 5.22±0.18 | 11.9±5.22 |
| Ciğerci et al., 2011 Hearing-Impaired volleyball | 26.93±8.93 | 26.17±8.72 | | | | | | |
| Aksen and Günay, 2014 Hearing-Impaired Basketball | | | 45.3±5.6 | | 231.5±38.5 | 215.8±29.7 | | 19.2±6.1 |
| Açak et al 2012, Hearing-Impaired futsal, | | | | | 244.42±10.36 | 249.30±10.37 | | |
| Çağlar et al.,2013 Hearing-Impaired Kids Doing Sports | Preferred Hand 22.57±9.33 | | 37.47±10.69 | | Preferred Hand 341.20±53.24 | | | 25.55±7.97 |
| Şirinkan, 2013 Hearing-Impaired Kids Doing Sports | | | 32,65±4,74 | | | | | 4.44±2.78 |
| Eskicioğlu and Çoknaz (2016) Hearing-Impaired sportsmen | | | | | Dominant Hand 232±,045 | | | |
| Zorba et al. (2014) elite handball player | 42.93 1.96 | 41.87 1.74 | 49.39 ±3.24 | | 212 ±0.01 | 217±0.01 | | |
| Çolak and Kolukısa (2017) handball player | 47.05±9.04 | 44.31±7.97 | 45 ±5 | | | | | 22 ±8,84 |
| İri et al., (2013) handball player | 47.5±5.7 | 43.5±4.9 | | | | | | |
| Yıldırım and Özdemir (2010) elite handball player | | | 17-21 y/o 48.86±2.12 | 22-27 y/o 53.07±2.27 | | | | |
| Albay et al. (2008) handball player | | | 53.80±9.07 | | | | | |
| Alp et al. (2015) University Handball Team | 48.52±4.88 | 42.83 ±4.95 | 51.91±6.93 | | | | | 27.33 ±7.26 |
| İri et al. (2017) Elite handball player | 50,05±4,65 | 45,30 ±3,83 | 50,20 ±3,17 | | Preferred Hand 203,41±16,57 | | | 34,02±2,96 |

Ciğerci and et. al (2011) reported that hearing impaired volleyball players had a right hand pinch strength value of 26.93 ± 8.93 kg, a left hand pinch strength value of 26.17 ± 8.72 kg, Alp and f et. al' (2015) study on elite handball players showed that right-left hand grip strength values of them are 48.52 ± 4.88-42.83 ± 4.95, Çolak and Kolukısa (2017) reported that the right-left hand grip strength of handball players was 47.05 ± 9.04-44.31 ± 7.97 kg, İri et al., (2003) found right hand grip strength values of handball players as 47.5 ± 5.7 kg and left hand grip strength values as 43.5 ± 4.9 kg.

Yıldırım and Özdemir (2010) found that the vertical jump values of elite handball players in super league who are aged between 17-21 years as 48.86±2.12 cm, who are aged between 22-27 years as 53.07 ± 2.27 cm; Albay et. al. (2008) found the values in handball as 53.80±9.07, Çağlar et. al (2013) found them as 37.47±10.69 cm for hearing impaired active sportsmen, and Aksen and Günay (2014) found them as 45.3±5.6 cm for hearing impaired male basketball players.

Table 5. Comparison of Performance Values of Athletes

| | Grip strength (kg) | | Hands free | Hands fixed | Reaction time (ms) | | Pro-agility | Flexibility |
|---|---|---|---|---|---|---|---|---|
| | right | left | Jump (cm) | Jump (cm) | right | left | (sn) | (cm) |
| Current study | 47,5±7,38 | 46.67,387.14 | 36.5±4.45 | 30.1±3.62 | 258.9±27.77 | 261.8±53.04 | 5.22±0.18 | 11.9±5.22 |
| Ciğerci et al.,(2011) Hearing-Impaired volleyball | 26.93±8.93 | 26.17±8.72 | | | | | | |
| Aksen and Günay, (2014) Hearing-Impaired basketball . | | | 45.3±5.6 | | 231.5± 38.5 | 215.8±29.7 | | 19.2±6.1 |
| Açak et al., (2012) Hearing-Impaired futsal, | | | | | 244.42±10.36<br>249.30±0.37 | | | |
| Çağlar et al.(2013) Hearing-Impaired kids doing sport | Preferred hand<br>22.57±9.33 | | 37.47±10.69 | | Preferred hand<br>341.20±53.24 | | | 25.55±7.97 |
| Şirinkan, (2013) Hearing-Impaired kids doing sport | | | 32,65± 4,74 | | | | | 4.44± 2.78 |
| Eskicioğlu and Çoknaz (2016) Hearing-Impaired sportsmen | | | | | Dominant hand<br>232±,045 | | | |
| Zorba et al. (2014) elite handball player | 42.93±1.96 | 41.87 ±1.74 | 49.39 ±3.24 | | 212 ±0.01 | 217±0.01 | | |
| Çolak and Kolukısa (2017) handball player | 47.05±9.04 | 44.31±7.97 | 45 ±5 | | | | | 22 ±8,84 |
| İri et al., (2013) handball player | 47.5±5.7 | 43.5±4.9 | | | | | | |
| Yıldırım and Özdemir (2010) elite handball player | | | 17-21 y/o<br>48.86±2.12 | 22-27 y/o<br>53.07±2.27 | | | | |
| Albay et al. (2008) handball player | | | 53.80±9.07 | | | | | |
| Alp et al. (2015) University Handball Team | 48.52±4.88 | 42.83 ±4.95 | 51.91± 6.93 | | | | | 27.33 ±7.26 |
| İri et al. (2017) Elite handball player | 50,05±4,65 | 45,30 ±3,83 | 50,20 ±3,17 | | Preferred hand<br>203,41± 16,57 | | | 34,02±2,96 |

Alp et. al. (2015) stated the flexibility value of elite handball players as 27.33±7.26 cm, Aksen and Günay (2014) stated the flexibility value of hearing-impaired male basketball players as 19.2±6.1 cm. Yıldırım and Özdemir (2010) found statistically, leg strength and flexibility of elite handball players are important factors in the vertical jump distance. The average pro-agility agility test of the athletes was determined as 5.22±0.18 sec.

## 5. Conclusions

As a result, it is shown that the physical and physiological characteristics, the height, body weight, BMI, reaction speed, agility and body fat ratio values of the Olympic Champion Turkish Deaf Men's National Handball Team is parallel to other handball players in the literature. But the flexibility and jumping values were found to be lower than other hearing-impaired athletes and handball players. In particular, grip strength values are higher than other hearing-impaired athletes, and parallel to the values of handball players.

Recently in Turkey, the disability sports is of great importance. However, it can be said that the work and preparations made in this area have just begun. This idea is supported by the lack of hearing-impaired handball league in our country, and the fact that scientific studies are limited in number, according to our current knowledge. The increase in the number of organizations and the works done for the disabled people will be an important step in integrating the disabled people to the society and it will contribute to science.

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