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An Analysis of Selected Motor Characteristics According to Age Groups in Hearing-impaired Individuals

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KEYWORDS Agility. Balance. Flexibility. Hearing-impared. Reaction

ABSTRACT The aim of this study is to examine various characteristics such as agility, balance, flexibility, reaction time, movement speed of individuals with hearing impairment by age variable. A total of 51 voluntary male individuals with hearing impairment participated in the study. The age range is between 16 and 20. Variables such as height, body weight, balance, agility, reaction time and movement speed were measured. All measurements were done three times and best score was recorded. Measurement results were presented as mean and standard deviation values. One way analysis of variance was used in order to determine differences between age group and $p<0.05$ value was considered to be statistically significant. Study results show that there are no statistically significant difference between groups regarding balance, agility and flexibility values ($p>0.05$). However, regarding reaction time of hands and feet the difference between them are found to be statistically significant ($p<0.001$). As a result, it was observed that static balance, agility and flexibility performances of individuals with hearing impairment are not related to age while reaction time and movement speed scores values are age-related.

INTRODUCTION

Human body needs to move constantly and to communicate with his/her environment by his/her innate characteristics. Human beings move owing to the musculoskeletal system whereas they communicate with the environment through sensory organs. Human beings sense hearing, react to sounds and communicate with the environment. Sensory organs are the centre that helps standing, movement of the musculoskeletal system and balancing in addition to its communicative function (Polat 2008). The concept of disability, which is the subject of this study, is the state of non-adaptability with normal life as a result of the loss of physical, psychological, emotional and social skills congenitally or as acquired due to a disease or injury (Atalay and Karadag 2011). Ensuring participation of people with a physical, psychological, emotional, mental, visual or auditory impairment – congenital or acquired due to a disease or injury – or people with multiple disabilities having some of them at the same time in sports activities is one of the most important items of government policies of countries today (Inal 2011). The most important criterion in daily lives of healthy and disabled people and in increasing their sportive performance is some basic motor attributes such as agility, balance, flexibility and reaction time.

Agility is the skill to control the body position accurately while changing your direction swiftly throughout a series of movements (Yap et al. 2000). Agility is a term used in strength and condition, and is considered as a critical element for many sports and activities. Agility is often defined as an effective combination of stopping suddenly, changing direction and acceleration while maintaining motor control on vertical or horizontal planes (Verstegen and Marcello 2001). Athletes displaying good agility often have other attributes such as dynamic balance, spatial awareness and rhythm as well as visual monitoring (Ellis et al. 2000).

Balance is a complex process which covers coordinated actions of many sensory, motor and biomechanical components. Balance is having the body in straight position in order to do the required action in well-advanced motor activities. Balance is most often a skill to produce solution for the unbalance due to any change in the centre of gravity of the body (Koç et al. 2011; Bressel et al. 2007). Balance is divided into two as static balance and dynamic balance. Static balance, as the subject of this study, is ensuring

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the balance of our body on a certain place or position while dynamic balance is the skill to maintain body balance in motion (Hazar and Tasmektepli 2008). Balance is an important factor in development of other motor systems and in preservation of body composition required for successful performance in sports. It is reported that elite athletes display a balance control which they develop in line with requirements of their respective sports branches (Carraffa et al. 1996).

Flexibility (mobility) is the ability of an athlete to do athletic actions at the widest angle and towards various directions to the extent that his/her joints allow doing so (Sevim 2010). We use our joints and muscles when doing an action. Lack of sufficient flexibility in muscles impairs joints mobility (Çakmakçi 2002).

Reaction time is defined as the time that elapses between the starting time of the stimulant and the starting time of response (Tamer 2000). For instance, the time elapsing from the time an athlete hears the sound of starting pistol until he/she moves to start is reaction time. Attributes such as transmission pace of nerves that play a role in transportation of the incoming stimulus to the central nervous system and transmission of the response to the effector organ and fast or slow effector muscles vary from human to human, resulting in millisecond differences. In human beings, reaction time is directly associated with the neural transmission speed. Action speed is the time that elapses from the moments the action starts to the moment it finishes. Accordingly, the action speed is the time elapsing from the moments the athlete starts moving from the starting line until the moment he/she arrives at the finish line. Combination of the reaction time and action speed is called 'response time'. For instance, the time elapsing from the moment of stimulation that starts the race until the moment the athlete reaches the finish line is the response time (Guyton and Hall 2006; Taskiran 2007).

This study analyzed the agility, balance, flexibility, reaction time and action speed scores of hearing-impaired individuals according to age groups (age range is16–20 years).

METHODOLOGY

Subjects

This study participated 51 hearing-impaired male volunteers (12 people -16 years old (X_1), 8 people -17 years old (X_2), 11 people -18 years old (X_3), 11 people -19 years old (X_4) and 9 people -20 years old (X_5)). Information was taken as basis in defining the ages of the participating volunteers.

Procedure

Participants were measured for their body height, body weight, static balance, agility, flexibility, reaction time and action speed. Their body height was measured and recorded in cm terms and body weights in kg terms. The Stork Stand Test was used to measure static balance performance of the participants (Basöz et al. 1999). This test recorded the balance time of the participants where they established their balance on the supporting ground without any movement by standing on their dominant foot. "T test" was used to measure agility (Sporis et al. 2010). This test measured running speeds of participants as they switched their directions such as forward sprinting, right-left switch and reverse running. The flexibility table was used for flexibility measurements. Subjects stretched their bodies forward and the furthest point they could reach was recorded. Nelson reaction time scale was used to measure hand reaction time (HRT), foot reaction time (FRT) and action speed (AS). This test measured the time elapsing from the starting time of stimulant until the starting time of response. The score read on the scale was calculated in the following formula and reaction times of the subjects were calculated accordingly (Tamer 2000).

Reaction time = + 2 x distance covered on the scale / gravity-relative speed

Reaction speed = +2 x Distance (cm) / 980 sec.

Statistical Analyses

Measurements were repeated for three times and the best score was recorded. SPSS (Statistical Package for the Social Sciences) was used in data analysis. Shapiro Wilk Test was used in order to see whether the data displayed a normal distribution, and it was found that the data displayed a normal distribution. Measurement scores were presented in median and standard deviation. One way analysis of variance (post-hoc Tukey) was made to see the difference among age groups. The $p<0.05$ value was considered to be significant.

RESULTS

Table 1 shows that when compared the groups did not find any significant difference among the groups in body height and body weigh scores ($p>0.05$).

Table 2 shows that when compared the groups did not find any significant difference among the groups in static balance, flexibility and agility performance medians ($p>0.05$)

Table 3 shows that when compared the groups found significant difference among the groups in reaction times for hands and feet and movement speed scores ($p<0.01$).

DISCUSSION

As the researchers analyzed agility, balance, flexibility, reaction time and action speed scores of hearing-impaired individuals according to age groups (age interval of 16–20 years), they did not observe any significant difference among the groups in agility, balance and flexibility scores ($p>0.05$) whereas the difference among the groups in reaction times for hands and feet and action speed scores was significant ($p<0.001$). The best scores in reaction times for hands and feet and action speed scores were found in the age group of 20 years while the worst scores were in the age group of 16 years. A comparison of the researchers' findings with other studies conducted in this field displayed similarities as well as differences.

Balance, as a complex process containing coordinated activities of many sensory, motor and biomechanical components, was found the best in the age groups of 16 and 17 years while the worst in the age group of 18 and moderate in

Table 1: Scores of physical attributes of participating subjects

Variables	*Group*	*n*	*Mean*	S_D	*F*	*P*
Age (years)	X_1	12	16.00	0.00	-	-
	X_2	8	17.00	0.00		
	X_3	11	18.00	0.00		
	X_4	11	19.00	0.00		
	X_5	9	20.00	0.00		
Height (cm)	X_1	12	168.50	9.79	0.425	0.790
	X_2	8	169.50	9.84		
	X_3	11	172.63	6.60		
	X_4	11	171.63	7.25		
	X_5	9	171.44	9.34		
Body Weight (kg)	X_1	12	63.83	5.99	0.606	0.660
	X_2	8	64.87	7.33		
	X_3	11	66.09	7.89		
	X_4	11	69.00	8.00		
	X_5	9	66.77	12.22		

Table 2: Balance, flexibility and agility scores of participating subjects

Variables	*Group*	*n*	*Mean*	S_D	*F*	*P*
Static Balance (sn)	X_1	12	56.33	40.26	1.430	0.239
	X_2	8	63.75	47.78		
	X_3	11	32.45	21.95		
	X_4	11	42.27	12.80		
	X_5	9	49.44	29.19		
Flexibility (cm)	X_1	12	18.16	6.65	0.762	0.556
	X_2	8	19.12	5.46		
	X_3	11	18.14	9.60		
	X_4	11	15.09	5.10		
	X_5	9	14.22	9.89		
Agility (sn)	X_1	12	11.83	1.46	0.980	0.428
	X_2	8	11.87	1.88		
	X_3	11	12.45	2.11		
	X_4	11	10.90	1.51		
	X_5	9	11.88	2.31		

Table 3: Reaction time and movement speed scores of participating subjects

Variables	*Group*	*n*	*Mean*	S_D	*F*	*P*
Hand Reaction Time (ms)	X_1	12	0.247	0.04	9.948	0.000
	X_2	8	0.230	0.07		
	X_3	11	0.239	0.14		
	X_4	11	0.156	0.09		
	X_5	9	0.142	0.10		
Feet Reaction Time (ms)	X_1	12	0.259	0.06	7.370	0.000
	X_2	8	0.251	0.07		
	X_3	11	0.247	0.15		
	X_4	11	0.180	0.12		
	X_5	9	0.149	0.13		
Movement Speed (ms)	X_1	12	0.259	0.02	6.364	0.000
	X_2	8	0.251	0.06		
	X_3	11	0.239	0.14		
	X_4	11	0.186	0.13		
	X_5	9	0.156	0.14		

the age groups of 19 and 20. Atar et al. (2014) suggested that the balance performance did not develop according to age because it did not display any numerical difference over and below 18 years. This conclusion supports the researchers' findings. Eliöz et al. (2013) conducted a study on static balance performance of hearing-impaired football players and found that the balance performance of hearing-impaired football players was better than that of hearing-impaired sedentary individuals.

It was also found that sportive activities had a positive contribution in development of physical performance and balancing skills of hearing-impaired children. We can find many studies in the literature suggesting that it has a particular contribution in the ability of vestibular coordination structures to work in harmony with one another (Yagci et al. 2004). Literature suggests that regular physical activities contribute in development of physical, psychological, sociological and motor skills of children, which suggests that regular physical activities have an impact on both healthy and hearing-impaired individuals (Cigerci et al. 2011). It is considered that the most important factor underlying this fact is the training age.

In this study, agility, as the skill to control the body position accurately while changing your direction swiftly throughout a series of movements, was found best in the age group of 19 while the lowest in the age group of 18, and moderate in age groups of 16,17 and 20 years. Açak et al. (2012) conducted a study to compare agility performances of hearing-impaired futsal players and found that there were statistically significant difference between players who do not hear at all and the players who can hear by means of a hearing aid in agility test scores of the experiment group according to the variable of state disability. It suggests that agility parameter of hearing impaired people differs according to the level of disability. Despite the fact that there is numerical difference in agility performance according to age group variable, the difference was not statistically significant. It suggests that agility does not develop according to age. An analysis of literature shows that there was a statistically significant, positive correlation between agility test and balance (Bakir and Aydogan 2011). The researchers' findings are parallel to those in the literature.

The flexibility parameter, as the ability of an athlete to do athletic actions at the widest angle and towards various directions to the extent that his/her joints allow doing so, was at good levels in age groups of 16, 17 and 18 years whereas at lower levels in the age groups of 19 and 20 years, which suggests that flexibility is negatively impacted as age goes up. Yörükoglu and Koz (2007) found flexibility scores as 20.31 ± 3.99 cm in subjects in the sports clubs while as 19.66 ± 4.41 cm in subjects in sports school for male subjects with an average age of 13.37 ± 0.74, where subjects were younger than those in this study and therefore the flexibility parameter was higher than this study's findings. It suggests that flexibility is better in younger age groups.

In the field of reaction time, which is defined as the time elapsing from the moment of stimulation until the response is given, hand reaction time, foot reaction time and action speed were at

lowest levels in the age group of 16 years while the best in the age group of 20, which suggests that this skill might develop according to age. Koç et al. (2011) conducted a study to compare reaction times of hearing-impaired sedentary individuals and hearing-impaired football players at the same age group, and found the reaction time as 0.243±0.043 sec in hearing-impaired football players whereas 0.274 ±0.041sec in hearing-impaired sedentary individuals; and action speed as 0.267±0.063 sec in hearing-impaired football players whereas 0.278± 0.054 sec in hearing-impaired sedentary individuals. Bakir and Akdogan (2011) compared auditory simple reaction times between visually-impaired individuals who do sports and visually-impaired individuals who do not, and found that regular physical exercise shortened auditory simple reaction times; and neuromotor system reactions of individuals attending physical activity programs regularly were faster than that of sedentary individuals at the same age.

In this study, reaction time that develops according to age is shortened by regular physical activity, leading up to an increased performance. It was also highlighted that good athletes had shorter reaction times than other athletes (Fox et al. 1999; More 1992) and it was recommended to give more weightage to exercises that shorten reaction time in order to increase performance (Agaoglu 2001).

CONCLUSION

As a conclusion, the findings show that static balance and agility performance of hearing-impaired individuals did not depend on age whereas flexibility, reaction time and action speed depended on age. It is considered that reaction time performance of hearing-impaired individuals improved as age went up whereas aging had a negative impact on flexibility performance. In order to generalize the results of this study further research should be conducted.

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Paper received for publication on January 2016
Paper accepted for publication on June 2016