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The Relationship between Body Mass and Handgrip Strength for Children with Hearing Impairment in Jordan

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The Relationship between Body Mass and Handgrip Strength for Children with Hearing Impairment in Jordan

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Abstract:

This study assessed 1) the relationship between body mass and handgrip strength for children with hearing impairment in Jordan; 2) handgrip strength values of our sample with the established norms for healthy individuals. 51 students with hearing impairment volunteered for the study. Body mass, height, handgrip for the left and right hand were measured and body mass index was also calculated. Handgrip strength was measured 3-times for each hand and the average of the 3-values was calculated. There was a significant correlation between body mass and handgrip strength for both hands ($P < 0.05$). Handgrip strength of the right hand was higher than the left hand ($P < 0.05$). The handgrip strength of both hands was equal to the 70th percentile in comparison to the norms of healthy students. In conclusion, body mass index correlated with handgrip strength of both hands for students with hearing impairment. In addition, handgrip strength values for students with hearing impairment were within the normal range for healthy-normal students.

Key Words: handgrip strength, body mass, hearing impairment, left and right hand.

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العلاقة بين كتلة الجسم وقوة القبضة لدى الأطفال المعاقين سمعيا في الأردن

ملخص:

هدفت هذه الدراسة التعرف إلى العلاقة بين كتلة الجسم وقوة قبضة اليد لدى أطفال من ذوي الإعاقة السمعية في الأردن ومقارنتها بالمعايير الموجودة لدى الأسوياء. وتم استخدام المنهج الوصفي بصفته الارتباطية. أجريت هذه الدراسة على (51) طالب من مركز التأهيل المجتمعي في مخيم البقعة للاجئين الفلسطينيين في الأردن . تم استخدام المتوسطات الحسابية والانحرافات المعيارية ومعامل ارتباط بيرسون واختبارات ت للمجموعات المستقلة. تم قياس الوزن والطول وحساب مؤشر كتلة الجسم وقياس قوة قبضة لليد اليمنى واليسرى 3 مرات لكل يد . وأظهرت نتائج الدراسة وجود علاقة ارتباط ايجابية بين كتلة الجسم وقوة فبضة اليد اليمنى واليسرى. وكذلك أظهرت نتائج الدراسة وجود فروق دالة إحصائيا في قوة فبضة اليد اليمنى واليسرى وان قوة القبضة للمعاقين سمعيا مساوية ل 70% مقارنة بالأسوياء . وكذلك توصلت الدراسة إلى دلالة في قوة اليد اليمنى واليسرى ولصالح اليمنى بنسبة 8% . مؤشر كتلة الجسم كان ضمن التصنيف الطبيعي لمؤشر كتلة الجسم.

الكلمات المفتاحية: قوة القبضة ، مؤشر كتلة الجسم، الإعاقة السمعية.

Introduction:

Hearing impairment is one of the main problems facing both developed and developing countries, especially children. Hearing impairment is one of the most prevalent disabilities in the world (World Health Organization, 2017). There are about 31.5 million of US people suffering from this disability (Ellis & Karasinski, 2009). Hearing disability is defined as those problems that prevent the auditory system of the person to do its functions or reduce the person's ability to hear different sounds normally (Ellis & Karasinski, 2009). The hearing disability ranges in severity from simple and middle degrees that cause an audio weakness to very severe degrees which cause deafness.

Handgrip strength is the amount of the static strength that the hand generates around Dynameters device (Massy-Westropp et al., 2011). Handgrip strength is often measured in kilograms, pounds and Newton (Massy-Westropp et al., 2011). Handgrip strength measurement is one of the well established and approved measurements of static strength if the measurement was conducted accurately using a reliable and valid device (Mathiowetz, 2002). Previous studies have shown that handgrip strength reaches its peak in the fourth decade of males and females life of and then begins to decline thereafter (Angst et al., 2010). Previous studies also showed that handgrip strength of males is better than handgrip strength of females at a given age (Mathiowetz et al., 1985).

Handgrip strength is positively associated with body mass index (REF). With this regard, previous studies have shown that thin individuals (BMI < 18.5 kg/m2) have low handgrip strength compared to those with normal body mass index (Koley et al., 2009). Handgrip strength is positively associated with mineral density in women natural bone health after menopause (Di Monaco et al., 2000). Some researchers have mentioned that hand grip strength can be used as a tool to diagnose women who may suffer from osteoporosis (Di Monaco et al., 2000). The consecutive studies indicated that weak handgrip strength can be used to predict mortality resulting from heart disease and cancer for men (Gale et al., 2007).

Previous studies showed that students with hearing impairment have low values in muscular endurance (sit-up and push up exercise tests) cardiorespiratory system (1-mile run exercise test), agility (4*10 m exercise test) compared to healthy-normal students Al-Rahamneh et.al. (2013). However, in sit and reach exercise test students with hearing impairment performed better compared to healthy-normal students (Al-Rahamneh et al.,

2013). Students with hearing impairment had higher body mass index compared to those with visual impairment and healthy-normal persons (Al-Rahamneh & Bani Hamad, 2015). Therefore, the aim of the current study was to assess the relationship between handgrip strength and body mass for students with hearing impairment. The second aim was to assess whether handgrip strength of students with hearing impairment are within the normal range compared to those healthy-normal students.

Methods:

Participants

Fifty-one male students with hearing impairment (age = 11.4 ± 1.3 years; height = 140 ± 11 cm; body mass = 40.8 ± 14.1 kg; body mass index = 20.9 ± 7.1 kg/m2) volunteered for the study. Inclusion criteria were age range between 9 – 13 years old, healthy and free of illness apart of their hearing impairment and not to have other disabilities. Students with hearing impairment were chosen from local club for hearing impairment in al Bqa'a camp. Parents signed informed consent was obtained. This study was conducted with institutional ethical approval from the Faculty of Physical Education at the University of Jordan**.**

Procedures

Body mass was measured for each student to the nearest 0.1 kg and height was also measured for each student to the nearest 0.5 cm while standing barefoot, wearing shorts (Seca weight-height Scale, Hamburg, Germany). BMI is weight in kilograms divided by height in meters squared, (BMI = weight (kg) / height (m2)) and was calculated for each student. Handgrip strength was measured while standing, the arm is fully extended and away from the body to avoid body strength contribution while measuring (Jamar Analogue Hand Dynamometer, USA). Handgrip strength was measured 3-times for each hand and the average of the 3 values was calculated and used in further analysis (i.e., correlation and paired sample t-test). This study was conducted between November 15th – December 15th.

Data analysis

Body mass index was calculated for each student. The average of the three measurements for each hand was calculated. The data were checked for normality using the Shapiro-Wilk test (Field, 2009). Pearson correlation was used to assess the strength of the relationship between body mass and handgrip strength for each hand. Paired sample t-test was used to assess whether there is a difference between handgrip strength of the left hand and

right hand. All data were analyzed using the Statistical Package for Social Sciences (SPSS) for Windows, PC software, version 21. Alpha was set at $P < 0.05$.

Results

The Results of Pearson correlation coefficient between body mass and handgrip strength for each hand are shown in table 1. The results of Paired sample t-test to calculate the difference between both hands in handgrip strength are shown in table 2.

Table 1: shows the relationship between body mass and handgrip strength for the right and left hand

	Handgrip strength for the right hand	Handgrip strength for the left hand
Body mass (Kg)	0.281	0.314
Significance	0.045	0.013

There was a significant relationship between handgrip strength of the right hand and body mass ($r (49) = 0.281$, $P < 0.05$). There was also a significant relationship between handgrip strength of the left hand and body mass ($r (49) = 0.314$, $P < 0.05$).

Table 2: shows mean and standard deviation of handgrip strength for each hand and the difference between the two hands in handgrip strength using paired sample t-test

Hand grip strength	Mean	SD	t	df	Sig level
Right hand	15.4	3.6	4.1	50	0.000
Left hand	14.2	3.7			

Paired sample t-test showed that handgrip strength of the right hand is higher compared to the left hand ($t_{(50)} = 4.1$, $P < 0.001$). In other words, handgrip strength of the left hand is about 92% of the right hand.

Table 3: shows percentiles of handgrip strength for healthy-normal students in Saudi Arabia (adapted from: Al-Hazza'a, 1997: n=1200)

Percentiles	Handgrip strength value (kg)
95	20.06
70	14.8
50	13.04
20	10.2

The means of handgrip strength for the right hand (15.4 kg) and left hand (14.2 kg) for students with hearing impairment in the current study were equal to the 70th percentile in healthy-normal students in Saudi Arabia. That means handgrip strength of students with hearing impairment

was above the average, which means hearing impairment does not affect handgrip strength for both hands.

Discussion

The results of this study are in agreement with the result of (Bassey& Harries, 1993) who indicated that handgrip strength of the right hand is better than the left hand by 10%. The better handgrip strength of the right hand compared to the left hand for older individuals in (Bassey & Harries, 1993) study and for students with hearing impairment in the current study may be attributed to the fact that most people use their right hand in their daily activities such as eating, drinking, putting on clothes, writing and body language including shaking hand.

The means of handgrip strength of both hands for students with hearing impairment in the current study were equal to the 70th percentile in healthy-normal students. These findings of above average values for handgrip strength for students with hearing impairment are expected compared to normal students. This can be due to the fact that students with hearing impairment use the sign language to express themselves. Sign language is an official language for students with hearing impairment which includes many of hands' movement.

There was a significant relationship between handgrip strength and body mass and that was evident for both hands. The researchers attribute these results to the fact that when body mass increases, the muscle strength increases in general and handgrip strength increases. This seems true especially when considering that the average of body mass index for study sample is less than obesity limit for the age of 9 years old (22.77 kg/m2) and for the age of 13 years (26.84 kg/m2). This significant relationship between handgrip strength and body mass are in accordance with Koley et al. (2009). These researchers observed that handgrip strength was higher for people who have a normal body mass index compared to those who are underweight based on BMI. That means the increase in body mass index was associated with the increase of the muscle mass and not fat tissue in the body.

Conclusions

Handgrip strength of the right hand was higher compared to the left hand which is in agreement with previous studies. In addition, body mass has a significant positive correlation with handgrip strength of both hands. Finally, handgrip strength of student with hearing impairment in the current study equalize to the 70th percentile of healthy-normal student. We can

conclude that hearing impairment does not affect the relationship between handgrip strength and body mass either handgrip strength compared to healthy-normal students. We recommend establishing norms of handgrip strength for healthy individuals with hearing impairment. We also recommend measuring handgrip strength for females with hearing impairment.

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