COMPARISON OF BODY COMPONENTS AND BALANCE LEVELS AMONG HEARING-IMPAIRED WRESTLERS AND HEALTHY WRESTLERS

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Abstract

The purpose of this study is to compare the body components and static and dynamic balance levels of hearing-impaired wrestlers (H-IW) and healthy wrestlers (HW). Thirty-five H-IW and twenty-two HW participated in this research. The body components of the participating wrestlers were obtained by the Bioelectrical Impedance Analyzer (BIA), static and dynamic balance measurements via the Biodex Balance System, and back and leg strengths according to the protocols of back and leg dynamometry. The normality of data was tested by the Kolmogorov-Smirnov test. The independent Samples T Test was used to compare pair wise group variables that followed a normal distribution. Significance was accepted for values of $p<0.05$ with a 95% confidence interval. No statistically significant difference was found among the values of H-IW and HW in terms of age, height, weight, Body Mass Index (BMI), sporting age, Percentage of Body Fat (PBF), Fat Mass (FM), Free Fat Mass (FFM). On the other hand, that there was a significant difference between back and leg strengths and static and dynamic balance levels among H-IW and HW. As a result, when H-IW and HW were compared, it was found that there was no difference between body components (PBF, FM and FFM) and demographic variables (age, height, weight, BMI, sport age) whereas HW had both higher average back and leg strengths and their dynamic and static balance levels were better than H-IW.

Key words: *body components, dynamic balance, static balance, hearing-impaired wrestlers.*

Introduction

Wrestling is defined as a sports branch that affects the performance by the factors such as speed, strength, quickness, flexibility, muscular and cardiovascular endurance, coordination and balance, in which aerobics and anaerobic energy metabolism are used together to bring each other's back or get technical superiority over his/her opponent in the frame of official rules (Soyduden et al., 2014). The balance is the fundamental component of many daily life activities and sportive motor skills such as sitting, standing, and walking (İbiş, Iri, and Aktuğ, 2015). It has been reported that the balance feature is related to age, gender, anthropometric structure, and support points (Ünlüsoy et al., 2011, Blaszczyk et al., 2009). Hearing loss is, according to the World Health Organization (WHO) data, one of the most common types of handicaps observed in the world. It was reported by WHO that there have been 360 million hearing-impaired individuals worldwide. 32 million of these are children and 328 million are adults with hearing-impairment (Garg and Gupta, 2015). In addition to aforegiven details, 183 million people, that is to say 56%, are men and 145 million people, that isto say 44%, are women. About 6% of the world's population is made up of hearing-impaired individuals according to the figures given above. It has also been reported that 2/3 of these figures have been livingin developed countries (Chauhan et al., 2015). Hearing loss may be resulted from many causes such as genetic, birth complications, infectious diseases, coronary ear infections, various drug uses, and exposure to high noise levels (Reyhani et al., 2016). The balance can be defined statically as the ability to sustain the support point with small motions and dynamically as the ability to perform a task while maintaining a fixed position (Winter, Patla, and Frank, 1990). The postural control of the body and the balance protection are administered by the Central Nervous System (CNS).The CNS receives information, required for postural and balance control, from the somatosensory system, the vestibular system, and the visual system. The sensory input alone is not, meanwhile, enough to sustain the postural control. The integrity of the postural stability muscle mass depends on the efficiency of the systems in the CNS and the complete neural pathways for motor control. The somatosensory system senses touching, pressure, pain, joint movements, and positions of joints. These inputs are called as proprioception. The proprioception is the sum of perceptions of joint positions and joint movements responsible for the balance and postural control. The movement of body joints during imbalance periods stimulates the proprioception in the joints (Aksakal and Şen, 2016). Hearing performs a great number of important tasks, such as differentiating the surrounding sounds, defining the direction of sound, and adjusting the frequency of the acoustic signals. The vestibular system in the inner ear plays an important role, meanwhile, in stabilizing the gravity related with posture and walking. The vestibular system is operated by means of information from many systems such as hearing, vision, and muscular structures. The vestibular system disabled temporarily or permanently

because of any reason causes various troubles such as disorientation in movements, disruption of balance during walking, etc. (Wolff et al., 1998, Akyuz et al., 2016). There are numerous studies showing that static and dynamic balance abilities can be affected negatively in terms of age, gender, etiology, and degree of hearing loss in hearing-impaired individuals (Butterfield and Ersing, 1986; Siegel, Marchetti, and Tecklin, 1991; Slobounov and Newell 1994). The control of static and dynamic balance is very important for high-quality movements and success performance during training and competitions (Sucan et al., 2005). Balter et al. (2004) reported, that a good balance between experienced athletes is due to long-term repeated training activities that affects motor responses rather than the more advanced sensitivity of the vestibular system.

However, Ashton-Miller et al. (2001) reported, contrary to the above, that a good balance for the athletes was due to person's visual clues and to the training affecting the ability to pay careful attention to the relevant proprioceptive. The relevant measurements of research were conducted in hearing-impaired men national team camps and the senior men's national team camps. The wrestlers at the national team level have been applying generally the same training programs during the same periods. In this context, the hypothesis of the current study, that there will be no difference in terms of body components, but in terms of strengths and balance performances.

Because H-IW in Turkey can play, if they desires, official matches with HW. It has been determined, meanwhile, that healthy athletes who receive medals in the World and European Championships for Hearing Impaired athletes cannot achieve any success in the championships participated by healthy athletes. This indicates, meanwhile, that the performance criteria of H-IW are not sufficient compared to HW. In this context, the current study aimed to compare the body components and static and dynamic balance abilities among H-IW and HW.

Methods

Subjects
The subjects of the study consisted of thirty-five H-IW and twenty-two HW. At the beginning of the study, the subjects were informed about the purpose of the research subjects and all of the subjects took part in the study with their own consents.

Applied Tests
Measuring of Body Weight and Length
The body weight and heights of relevant participants were measured by Seca brand stadiometer with an accuracy of 1 mm.

Measuring of Body Components
Body components of the wrestlers were measured at athlete mode, wrestling suit with a tare of 250 gr through BIA.

Back Strength
The back and leg dynamometer (Takei brand) was used to measure back strength. After the subjects placed their feet on the stand of dynamometer, required measurements were completed accordingly in a body position when they lifted the dynamometer bar vertically up by hands to the maximum position with their knees and arms stretched, the back straight, and the body slightly inclined forward (Harbili et al., 2005).

Leg Strength
The back and leg dynamometer (Takei brand) was used to measure the leg strength. After the subjects placed their feet on the dynamometer stand with knees at an angle of 130° - 140°, back straight, and body in a slightly inclined position, they lifted the dynamometer bar vertically up using only the legs without using the back at the maximum position till they reached their knees to the extension (Harbili et al., 2005).

All of the strength measurements were repeated three times and the best levels were recorded in kg.

Static and Dynamic Balance Measurements
The Biodex Balance System (Biodex, Inc., Shirley, New York) was used, in the study, for balance measurements. The Biodex Balance System consists of a swinging platform that allows the participant to remain stationary as well as to move forwards, backwards, and sideways as required.

The general index values were evaluated in the research. A high general index value indicates, therefore, a loss of balance at high levels. The balance scores of "0 degrees" indicate the maximum possible balance.

The platform has a degree of mobility between 0 and 12. While 12 is the most stable platform, 0 constitutes the most movable platform.

The static balance and 4th level dynamic balance testing were applied in this study. The tests were performed on the double-foot while standing bolt upright position. The double-foot balance tests were repeated 3 times, with a period of 30 seconds and a break time of 10 seconds between tests.

Statistical Analyses
The normality of data was tested by means of the Kolmogorov-Smirnov test. The independent Samples T Test was used to compare pair wise group variables that followed a normal distribution. A significance was accepted for values of $p<0.05$ with a 95% confidence interval.

Results

When demographic variables and differences of body components between the H-IW and HW groups were examined, it was observed that there was no significant difference between wrestler groups ($p>0,05$; Table 1).

Table 1. Comparison of Physical Characteristics and Body Components of Wrestler Groups

Variables	Groups	N	Mean±Std. Dev.	t	p
Height (cm)	HW	22	174,73±5,91	1,097	0,277
	H-IW	35	172,63±8,52		
Weight (kg)	HW	22	77,87±12,57	1,471	0,147
	H-IW	35	72,18±16,52		
Body Mass Index (kg/m^2)	HW	22	25,37±2,73	1,634	0,108
	H-IW	35	23,96±3,77		
Sports Age (year)	HW	22	12,18±2,42	0,637	0,527
	H-IW	35	11,54±5,09		
Percentage of Body Fat (%)	HW	22	11,45±4,12	1,288	0,204
	H-IW	35	9,91±4,78		
Body Fat Mass (kg)	HW	22	9,28±4,53	1,174	0,246
	H-IW	35	7,71±5,50		
Free Fat Mass (kg)	HW	22	68,60±8,86	1,480	0,145
	H-IW	35	64,48±12,08		

HW: Healthy Wrestler; H-IW: Hearing-Impaired Wrestlers

Table 2. Comparison of Strength and Balance Levels of Wrestler Groups

Variables	Groups	N	Mean±Std. Dev.	t	p
Leg Strength (kg)	HW	22	167,00±29,39	3,436	**0,001****
	H-IW	35	140,07±27,85		
Back Strength (kg)	HW	22	138,80±16,24	5,245	**0,001****
	H-IW	35	109,87±25,39		
Static Balance	HW	22	0,42±0,16	-2,199	**0,033***
	H-IW	35	0,57±0,37		
Dynamic Balance	HW	22	1,08±0,36	-4,359	**0,001****
	H-IW	35	1,85±0,94		

*p<0,05, **p<0,001, HW: Healthy Wrestler; H-IW: Hearing-Impaired Wrestlers

When strength and balance levels differences between the H-IW and HW groups were examined, significant differences were observed between the levels of leg strength, back strength, static balance, and dynamic balance levels (p<0,05; Table 2).

Discussion and conclusion

The human being needs three sensory systems primarily to provide his/her orientation in space. These are visual, vestibular, and proprioceptive systems (Teasdale et al., 1993). The visual system is, meanwhile, the first system to schedule our movements and to give us signal for the situations that prevent us from seeing our way ahead. The vestibular system is, on the other hand, a texture that perceives our linear and angular movements. The proprioceptive system consists of receptors sensitive to the positions, velocities, and contacts made to other objects of body segments and to the direction of gravity (Winter, 1995). The sensory information from visual, vestibular, and proprioceptive systems is used as inputs. In uncomplicated situations, meanwhile, only one of the three main systems is sufficient (Sucan et al., 2005). However, the vestibular deficiency in the sensory system can often cause troubles in motion perception and balance due to the complicated texture of the wrestling since the wrestling has a complex structure involving the attacks applied by two wrestlers and / or contra-attacks against the opponent's attack.

For this reason, visual, proprioceptive sensitivity, and vestibular system should be at improved levels in order to provide postural stabilization in both cases.

This study was planned to compare the body components and balance ability of H-IW and HW.In the current study it has been found no significant difference between H-IW (20,74±5,80 year) group and HW (22,09±2,76 year)group in term of age.In addition, no statistically significant difference was observed between physical characteristics (height, weight, body mass index), body components (PBF, FM, and FFM,) and sports ages (p <0.05). This suggests that the research group, despite it is consisted of independent groups, is homogeneous (in comparable composition). The sporting age represents the level of expertise of athletes and indicate that there is no difference in the number of training they apply.

Regular exercising and sporting increase the strength proportionally. Caglar et al. (2013) found, as a matter of fact, that there is a difference between the back and leg strengths of hearing-impaired athletes and hearing-impaired sedentary ones. When we examine, in our research, the difference between the leg strengths of the wrestlers, the average level of leg strength of the H-IW was found as 140,07±27,85 kg whereas the average level of leg strength of HW 167,00±29,39 kg.

When the difference between back strengths was examined, meanwhile, the average of leg strength of H-IW was 109.87±25.39 kg whereas the average of leg strength of HW was 138.80±16.24 kg. This results show that the strength levels of HW have a higher average than the levels of H-IW. Cigerci et al. (2011) reported, after examining the studies accomplished in the literature, in their study on hearing impaired and healthy sedentary men that healthy individuals had higher averages in terms of strength variables. Kitis et al. (2015) compared the back extensor muscle strength and quadriceps muscle strength of hearing-impaired individuals and healthy individuals and found that healthy individuals had a higher average than hearing-impaired individuals. Our study has similar results to the studies in the literature. It can be considered that being the lower strength variables of H-IW below the variables of healthy wrestlers are caused by the defects on their vestibular system.

The balance is an important factor to sustain the body composition and success in sports. It is the basis of the movement especially for the dynamic sports containing sudden movements within and sports branches prosecuted with movement. The balance performance is required for all kind of sports (Karakoc, 2016). Many studies point to motor dexterity and more specifically balance loss in hearing-impaired children (Cushing et al., 2008; Hartman, Houwen, & Visscher, 2011; Livingstone, & McPhillips, 2011). Because it is necessary to integrate and evaluate the visual, vestibular, and somatosensorial information for attaining appropriate postural stabilization. Wrestling has a complex structure. For this reason, the vestibular system defects in the hearing-impaired ones can cause them to face some troubles of balance levels.

When we analyzed the differences between the static balance levels of the wrestlers in our research, the static balance averages of the H-IW were obtained as 0,57±0,37 while the leg strength averages of the HW as 0,42±0,16. On the other hand, when the differences between dynamic balance levels were examined, the average of the dynamic balance of H-IW was obtained as 1,85±0,94 and the average of the dynamic balance of HW as 1,08±0,36. The results, acquired show that the static and dynamic balance levels of HW have a lower average than the levels of H-IW. Such a finding shows that HW aremuch more balanced than the H-IW. Eliöz et al. (2013) reported that the averages of healthy soccer players were higher than the averages of hearing-impaired soccers in terms of static balance performances of both groups. Ciğerci et al. (2011) reported, in their study on hearing-impaired and healthy sedentary people, that the balance levels of healthy individuals were at a better level. Our research shows similarities to the hearing researches accomplished in the literature.

It has been determined consequently that there is no difference between body components of H-IW and HW. Statistically significant differences were found, meanwhile, between back and leg strength and static and dynamic balance levels. It is considered that such an outcome is resulted from loss, premature birth, of vestibular system in the hearing-impaired athletes.

This research was applied on hearing-impaired and healthy wrestlers in the same branch. The investigation of body components, balance, and strength differences between the inherently or afterwards hearing-impaired athletes or the sedentary ones is so much important in terms of athlete's health and for the aspects of improving performance. In addition, only limited numbers of research have been observed in the literature on hearing-impaired and healthy individuals competing in the same sports branch. For this reason, to accomplish more studies on more different sample groups will give a light to the literature.

Conflicts of interest
The authors declare that there is no conflict of interest with this manuscript.

Dates of any Congress
This study was not presented as an oral or poster at any congress.

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USPOREDBA TJELESNIH KOMPONENTI I RAZINE RAVNOTEŽE IZMEĐU HRVAČA S OŠTEĆENJEM SLUHA I ZDRAVIH HRVAČA

Sažetak

Svrha ovog istraživanja je usporediti sastav tijela i statičke i dinamičke ravnoteže razina hrvača s oštećenjem sluha (H-IW) i zdravih hrvača (HW). Trideset i pet H-IW i dvadeset i dva HW sudjelovalo je u ovom istraživanju. Tjelesne komponente hrvača koji su sudjelovali su dobivene analizatorom Bioelectrical Impedance (BIA), statičkim i dinamičkim mjerenjem ravnoteže putem Biodex Balance System, te snage za leđa i noge prema protokolima leđa i noge. Normalnost podataka testirana je Kolmogorov-Smirnovovim testom. Neovisni test uzoraka T je korišten za usporedbu parnih varijabli koje su slijedile normalnu distribuciju. Značaj je prihvaćen za vrijednosti p <0,05 s 95% intervala pouzdanosti. Nije pronađena statistički značajna razlika između vrijednosti H-IW i HW u odnosu na dob, visinu, težinu, indeks tjelesne mase (BMI), sportski dob, postotak tjelesne masti (PBF), masnu masu (FM), slobodnu masnoću (FFM). S druge strane, došlo je do značajne razlike između jačine prednjih i nogu i statičkih i dinamičkih ravnotežnih razina između H-IW i HW. Kao rezultat toga, kada se uspoređuju H-IW i HW, utvrđeno je da nema razlike između sastavnica tijela (PBF, FM i FFM) i demografskih varijabli (dob, visina, težina, BMI, sportska dob), dok je HW imao prosječno veći stražnji i prednji dio noge te su njihove dinamičke i statičke ravnoteže bile bolje od H-IW.

Ključne riječi: *sastav tijela, dinamička ravnoteža, statička ravnoteža, hrvanje s oštećenjem sluha.*

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