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Health-related physical fitness levels of youths with visual impairment in Jordan

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Abstract

As fitness is an important component of quality of life, it is necessary to determine fitness levels among various population groups to be able to plan programs for their future fitness improvement. Previous research shows that individuals with visual impairments have lower levels of health-related physical fitness than people without visual impairment. In Jordan, research mainly focuses on youths without visual impairment, whereas no previous studies have been conducted on children with visual impairment and their physical fitness levels. This study aimed to explore health-related physical fitness levels of children with visual impairment in Jordan. A total of 107 children (65 boys and 42 girls) with visual impairment aged 11–15 years and 114 children without visual impairment were included in this study. All children were asked to perform the following assessment items: a one mile run/walk test to measure cardiovascular endurance, a handgrip strength to measure the maximum isometric strength of the hand and forearm muscles, push-up and curl-up tests to measure upper body and abdominal muscular endurance, respectively, sit-and-reach test to measure flexibility, and two-site skinfold measures to determine body composition. Children with visual impairment appeared to have low health-related physical fitness. For instance, the overall mean of push-ups was 4.06, while cardiovascular endurance was excluded from data analysis as only a few students (7) completed the test. No significant differences were found in any of the tested variables among the various age groups. Furthermore, boys showed statistically significant measurements in strength, curl-up, and push-up tests than girls. Children with visual impairment had significantly better score in only push-up test than children who were blind. In addition, except boys with visual impairment aged 15 years, all children with visual impairment failed FitnessGram, whereas sighted children passed all tests.

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Introduction

Physical activity and physical fitness levels are important factors for health and well-being of every child, including children with disability. Higher levels of physical fitness may be significantly related to intensity and duration of physical activity in children and adolescents (Cohen et al., 2014; Fang et al., 2017). However, it seems that many children with disability do not meet World Health Organization (WHO, 2010) recommendations of 60 min of moderate to vigorous physical activity daily (Lobenius-Palmér et al., 2018). It has been documented that children with disability are more likely to be sedentary (Perkins et al., 2013) and consequently have lower levels of health-related physical fitness such as cardiorespiratory fitness, muscular endurance, and higher rates of obesity (Murphy & Carbone, 2008).

Furthermore, children and adolescents with visual impairment are less physically active than their sighted peers (Aslan et al., 2012; Houwen et al., 2009; Kozub & Oh, 2004). Children with visual impairment are also less involved in physical education (PE) classes than the curriculum standard and even less than young people with other impairments (except physical impairment; Atkinson & Black, 2006), and they are most limited from physical activity participation (Longmuir & Bar-Or, 2000). Therefore, children with visual impairment tend to be less physically active and have lower physical fitness levels than children with no visual impairment (Augestad & Jiang, 2015). Limited opportunities for physical activity, including PE classes, may lead to poor physical fitness levels (Lieberman et al., 2010; Lieberman & McHugh, 2001; Robinson & Lieberman, 2004). Augestad and Jiang (2015) also reported that overweight and obesity is more prevalent among children with visual impairment compared to children without visual impairment. This means that the health-related fitness levels of people with visual impairments are generally lower compared to their peers with normal sight as has been shown in the previous research (Houwen et al., 2009; Kozub & Oh, 2004; Lieberman & McHugh, 2001).

Research focused on fitness and children with disability, including children with visual impairment, is rare (Martin et al., 2011). While most of the previous research have been conducted in developed countries, to our knowledge, studies on children with disabilities in developing countries are limited. For instance, in Jordan, research mainly focus on youths without visual impairment (Batayneh & Mestrihi, 2016), whereas no previous studies have been conducted on children with disabilities and their physical fitness levels. One study was conducted in Jordan, and Al-Rahamneh et al. (2013) found that children with hearing loss aged 10–13 years have lower muscular endurance and cardiovascular endurance than their hearing counterparts. No such studies have been conducted regarding children with visual impairment in Jordan. All we know that children with visual impairment in Jordan is that they are more obese than children with hearing loss and children without sensory impairments (Al-Rahamneh & Bani Hamad, 2015). Therefore, this study aimed to explore health-related physical fitness levels of youths with visual impairment in Jordan as a first step to set up appropriate programs for their future fitness development. We focus on health-related physical fitness levels of children with visual impairment in Jordan, as an example of developing countries. Due to limited opportunities for physical fitness improvement of children with visual impairment in Jordan, we hypothesized that the physical fitness level of students with visual impairment would be lower compared to their counterparts without visual impairment, regardless of gender.

Methods

Participants

After obtaining approval from the internal committee at the faculty of PE at Yarmouk University for conducting this study, informed consent was obtained for all individual participants included in this study. In total, 107 children (65 boys and 42 girls) with visual impairment aged 11–15 years were recruited from a special school for visually impaired (Table 1).

All children had to meet International Blind Sports Association (IBSA) for visual impairment criteria. This means that any child whose visual impairment was within B1, B2, or B3 classification was invited for this study. In addition, after interviewing PE teachers in the school, children younger than 11 years were excluded as teachers reported that these children do not have enough physical ability to perform required physical tests or were not familiar with them. This means that according to the PE teachers in the schools, these children have never been trained for the tests that were applied in the current study, but only focused on basic movement skills namely walking, running, and jumping. In addition, we recruited 114 male and female students aged 11–15 years without visual impairment as a control group. Students who were selected for this study, and according to the schools' records, did not suffer from health conditions and/or disability. The schools that were selected were close to the school in which children with visual impairment study. However, we could not guarantee that the socioeconomic status of children with and without visual impairment was similar as the school for children with visual impairment included children from the whole country. Moreover, we recruited sighted children from two schools: one for the boys and one other school for girls. We sought for age and gender match between children with and without visual impairment but no other criteria were used (Table 2).

Measurements

For the purposes of this study, we used the Brockport Physical Fitness Test developed by Winnick and Short (1999) to assess health-related physical fitness of children with visual impairment. This test was used in the previous study on children with visual impairment (da Cunha Furtado et al., 2016; Haegele et al., 2018; Lieberman et al., 2010). Although we followed the same protocol that had been reported in their study (detailed tests protocol can be found in Lieberman et al., 2010), a short description of the six measurements is described in the following.

Flexibility. The sit-and-reach test was performed using a wooden box set against the wall with a 15 cm extension of wood from the front. The participants put one leg out straight against the box

Table 1. Number of participants according to the age, sex, and visual impairment.

	Age group	Sex		Degree of vision loss	
		M	F	VI	B
Total number	11	9	15	12	12
	12	12	5	10	7
	13	12	9	12	9
	14	15	6	9	12
	15	14	10	12	12
		62	45	55	52

VI: visually impaired, B: blind.

Table 2. Number of participants without visual impairment according to the age and sex.

	Age group (years)	Sex	
		M	F
Total number	11	11	15
	12	12	10
	13	12	10
	14	12	10
	15	12	10
		59	55

under the 15 cm extension. They sat with one leg straight and the other leg bent with the foot of the bent leg placed at the knee of the straight leg. Then they reached as far as they could with both hands to obtain a measure of flexibility. The participants practiced the test three times with verbal and physical feedback from their guide to enhance the accuracy of the assessment. They then performed the sit-and-reach stretch twice on each leg. The highest value measured with no knee flexion was calculated.

Cardiovascular fitness. All the participants were asked to run 1.6 km on an indoor playground (its measurement was 20 m × 20 m) to evaluate their cardiovascular fitness. The evaluation was performed individually. All the participants were instructed to complete the distance in the shortest time possible and were told their split times every quarter kilometer. After each lap, they were told the number of remaining laps (19, 18, 17, . . ., 1). Participants who were not able to run independently guide runner alongside was offered.

Upper body muscular endurance. The participants were asked to lie down with their hands next to their shoulders and push themselves up off the floor. An assistant positioned each participant's body such that a straight line was maintained among the shoulders, pelvis, knees, and feet. The participants were assessed once they could independently demonstrate the proper form and technique. Once the assessment began, the participants were allowed 3 seconds to complete each push-up and were instructed to complete as many as possible. The test was terminated when the participant was no longer able to perform push-ups with appropriate form. For those who did not know how to perform a push-up physical and tactile, guidance was provided

Abdominal muscular endurance. All the participants began by lying in a supine position while maintaining 90° of knee flexion with their hands at their sides. They contracted their abdominal musculature until their hands had traveled along the mat to a point below their knees and then returned their shoulders to the mat in a controlled movement. The test was terminated when the participant was no longer able to perform sit-ups with appropriate form.

Body composition. The percentage of body fat was estimated using a two-site (calf and triceps) skinfold technique (Winnick & Short, 1999). All the measurements were taken on the dominant side, and each skinfold thickness was measured two to three times (depending on the repeatability of the measurements) using calipers. Once the data were collected, the sum of the skinfolds was then used to estimate body density and subsequently the percentage of body fat (Siri, 1961). Moreover, we calculated body mass index (BMI) to compare its results to FitnessGram.

Strength. Handgrip strength was measured to explore the maximum isometric strength of the hand and forearm muscles by using hand dynamometer. The participants were asked to use their maximal strength to grip the dynamometer. The test was terminated when the device showed the highest score. They performed the test twice and the highest value measured was calculated.

Statistical analysis

In addition to descriptive statistics, analysis of variance (ANOVA) was used to investigate differences within the groups and between the groups according to the age. T-test was used to investigate whether children achieved different results because of vision loss, gender, or degree of vision loss differences. Following that, percentage of passing rates according to FitnessGram Standards (Cooper Institute, 2013) were used for children with and without visual impairment.

Results

In general, study results showed that children with visual impairment had poor health-related physical fitness level (Table 3) compared to children without visual impairment. Moreover, only seven students completed the required distance in a cardiovascular fitness test, and therefore, this test was excluded from the statistical analysis. Many students could not perform neither one sit-up nor one push-up (9 and 59, respectively), mean score of which was 4.06.

In addition, we found statistically significant differences in all health-related physical fitness test between children with visual impairment and children without visual impairment (Table 3).

In addition, ANOVA revealed that students who were born in 2003 (15 years old) did not achieve better results compared to those born in 2007 (11 years old). No significant differences were found between any age groups on any given physical tests. Children's ability to perform either sit-ups or push-ups ($p = .931$ and $p = .213$, respectively), their strength ($p = .902$), flexibility ($p = .756$), and fat percentage ($p = .748$) were similar regardless their age.

Boys achieved better scores in hand grip strength and sit-up tests ($p = .000$). However, no significant differences were found regarding flexibility ($p = .807$), push-ups ($p = .20$), and body fat percentage ($p = .519$) between boys and girls.

Furthermore, Table 4 shows that children with visual impairment failed in all health-related physical fitness tests, except boys aged 15 years where the passing rate was 69.6%. By contrast, sighted children passed in all health-related physical fitness tests. However, grip strength was not calculated as FitnessGram does not contain this test.

Table 3. Mean values and *p* values of cardiovascular strength, sit-up, push-up, and flexibility, and emotional well-being for children with and without visual impairment.

	Children with VI *M* (*SD*)	Children without VI *M* (*SD*)	*p* value
Cardiovascular fitness	NA	8.58 (1.623)	–
Strength	20.756 (8.068)	27.189 (8.207)	0.000
Sit-up	17.12 (13.948)	37.56 (14.439)	0.000
Push-up	4.06 (7.332)	28.73 (7.863)	0.000
Flexibility	15.39 (7.89)	32.32 (7.548)	0.000

VI: visually impaired.

Table 4. Percentage of participants meeting criteria according to age and sex.

		Cardiovascular endurance	Push-ups	Sit-ups	Flexibility	BMI
11	VI (F)	0%	8.3%	8.3%	4.2%	20.8%
	VI (M)	0%	25%	29.2%	20.8%	50%
	S (F)	86.6%	73.3%	80%	86.6%	86.6%
	S (M)	81.8%	81.8%	90.9%	63.6%	81.8%
12	VI (F)	0%	11.1%	11.1%	5.6%	33.3%
	VI (M)	5.6%	5.6%	27.8%	5.6%	38.9%
	S (F)	80%	70%	70%	90%	70%
	S (M)	83.3%	83.3%	83.3%	66.6%	75%
13	VI (F)	0%	0%	0%	9.5%	19%
	VI (M)	0%	9.5%	19%	33.3%	47.6%
	S (F)	70%	70%	70%	90%	70%
	S (M)	91.6%	83.3%	75%	75%	75%
14	VI (F)	0%	38.1%	0%	4.8%	28.6%
	VI (M)	0%	42.9%	23.8%	14.3%	23.8%
	S (F)	70%	80%	80%	80%	70%
	S (M)	100%	91.6%	83.3%	75%	75%
15	VI (F)	0%	30.4%	8.7%	0%	13.%
	VI (M)	13%	69.6%	13%	17.4%	26.1%
	S (F)	70%	70%	70%	90%	60%
	S (M)	100%	83.3%	83.3%	66.6%	75%

BMI: body mass index; VI (F): visual impairment (female); VI (M): visual impairment (male); S (F): sighted (female); S (M): sighted male.

Discussion

This study aimed to explore health-related physical fitness levels of children with visual impairment in Jordan compared to children without visual impairment. We also sought to explore whether significant differences would exist according to age and sex. Current results show that children with visual impairment in Jordan have low physical abilities. Children with normal sight had performed significantly better in all health-related physical fitness tests. This finding has been supported previously in the European and US population (Houwen et al., 2009; Kozub & Oh, 2004; Lieberman & McHugh, 2001). Houwen et al. (2009) found that children without visual impairment do more physical activities than children with visual impairment. In agreement with our findings, Lieberman et al. (2010) found that children with visual impairment have low physical fitness levels, namely in the domains of upper body strength and cardiovascular fitness. However, most children with visual impairment from the current study could not perform cardiovascular test. Importantly, girls with visual impairment across all age groups failed to pass cardiovascular test. This was reported previously in Lieberman et al. (2010) study where girls aged 14–17 years and percentage of pass rate was 0%.

According to the PE curriculum in Jordan, children in the secondary schools (participants from the current study) are provided with only one PE class weekly. Previous review (Trudeau & Shephard, 2005) suggested that a sufficient quantity of a qualitative PE program can contribute in the overall amount of physical activity of children. They also recommended that schools should ensure a sufficient amount of PE classes to enhance a child's physical fitness. However, PE teachers get employed in the schools (public and special) by the same criteria set by the Ministry of Education. Thus, PE teachers in the special school for children with visual impairment do not receive any additional information regarding adapted PE. Only one compulsory course of adapted PE is offered across the faculties of PE in Jordanian universities. Consequently, their lack of knowledge about teaching children with visual impairment is expected and as a result children with visual impairment are not familiar with different physical activities and fitness tests. However, sport clubs in Jordan must be enrolled either in a certain sport federation on Paralympics Committee. To date, only one goalball team and track and field disciplines are available for some individuals with visual impairment. This indicates that children with visual impairment in Jordan have not really many opportunities to be involved in physical activity and improve their physical fitness. Therefore, low passing rates on health-related physical fitness components are not unexpected. In addition, current passing rates are less than almost all participants from Lieberman et al. (2010) study.

Furthermore, no significant differences were found between any age groups on any given physical tests. Children's ability to perform either sit-ups or push-ups, their strength, flexibility, and fat percentage were similar regardless of their age. This means that their physical fitness levels do not improve with age. This result is inconsistent with a review analysis in which data from 30 European countries showed that boys and girls without disability improved their fitness with age (Tomkinson et al., 2018). Our result could be explained by previous finding which reported that children with visual impairment aged 6–16 years did not take part in any physical activity (Sport England, 2001) and tended not to meet general physical activity guidelines (Augestad & Jiang, 2015; Haegele & Porretta, 2015). This is important as a relationship between physical activity and health-related physical fitness has been reported previously (WHO, 2010). Consequently, without previous appropriate physical preparation, an improvement in physical fitness is not expected to occur.

Conclusion and future implications

The current findings demonstrate that children with visual impairment in Jordan have poor physical fitness levels. Therefore, it is necessary to explore reasons behind such low fitness levels of children with visual impairment. Practitioners in the field probably need further, more specific, education to increase their knowledge about visual impairment and physical activity, namely teaching strategies. This may also encourage future PE teachers to have more positive attitudes toward teaching students with visual impairments (Alsalhi, 2013). Moreover, future research should focus on motivation methods of both children and PE teachers about children's physical activity engagement.

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Informed consent

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