The Comparison of Reaction Time and Static Balance Performance of Young Hearing-Impaired Sedanters and Athletes

Özdemir Atar, Cemil Aksoy and Hürmüz Koç

Erciyes University, School of Physical Education and Sport, Kayseri, Turkey
Sütçü Imam University, School of Physical Education and Sport, Kahramanmaraş, Turkey
Erciyes University, School of Physical Education and Sport, Kayseri, Turkey

Abstract: The aim of this study is to compare reaction time, movement speed and static balance performance of hearing-impaired athletes and hearing-impaired sedanters who were aged between 18 and 20 and had similar physical characteristics. A total of 30 young, male, hearing-impaired volunteers participated in the study and mean age for Group 1 composed of hearing-impaired athletes was 18, 66±0,72 years and mean age for Group 2 composed of hearing-impaired sedanters was 19, 06±0, 79. Stature, weight, reaction time, movement speed and static balance variables of the participants were measured. Identity information of the volunteers was taken as basis to determine their ages. Their stature was measured in cm and weight was measured in kg. In order to measure static balance performance of the participants, flamingo balance test was used. For the measurement of reaction time and movement speed “Nelson Reaction Scale” was used. The obtained data was analysed using Statistical package program. To determined difference between the groups t test was used in independent groups and level of meaningfulness was accepted to be p<0.05. As a result of the study when the variables regarding physical characteristics were examined, it was found that there was no difference between the groups (p>0, 05) and that the difference between reaction time, movement speed and static balance was meaningful (p<0.05). It was also seen that reaction time in hearing-impaired individuals was better and movement speed and static balance performance in hearing-impaired athletes were better. In light of this information, it is believed that regular exercise has an effect on the chosen motoric characteristics. Still, repetitive, similar studies are required.

Key words: Hearing-Impaired · Reaction Time · Movement Speed · Balance

INTRODUCTION

Human body moves and communicates with the environment continuously due to its inborn characteristics. Movement is enabled through musculoskeletal system and sense organs enable communication with the environment. Humans react to sounds and communicate with the environment. As well as providing communication, sense organs help humans stand, redress the balance and musculoskeletal system move [1]. Impairment is the situation of not being able to adapt to normal life due to losing physical, psychological, emotional and social abilities as a result of an inborn or subsequent illness, disease or accident [2]. The participation of individuals with a physical, psychological, emotional, mental, auditory or visual disturbance as a result of inborn or subsequent illness or accident or individuals with multiple disabilities in sport activities is one of the most overemphasized issues in our country [3]. The most significant determiners of maintaining daily life activities and increasing sportive performance of healthy and disabled individuals are some basic motoric characteristics such as balance, reaction time and movement speed, which are also subject of our study.

Reaction time is defined as the interval between application of a stimulus and a response [4]. For instance, the interval between an athlete hearing the starting pistol and moving for starting is the athlete’s reaction time. Factors such as speed of neural transmission and speed of the effector muscle create millisecond differences among individuals. Reaction time in humans is directly related to the speed of neural transmission [5-7].
Movement speed is the interval between the start and ending of the movement. Accordingly,.speed movement is the interval between the athlete’s start in the starting line and reach the finish line. The combination of reaction time and movement speed is named “Reaction time” [4, 6]. Factors such as reaction time, movement speed and movement frequency and moving the whole or part of organism in a certain time can be developed through regular exercise. Although reaction time, movement speed (The speed of movement of body parts or in other words agility) and movement frequency seem similar, the functions of each are different [7]. Balance is a complex process which includes the coordinated activities of a number of sensory, motor and biomechanical components [8]. Balance is an ability that finds solutions against balance disorder stemming from the change of the body’s centre of gravity. There are two types of balance, namely static and dynamic. Static balance is the ability of redressing balance in a certain place or position whereas dynamic balance is the ability of redressing balance while moving [9-12]. Balance might differ by the state of musculoskeletal system, age, visual and vestibular stimulants and the integrity among these components [13]. Balance is centre of gravity’s ability of endurance on a support base connected to a good functional postural control system. This complex feedback underlies visual, vestibular and somatosensory stimulants in the afferent direction corresponding to neuromuscular movement in the efferent direction [14].

The ability to redress balance is an important factor for developing other motor systems and maintaining body composition, which is necessary for a successful performance in sports. It is stated that high level athletes exhibit balance control which develops in connection with the necessity of each discipline [15]. Elite athletes use exact sensory information dominantly in order to regulate posture by their branches [16].

The aim of this study is to compare reaction time, movement speed and static balance performance of hearing-impaired athletes and hearing-impaired sedanters who were aged between 18 and 20 and had similar physical characteristics.

MATERIAL AND METHODS

A total of 30 young, male, hearing-impaired volunteers aged between 18 and 20 with a training age of 3 years and above participated in the study and mean age for Group 1 composed of hearing-impaired athletes was 18, 66±0,72 years and mean age for Group 2 composed of hearing-impaired sedanters was 19, 06±0, 79. Stature, weight, reaction time, movement speed and static balance variables of the participants were measured. Identity information of the volunteers was taken as basis to determine their ages. Their stature was measured in cm and weight was measured with an electronic bascule and noted in kg.

In order to measure static balance performance of the participants, flamingo balance test was used. The subjects stood in balance on a 50 cm long, 4 cm high and 3 cm wide balancing beam on rest step. The other knee was bent and held with the same hand. The time started and the subject tried to stand in balance for 1 minute and when the balance disrupted, time stopped. The test continued as described above for 1 minute. The number of falling down in 1 minute was recorded as test score [17]. In order to measure hand reaction time Nelson Reaction Scale was used. Hand reaction measurement was made standing and body balance on both feet. For hand reaction the value on the upper side of the ruler held between thumb and forefinger was read; the dominant hand of the subject was measured three times and the best value was recorder.

With this formula “Reaction Time= v2 x Distance (cm) / 980 cm (Reaction Time = v 2 x the distance the ruler dropped (cm) / Speed due to Gravity)” reaction time of the volunteers was measured [18]. For the measurement of reaction time and movement speed “Nelson Reaction Scale” was used. For movement speed, the subjects sat on the chair leaning the hands on the edge of the table. Small fingers put on the lines on the table 30 cm away from each other, palms facing each other. The tester held from the end of the ruler and in the middle of the subject’s hand. The base line levelled with the upper line of the subject’s hand. Upon the instruction “Attention!” the test ruler was dropped and the subject tried to stop the ruler in both palms by clapping hands in the shortest time. In the meantime, the subject paid attention not to slip the hands upside or downside. This test was repeated for 20 times. For the evaluation of the test, the value on the upper level of the hand was recorded. The best and the worst 5 measurements were excluded and the average of the rest of the 10 tests was used to calculate movement speed of the volunteers [4].

The obtained data was analysed via IBM SPSS Statistics 21 statistical package program. Shapiro-Wilk test was used to determine whether the data had normal distribution or not. The measurement results were presented in arithmetic mean and standard deviation. T test was administered for independent groups in order to find the differences between the groups and the level of meaningfulness was accepted to be p<0.05.
RESULTS

The values belonging to the participant athletes were presented below in tables.

The values regarding age variable showed that the youngest age was 18 and the oldest age was 20 and the mean age was 18, 86/0, 77 years. The values regarding stature variable showed the lowest value was 155 cm the highest value was 188 cm and height average was 173, 43±, 47 cm. In terms of weight variable the lowest value was 58 kg, the highest value was 85 kg and the mean was 69, 96±, 64 kg. In terms of body mass index the lowest value was 18, 50kg/m², the highest value was 30, 80 kg/m² kg and the mean was 23, 29±, 68 kg/m².

Hand reaction time values showed that the lowest value was 0, 15 ms, the highest value was 0, 31 ms and the mean was 0, 24±, 08 ms. In terms of movement speed the lowest value was 0, 24 ms, the highest value was 0, 48 and mean was 0, 32±, 05 ms. The lowest static balance value was 3 item/min, the highest value was 8 item/min and the average was 5, 43±, 56 item/min.
Table 2 shows the distribution of physical characteristics of young, hearing-impaired athletes and sedanters. It was found that there was no statistically meaningful difference in age, stature, weight and body mass index (BMI) parameters ($p>0.05$).

According to the table and the figure, there was a statistically meaningful difference in hand reaction time, movement speed and static balance performance averages of young, hearing-impaired athletes and sedanters ($p<0.05$).

**DISCUSSION AND CONCLUSION**

In this study which aimed to compare reaction time, movement speed and static balance parameters in hearing-impaired individuals it was found that there was not a meaningful difference in averages of age, stature, weight and body mass index parameters, yet that there was a meaningful difference in reaction time, movement speed and static balance values. When the studies in the regarding field were compared, both similarities and differences were seen ($p<0.05$).

Sirinkan [19] stated that educational games made a positive contribution to physical characteristics of hearing-impaired students. Also, the study carried out by Cigerçi et al. [20] compared some physiological and motoric characteristics of hearing-impaired and non-hearing-impaired subjects and found that hearing impairment affected some motoric characteristics negatively.

The studies in the literature showed that regular physical exercise contributes to the physical and motoric development of children [21]. This result shows that regular physical activities have an effect on both healthy individuals and individuals with hearing-impairment. It is possible to see in many studies in the literature that sportive habits increase the ability of especially vestibular coordination structures to work in harmony. In this context, the result of our study accords with the literature [22, 23].

Açak et al. [24] carried out a study on hearing-impaired futsal players and revealed that there was a meaningful difference between the athletes who could not hear and athletes who could hear with deaf-aid by disability situation variable of the study group. It was stated that the values of the hearing-impaired, deaf athletes were better, which shows that reaction time of hearing-impaired individuals differed by the degree of disability.

Koc et al. [25] investigated the reaction time of hearing-impaired sedanters and hearing-impaired footballers and found that reaction time in hearing-impaired footballers was 0, 243±0,043 s. And 0, 274 ±0,041s in hearing-impaired sedanters. Movement speed in hearing-impaired footballers was 0,267±0,063 s. and 0,278± 0,054 in hearing-impaired sedanters. These values show that regular exercise has an effect on hearing-impaired individuals. In their study Bakır and Akdogan pointed out that regular physical exercise shortened simple reaction time and that individuals participating in physical activity programs regularly had faster neonuromuscular system reactions compared to sedanters of the same age [26].

According to Gheysen et al. [27] compared hearing-impaired children with cochlea disorder with non-hearing impaired children; hearing-impaired children with cochlea disorder had poorer balance and motor skills. Kurt [28] investigated the effect of regular exercise on individuals with hearing impairment and stated that regular exercise had a positive effect on developing physical performance and balance skill in individuals with hearing-impairment. In other studies it was found that (When doing exercise habits were considered) especially in timed balance tests meaningful results in favour of the hearing-impaired individuals who did exercise showed the positive contribution of sportive activities to developing physical performance and balance skills in hearing-impaired children [23,29-32].

In conclusion, it is thought that static balance, reaction time and movement speed of hearing-impaired athletes developed thanks to exercise. However, it is necessary to carry out similar repetitive studies with larger groups. In these studies, by degree of hearing loss might be compared by forming age groups by gender.

**REFERENCES**


