TURKISH JOURNAL OF SPORT AND EXERCISE
www.turksportexe.org
Year: 2013 - Volume: 15 - Issue: 2 - Pages: 38-44
ISSN: 2147-5652

Evaluation of physical fitness parameters of hearing impaired adolescents who are active and non-active in sports*

Ozge CAGLAR [1], A. Hande ULUDAG [1], Tulin SEPETCI [2], Erkan CALISKAN [1,**]

[1] *School of Physical Education and Sports, Akdeniz University, Antalya (e-mail: huludag@akdeniz.edu.tr)*
[2] *Faculty of Communication, Akdeniz University, Antalya, Turkey.*
* *This study was presented as a poster at the 5th Training Science Congress in Hacettepe University (2-4 July 2013).*
** *Corresponding author: E. Caliskan, e-mail: caliskanerk@hotmail.com*

Abstract

The aim of this study is evaluate the physical fitness parameters of 9 – 17 years old hearing impaired adolescents who were active and non active in sports. The study was included totally 65 students attended to the Kepez hearing impaired school; 40 (26 male, 14 female) active in sports (participating the team sports at least 3 days a week) with the mean age of 12.85 ± 2.83 years and 25 (14 male, 11 female) non- active in sports with the mean age of the 11.48 ± 3.20 years. Physical characteristics, physical fitness and body composition of the subjects have been evaluated in this study. For statistical analyses; mean values, standard deviations and frequency distributions were calculated for all variables. Independent samples t- tests was used to compare the active and non-active groups. As result of statistical analyses stature resting heart rate, flexibility, standing long jump, 20 m sprint, reaction time, hand grip strength, back and leg strength, sit-ups, vertical jump, and percent body fat values were found significantly different between the active and non-active hearing impaired groups ($p<0.05$). Consequently it has been revealed that participating the sport would positively influence the physical development, physical fitness and body composition characteristics of hearing impaired childrens.

Keywords: Hearing impaired, adolescent, sport, physical fitness.

Aktif Spor Yapan ve Yapmayan İşitme Engelli Adölesanların Fiziksel Uygunluk Parametrelerinin Değerlendirilmesi

Özet

Bu çalışmada aktif spor yapan ve yapmayan 9-17 yaş grubu işitme engelli adölesanların fiziksel uygunluk parametrelerinin değerlendirilmesi amaçlanmıştır. Çalışmaya Kepez İşitme Engelliler Okulunda öğrenim gören yaş ortalamaları 12.85 ± 2.83 yıl olan 40 (26 Erkek, 14 Kız) aktif spor yapan (haftada en az üç gün takım sporları ile uğraşan) ile yaş ortalamaları 11.48 ± 3.20 yıl olan 25 (14 Erkek, 11 Kız) spor yapmayan toplam 65 işitme engelli öğrenci katılmıştır. Çalışmada fiziksel özellikler, fiziksel uygunluk özellikleri ve beden kompozisyonları değerlendirilmiştir. İstatistiksel analizlerde tüm değişkenler için ortalama, standart sapma ve frekans dağılımları hesaplanmıştır. Aktif spor yapan ve yapmayan gruplar bağımsız gruplarda t- testi ile karşılaştırılmıştır. İstatistiksel değerlendirme sonucunda; boy, dinlenik nabız, esneklik, durarak uzun atlama, 20 m sürat, reaksiyon zamanı, el kavrama kuvveti, sırt ve bacak kuvveti, mekik, dikey sıçrama ve vücut yağ yüzde değerlerinde aktif spor yapan ve aktif spor yapmayan işitme engelli öğrenciler arasında anlamlı fark bulunmuştur ($p<0,05$). Sonuç olarak, sporun işitme engelli çocukların fiziksel gelişimlerine, fiziksel uygunluk özelliklerine ve vücut kompozisyonlarına önemli ölçüde katkı sağladığı belirlenmiştir.

Anahtar kelimeler: İşitme engelli, adölesan, spor, fiziksel uygunluk.

INTRODUCTION

For most people hearing is a naturally developing process by itself meanwhile for some people during this procedure there may be some problems because of several reasons and they may have difficulties in hearing different sounds on

different levels (2). Hearing disability is defined as insufficiency in hearing that requires a special education. In other definition it is defined as the hearing disability emerging from the individual's not being able to develop, adapt and fulfil his/her functions in communication. Individuals who can not be able to realize communication are defined as hearing impaired individuals (21).

Hearing impaired children are not very different in physical fitness than children with normal hearing (11). Sport in hearing impaired is aiming to remove the social inequalities which exist also in other disability groups. Hearing impaired individuals do not have the same level of social and cultural opportunities with other individuals because of their sensory deficiencies. The main reason of this situation is their preferences of communicating frequently with each other and avoiding to communicate with other individuals in the society (8). It is stated that the physical fitness levels of impaired children are lower than healty childrenin similar ages. The retardation in the motor development, postural failures, and balance failures, weeknesses in muscle strength and problems in social adaptation in these children can affect their physical fitness levels in a negative way (6).

Sport is an essential pursuit for a healty and uplifted life and important for all people. However it has a more different importance for a disabled person. Because sport can open a new window for disabled individuals who already face many obstacles in their lives and live together with the stress created by these obstacles (9).

Research shows that the positive effects of exercise and sport on human health are indisputable (7). This positive effect also includes disabled people and and it provides them to establish better relationships in the society as well as improving their physical and mental development (5). This explains the making of movement's right and the current condition level of the body. According to this definition the individual with highest level of physical fitness is the individual who can make movements during the longest period of time without getting tired (23). Physical fitness may also be defined as the ability to make activities succesfully.

The aim of this study is the evaluation of physical fitness parameters of hearing impaired children who are involved and not involved in active sports and effects of the sports on hearing impaired children.

MATERIAL & METHODS

The subjects of this research consisted of 65 children studying in Kepez School for Hearing Impaired Children under Ministry of Education in Antalya city center. 40 (26 boys, 14 girls) hearing impaired participants with a mean age of 12.85±2.83 years were making active sports and 25 (14 boys, 11 girls) hearing impaired participants with a mean age of 11.48±3.20 years were not actively involved in sport. Hearing impaired particpants who are involved in sports were reported to play team sports like volleyball, basketball, football and handball.

Participants of the study have no other health problems than hearing disability. Depending upon the content of the study, participants were demanded to fill forms related with their sport participation habitudes. The filling of forms was conducted with the help of a sign language expert. Within the scope of physical fitness test battery, physical traits (height, weight, BMI), performance traits (strength, endurance, speed, flexibility, reaction time tests) and body compositions (body fat percentage, body fat weight, lean body weight) were measured. Test measurements were conducted in the sport hall of Kepez School for Hearing Impaired Children. Participants were demanded "voluntary informed consent forms" concerning their voluntary participation and documents proving "there is nothing harmful for making sports".

Test Measurements for Physical Fitness

Physical Traits

Height, body weight measurement:

Ages were measured by years. Height was measured with naked feet or with socks by the heigth scale on the bascule with a sensity level 0.01 cm. Body weight was measured with shorts by the bascule with 0.01 kg sensitivity (18).

BMI

Measured by height and weight levels with the formula: (BMI= (kg)/ m^2 (23).

Performance Traits

20 m Speed test:

20m speed test was applied to evaluate the speed of subjects. Subjects were asked to run 20m as fast as possible and photocell was used. Signs were

given to hearing impaired participants for making start (4).

Vertical jumping test and anaerobic strength

Anaerobic strength of hearing impaired participants was measured with Bosco's jump meter (1). Jump meter belt was fastened to the waists of participants and they were asked to jump up with feet adjacent and body steep. During jumping up participants were cautioned for not taking a step and to bend nees 90°. The number shown by the equipment has been recorded. Anaerobic strength was calculated according to this formula by using jumping interval and body weight:

Anaerobic strength (kgm/sec) = √4.9 x (body weight) x √D D= jumping interval (m) (19).

Curl up

Muscular endurance of hearing impaired participants was evaluated by curl up test. Participants were laid down and asked to pull their knees to their abdomens perpendicularly. By the help of a chronometer, the number of curl up that they can make in 30 seconds was recorded.

Back strength measurement

Measurements were made by Takkei back dynamometer. After 5 minutes of warm up, participants put their feet on dynamometer with a streched position. Participants pulled dynamometer bar in a vertical position with a maximum strength while arms were streched, back straight and body was bending slightly to front. This pulling was repeated 3 times and best result was recorded (19).

Leg strength measurement

Measurements were made by Takkei leg dynamometer. After 5 minutes of warm up, participants put their feet on dynamometer with knees bend. Participants pulled dynamometer bar in a vertical position by using their legs with maximum strength while arms were streched, back straight and body was bending slightly to front. This pulling was repeated 3 times and best result was recorded (19).

Standing long jump

Explosive strenght of hearing impaired participants were done by standing long jump method. After the long jump by double feet applied without getting speed from the standing position the interval between jumping point to the last point the athlete leaves a trace was measured as cm. The test was applied twice to participants and the best result was recorded. After the jumping the interval to the last point of contact was recorded as cm (15).

Hand grip strength

Measurements of hand grip strength of hearing impaired participants were made by Takkei handgrip dynamometer. Participants were asked to bend the dominant arm while standing and to grasp the dynamometer with all their strenght. After two repetitions best result was recorded (13).

Flexibility (sit Access test)

The flexibility test of participants were made by sit and reach test on flexibility stand. The participants have been taken to the test after a warm up process. The feet were naked, subjects were sitting with their feet leaning to the test stand without bending the knees, the ruler over the stand was pushed forward and the flexing interval was recorded where subjects stopped 2 seconds on the farthest point reached (19).

Reaction time test

This test was applied to measure the visual reaction time of hearing impaired subjects. In related to this aim, Bosco's New Test 2000 test equipment and protocol were used. Test was conducted in an environment where no noise components could disturb the attention of the participants for the test. Participants were asked to sit on a chair in front of a table where reaction time test equipment was put. During the test the sitting height of the individual was arranged according to his/her height where his/her hands were in an ergonomic position. The preferred finger of the subjects was put on the reaction time test equipment and they were asked to push the button when they see led light.

Body composition

Weight (kg), BMI (score), Basal Metabolism (kcal), % body fat, body fat weight (kg), lean body weight (kg) ve total body water (kg) measurements were conducted by bioelectrical impedance analysis. In this analysis Tanita (Japan, Model TBF 300A) equipment was used which utilizes foot to foot method with 0.1 kg sensitivity.

Statistical Analysis

In statistical analysis SPSS 18.0 package programme was used. Frequency distributions and percentages were taken for hearing impaired

children who are actively involved or not involved in sports according to their gender and sport participation frequency. The means and standart deviations of physical, performance traits and body composition values of groups and comparisons were made by independent samples t-test.

RESULTS

The results obtained by the research results are summarized in the following tables.

Participating in the study was considered physical characteristics of hearing-impaired children active in sports and non-active in sports. The active in sports with the mean height of 150.77±15.29, while the non active in sports with the mean height of 142.00±14.37. The mean heights of two groups were compared. It was evident from the data that there was significant difference between the active in sports and non active in sports of hearing impaired children ($p < 0.05$).

Table 1. Adolescents who were active and non active in sports physical characteristics of hearing impaired children.

Variables	N=65	X	SD	t	p
Age (year)	Active in sports (n=40)	12,85	2,83	1,7	0,09
	Non active in sports (n=25)	11,48	3,20		
Height (cm)	Active in sports (n=40)	150,77	15,29	2,3	0,013*
	Non active in sports (n=25)	142,00	14,37		
Weight (kg)	Active in sports (n=40)	44,40	14,21	0,4	0,50
	Non active in sports (n=25)	42,66	17,95		
BMI (kg/m²)	Active in sports (n=40)	18,72	3,12	-0,7	0,44
	Non active in sports (n=25)	19,64	5,39		

* p<0,05

It was examined the situation within sport of hearing-impaired children participating in our research, we found out that 65% of male was active in sports and 35% non active in sports, also 56% of female was active in sports and 44% non active in sports. It is examined the percentile values of total, 61.5 % of work group was active in sport, 38.5 % non active in sports. These results show us that the male group was more active in sports than female group (table 2). There was no significant difference results in statistical evaluation ($p > 0.05$).

Hearing impaired children of active in sports participating in the study examined frequency distributions according to the frequency of sports, were found 35% of two days per week, 65% of everyday.

Table 2. Participation in sports by gender of hearing-impaired children who were active and non-active in sport.

Gender		Status of Sports		Total
		Yes	No	
Male	N	26	14	40
	%	65,0%	35,0%	100,0%
Female	N	14	11	25
	%	56,0%	44,0%	100,0%
Total	N	40	25	65
	5	61,5%	38,5%	100,0%

$X^2=0.527$; $p=0.468$; $p>0.05$

Table 3. Frequency distributions according to the frequency of sports hearing impaired children of active in sports.

Frequency of sports	N	%
Two days per week	14	35%
Everyday	26	65%
Total	40	100%

It was examined physical fitness parametres of hearing impaired children participating in the research, the means of resting hearth rate of group active in sports were found 72.52±9.88 and the means of the group non active in sports were found 97.60±10.24. There was significant difference between the means of the two groups on the resting heart rate ($p<0.01$). Filexibility parametres was examined the means of filexibility of active in sports were found 25.55±7.97 cm while non active in sports were found 20.64±8.53 cm. There was significant difference between the means of the two groups on the filexibility ($p<0.05$). Standing long jump parametres was examined the means of standing long jump of active in sports were found 144.35±29.62 cm while non active in sports were found 101.76±19.71 cm. There was significant difference between the means of the two groups on the standing long jump ($p<0.01$). 20 m sprint parametres was examined the means of 20 m sprint of active in sports were found 3.88±0.50 s while non active in sports were found 4.77±0.73 s. There was significant difference between the means of the two groups on the 20 m sprint ($p<0.01$). Reaction time parametres was examined the means of reaction time of active in sports were found 341.20±53.24 mls while non active in sports were found 466.32±99.90 mls. There was significant difference between the means of the two groups on the reaction time

(p<0.01). Hand grip parametres was examined the means of hand grip of active in sports were found 22.57±9.33 kg while non active in sports were found 12.44±5.09 kg. There was significant difference between the means of the two groups on the hand grip (p<0.01). Back strenght parametres was examined the means of back strenght of active in sports were found 62.02±33.72 kg while non active in sports were found 40.72±26.30 kg. There was significant difference between the means of the two groups on the back strenght (p<0.01). Leg strenght parametres was examined the means of leg strenght of active in sports were found 80.55±46.37 kg while non active in sports were found 53.36±35.13 kg. There was significant difference between the means of the two groups on the leg strenght (p<0.05). Curl up parametres was examined the means of curl up of active in sports were found 15.67±3.95 while non active in sports were found 9.64±4.99. There was significant difference between the means of the two groups on the curl up (p<0.01). Vertical jump parametres was examined the means of vertical jump of active in sports were found 37.47±10.69 cm while non active in sports were found 26.84±9.30 cm. There was significant difference between the means of the two groups on the vertical jump task (p<0.01).

It was examined body composition parametres of hearing impaired children participating in the research, the means of body fat percentage of group active in sports were found 13.75±7.58 while non active in sports were found 19.12±9.47. There was significant difference the means of body fat percentage of between groups (p<0.05).

Table 4. Adolescents who were active and non active in sports physical fitness parametres of hearing impaired children.

Variables	Status of Sports	X	SD	t	P
Resting hearth rate	Active in sports	72.52	9.88	-9,7	0.00**
	Non active in sports	97.60	10.24		
Flexibility (cm)	Active in sports	25.55	7.97	2,3	0.022*
	Non active in sports	20.64	8.53		
Standing long jump (cm)	Active in sports	144.35	29.62	6,9	0.00**
	Non active in sports	101.76	19.71		
20 m sprint (s)	Active in sports	3.88	.505	-5,2	0.00**
	Non active in sports	4.77	.739		
Reaction time (mls)	Active in sports	341.20	53.24	-5,7	0.00**
	Non active in sports	466.32	99.90		
Hand grip (kg)	Active in sports	22.57	9.33	5,6	0.00**
	Non active in sport	12.44	5.09		
Back strength (kg)	Active in sports	62.02	33.72	2,8	0.006**
	Non active in sports	40.72	26.30		
Leg strenght (kg)	Active in sports	80.55	46.37	2,5	0.013*
	Non active in sports	53.36	35.13		
Curl up (score)	Active in sports	15.67	3.95	5,4	0.00**
	Non active in sports	9.64	4.99		
Vertical jump (cm)	Active in sports	37.47	10.69	4,2	0.00**
	Non active in sports	26.84	9.30		

* p<0,05, **p<0,01

Table 5. Adolescents who are active and non active in sports body composition parametres of hearing impaired children.

Variables	Status of sports	X	SD	t	P
Fat (%)	Active in sports	13.75	7.58	-2,5	0.021*
	Non active in sports	19.12	9.47		
Fat Mass (kg)	Active in sports	6.10	4.56	-1,8	0,28
	Non active in sports	9.16	7.48		
FFM (kg)	Active in sports	37.87	12.15	1,72	0,097
	Non active in sports	32.60	11.72		
TBW (kg)	Active in sports	27.45	8.81	1,65	0,098
	Non active in sports	23.76	8.67		

* p<0.05

DISCUSSION

This research has been conducted to evaluate the physical fitness parameters of active and non-active in sports hearing-impaired children. The findings of the study show that the physical fitness parameters of active in sports hearing-impaired children are beter than non-active in sports.

Yılmaz et al. have conducted a research with hearing-impaired students and found that regular physical activity affects stability and balance positive (21).

Regular physical activity (16) decreases risk factors for children and people with disabilities such as hypertension, diabetes and cardiovascular diseasese (14). The findings of this study show that resting pulses of hearing-impaired students' who make sports are lower than the resting pulses of hearing-impaired students' who are non-active in sports and this shows importance of sports in the context of physical fitness parameters in related to health.

Ciğerci et al. (3) evaluated 9-15 age group of non-hearing-impaired and hearing-impaired students in related to their physiological and motoric traits. They found that being hearing-impaired affects motoric features negatively such as reaction time, standing long jump, balance, flexibility, and the hand grip strength, anaerobic power and agility (3). That same study found that sports with hearing impaired or percentage of body fat, hand grip strength, flexibility, anaerobic power and speed values as seen in that hearing people found better or close. This results show that being hearing-impaired may have negatively affect on some motorsal abilities, however, making regular sports may reduce the negative effects of being hearing-impaired.

Rajendran et al. (12) looked at 23 hearing-impaired children's 6 week long vestibular specific effects of neuromuscular training program. Measuring group's training program took for 6 weeks, whereas the control assembly went on normal physical activities. As a result it has been found that training program improves hearing-impaired children's motor skills, balance, and health related lifestyle qualities (11).

Hartman et al. (9) have evaluated 42 hearing-impaired students' of primary school motoric performance in related to the participation to sports. According to the results, the active in sports hearing-impaired children's sport dynamic balance and the skill work with ball are better than than non-active in sports. This study shows sports participation increases the motoric performances of hearing disabled people (8).

Tsimaras et al. (19) have investigated the effects of 12-week dance training program applied to the 23 adult hearing impaired individuals to the aerobic capacity and muscle strength physical conformity parameters. As a result it has been found that systematic and good design of dance training program effects hearing-impaired adults' significant physical conformity parameters positive (19). These results are consistent with this study's findings in hearing-impaired children who sports artificial physical conformity better.

Şirinkan (18) has investigated the impact of educational sports games to physical development of 10- 15 years old hearing-impaired students. The educational sports game has been selected for work force, speed, agility, balance and coordination. It has been determined that physical conformity tests measured with hearing impaired children 4-month operating period, the education process developes the physical characteristics of the hearing impaired children. This study supports Şirinkan's study because in this study it has been revealed that physical fitness parameters of hearing-impaired children who sports standing long jump, 20 meters sprint, reaction time, and the hand grip, back strength, leg strength, vertical jump, curl up are better than hearing impaired children non-active in sports.

Surakka et al. (17) have investigated the effects of 6-week physical training program to the the upper body and body flexibility of and visually impaired individuals. They have been found that there are statistical significant developments in the flexible of the body of hearing-impaired individuals. These results are consistent with this study. Because it has been revealed that hearing-impaired children engaged in sports are beter in flexibility values according to the children non-active in sports.

As a result one can say that sport makes important contributions to the physical development, physical fitness traits and body composition of hearing-impaired children. The

hearing impaired children active in sports can show developments as well as normal children. The importance of sport is great in related to reducing the cardiovascular diseases, reducing the negative attitudes and judges and providing the integration of hearing impaired individuals to the society. Therefore guiding the hearing impaired children to the sports, contributes them to live in healtier physical and social conditions.

REFERENCES

1. Bosco P, Luthanen P, Komin V. A simple method for measurement of mechanical power in jumping. European Journal of Applied Physiology, 1983; 50: 273-282.
2. Cavkaytar A, Diken İH. Özel Eğitime Giriş. Kök Yayıncılık, Ankara, 2005.
3. Ciğerci AE, Aksen P, Cicioğlu İ, Günay M. 9-15 yaş grubu işitme engelli ve işitme engelli olmayan öğrencilerin bazı fizyolojik ve motorik özelliklerinin değerlendirilmesi. Selçuk Üniversitesi Beden Eğitimi ve Spor Bilim Dergisi, 2011; 13 (ek sayı): 35-42.
4. Craft DH. Visually impairments and hearing losses. Adapted Physical Education and Sport (Ed: J. P. Winnick). Illinois: Human Kinetics Books Champaigne, 1995; 143-166.
5. Çalışkan E, Pehlivan A, İnal S, Dane Ş, Akar S. Goalball Sporunun ve Hareket Eğitiminin Görme Engelli Çocukların Fiziksel Uygunluk Üzerine Etkilerinin Değerlendirilmesi. Beden Eğitimi ve Spor Bilimleri Dergisi, 2006; 8(3).
6. Ergun N. İşitme engellilerde fiziksel eğitim. BEGV dergisi, 1995; 1(2): 26.
7. Fernhall B. Physical fitness and exercise training of individuals with mental retardation. Medicine Science Sports and Exercise, 1993; 25(4): 442–450.
8. Gür A. Özürlülerin Sosyal Yaşamda Uyum Süreçlerinde Sportif Etkinliklerin Rolü. T.C. Başbakanlık Özürlüler İdaresi Başkanlığı, Ankara, 2001.
9. Hartman E, Houwen S, Visscher C. Motor skill performance and sports participation in deaf elementary school children. Adapted Physical Activity Quarterly. Human Kinetics, Inc, 2011; 28: 132-145.
10. Özer DS. Engelliler İçin Beden Eğitimi ve Spor, Ankara: Nobel Yayın Dağıtım, 2001.
11. Özer, DS. Engelliler için Beden Eğitimi ve Spor. Ankara: Nobel Yayın Dağıtım, 2004.
12. Rajendran V, Roy FG, Jeevanantham D. A preliminary randomized controlled study on the effectiveness of vestibular specific neuromuscular training in children with hearing impairment. Clinical Rehabilitation, 2013; 27(5): 459–467.
13. Rantanen T. MidIife handgrip strength as a predictor of old age disability. Journal of the American Medical Association, 1999; 281(6): 558-560.
14. Rimmer JH, Braddock D. Health promotion for people with physical, cognitive, and sensory disabilities: an emerging national priority. Am. J. Health Promot, 2002; 16: 220–224.
15. Sevim Y. Antrenman Bilgisi, Ankara: Tutibay Ltd.Şti., 1997.
16. Strong W, Malina RM, Blimkie CJR, Daniels SR, Dishman RK, Gutin B. Evidence based physical activity for school-age youth. J Pediatr, 2005; 146: 732–737.
17. Surakka A, Kivelä T. The effect training of a physical training programme on flexibility of upper body and trunk in visually impaired and deaf-blind persons. EuropeanJournal of Adapted Physical Activity, 2011; 4(1): 7-21.
18. Şirinkan A. 10-15 yaş işitme engelli öğrencilerde sportif eğitsel oyunlarin fiziksel gelişimlerine etkisinin araştirilmasi. Selçuk Üniversitesi Beden Eğitimi ve Spor Bilim Dergisi, 2011; 13(Ek Sayı): 74- 80.
19. Tamer K. Sporda Fiziksel Fizyolojik Performansın Ölçülmesi ve Değerlendirilmesi. Bağırgan Yayınevi, Ankara, 2000.
20. Tsimaras VK, Kyriazis DA, Christoulas KI, Fotiadou EG, Kokaridas DG, Angelopoulou NA. The effect of a traditional dance training program on the physical fitness of adults with hearing loss. Journal of Strength and Conditioning Research. 2010; 24(4): 1052-1058.
21. Tüfefçioğlu Ü. İşitme, konuşma ve görme sorunu olan çocukların eğitimi. Anadolu Üniversitesi Yayınları, Ağustos, 2006.
22. Yılmaz A, Kaya M, Kul H, Kurt AK. Düzenli egzersizin işitme engelli ve normal bireylerde statik denge üzerine etkisi. Uluslararası Akdeniz Spor Bilimleri Kongresi, Antalya, 2007.
23. Zorba E. Fiziksel Uygunluk. Ankara: Neyir Matbaası, 2000.