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A Comparison Study of Obesity among Able-Bodied Children and Adolescents Compared to Their Peers with Sensory Disabilities in Jordan

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Abstract

Introduction: This study assessed the prevalence of obesity among able-bodied children and adolescents compared to their peers with sensory disabilities. It also assessed whether there were differences between males and females in obesity.

Methods: 724 able-bodied male students (12.0 ± 2.5 years; 147 ± 15 cm; 42.5 ± 15.0 kg), 241 able-bodied female students (10.8 ± 2.3 years; 141 ± 15 cm; 36.3 ± 12.9 kg), 113 visually-impaired male students (11.6 ± 3.6 years; 142 ± 19 cm; 38.7 ± 16.1 kg), 101visually-impaired female students (12.9 ± 3.7 years; 145 ± 16 cm; 43.2 ± 15.1 kg), 192 hearing-impaired male students (13.2 ± 2.6 years; 152 ± 15 cm; 45.0 ± 15.0 kg) and 151 hearing-impaired female students (12.9 ± 2.8 years; 150 ± 13 cm; 46.3 ± 13.8 kg) volunteered for the study. BMI was calculated for each student.

Results: BMI values were significantly higher for hearing-impaired (19.6 ± 3.8kg.m^2) students compared to their able-bodied peers (18.9 ± 3.9kg.m^2). 5%, 2.9% and 6.5% of able-bodied, hearing-impaired and visually-impaired were obese, respectively. 13%, 13.7% and 12.2% of able-bodied, hearing-impaired and visually-impaired were thinness, respectively.

Conclusion: The prevalence of obesity among able-bodied children and adolescents is low compared to the literature and previous studies. That may be due to the fact that these children studying at public schools. Studying at public school may give indicator that the families of these children having low and moderate income which leads to less obesity and more thinness among these children. Low incidence of obesity and higher incidence of thinness for hearing-impaired and visually-impaired children may be attributed to the fact that most of these children and adolescents studying at residential schools which means that their dietary and food intake is monitored by their schools.

Keywords: able-bodied, hearing-impaired, visually-impaired, obesity, thinness

1. Introduction

It has been reported that children with hearing impairment, visual impairment, physical disability and chronic medical are less active and have low fitness level (Suzuki et al., 1991; Longmuir & Bar-Or, 1994; Longmuir & Bar-Or, 2000). The results of the study by Longmuir & Bar-Or (2000) showed that youth with hearing impairment are the most active group compared to youths with other disabilities. Visually-impaired youths had lower levels of physical activity and consider themselves less fit compared to their peers (Longmuir & Bar-Or, 2000). Visually-impaired youths also reported more limitations for physical activity participation compared to their able-bodied peers and those with other disabilities (Longmuir & Bar-Or, 2000).

It has been indicated that children with hearing impairment have higher percent of body fat than their hearing peers (Winnick & Short, 1986; Shephard et al., 1987; Goodman & Hopper, 1992). It has also been indicated that the fitness level of hearing impaired youths were lower compared to their hearing counterparts in some components of fitness such as strength (sit-up), grip strength and balance (Campbell 1983; Winnick & Short, 1986; Goodman & Hopper, 1992). With regard to visually-impaired students, Sundberg, (1982) observed

significantly higher maximal oxygen uptake values (46.3 ml.kg.min^{-1}) for sighted girls compared to their blind peers (36.8 ml.kg.min^{-1}). Sundberg, (1982) suggested that these differences might be a result of lower physical activity level of blind girls compared to their sighted peers.

Obesity is a health concern worldwide. Obesity is defined as excess of body fat above 25% and above 32% of body weight for men and women, respectively (Wallace & Ray, 2009). Obesity can be a result of more energy intake compared to energy expenditure, less physical activity and genetics (Wilmore & Costill, 2004; ACSM, 2010). Bar-Or & Rowland, (2004) have indicated that children of obese parents have higher chance for being obese. It is known that obesity is correlated to type 2 diabetes, hypertension, hyperlipidemia, coronary artery disease (Wilmore & Costill, 2004; Wallace & Ray, 2009; ACSM), 2010), stress and depression, lower back and joint pain (ACSM, 2010) and may also affect the quality of life. Children's obesity has increased worldwide in developed and developing countries (Bar-Or & Rowland, 2004; Al-Hazzaa, 2002). A high BMI in children has been demonstrated to lead to a high BMI (obese) in adulthood (Reilly et al., 2003), developing an early atherosclerosis (Berenson et al., 1998) and is also linked with total mortality (Must et al., 1992). Children's body mass index is changed largely with age. Therefore, Cole et al. (2000) and Cole et al. (2007) have established cut offs point for obesity, overweight, normal and underweight for males and females between 2 and 18 years old.

In the Middle East and Arab countries, obesity and overweight among children have increased (Al-Hazzaa, 2002). Al-Nuaim et al. (2012) observed that 21.2% were obese and 17.2% were overweight in the urban area and 20.7% were obese and 26.6% were overweight in rural desert of Al-Ahsa region of Saudi Arabia. In a recent study by Tayyem et al. (2014) which compared obesity among secondary-school students studying at public schools compared to their peers studying at private schools in Jordan. The authors reported that the prevalence of obesity was higher in private schools (26.0%) compared to public schools (16.7%). Al-Nakeep et al. (2012) reported that the prevalence of obesity was much higher in Al-Ahsa region in Saudi Arabia (18.3%) compared to Coventry city (4.8%) and Birmingham city in the United Kingdom (6.8%).

To our knowledge, there are no studies which have compared obesity among able-bodied children and adolescents compared to those with visually-impairment and hearing-impairment in Jordan. In addition, in a recent study by Al-Rahamneh et al. (2013) the authors observed that students with hearing-impairment have low physical fitness level in push-up, sit-up, 1 mile run and agility compared to their hearing peers in Jordan. Sundberg, (1982) observed significantly higher $\dot{V}O_2max$ values for sighted girls compared to their blind counterparts. Therefore, the aim of the current study was to assess the prevalence of obesity among able-bodied children and adolescents compared to their visually-impaired and hearing-impaired peers in Jordan. We hypothesized that children and adolescents with hearing-impairment and visually impairment would have higher incidence of overweight and obesity compared to their able-bodied peers.

2. Methods

2.1 Participants

Sensory disabilities include visually-impairment and hearing-impairment. Visual impairment is a loss of vision resulting in a major limitation of visual capability (Leverenz, 2009). Visual impairment includes total blindness and partial sight (Craft & Lieberman, 2000). Partially sighted individuals can read through large print or magnification whereas blind persons cannot read large print even with magnification (Craft & Lieberman, 2000). Hearing impairment includes deafness and hard of hearing. Deafness means a severe to profound hearing loss which does not allow the individual to use the remaining of hearing system for communication and processing information even with using augmentation devices, whereas individuals with hard of hearing may use the remaining of hearing system for communication and processing information (Ellis & Karasinski, 2009; Lieberman, 2011).

Seven hundred and twenty four able-bodied male students (12.0 ± 2.5 years; 147 ± 15 cm; 42.5 ± 15.0 kg), 241 able-bodied female students (10.8 ± 2.3 years; 141 ± 15 cm; 36.3 ± 12.9 kg), 113 visually-impaired male students (11.6 ± 3.6 years; 142 ± 19 cm; 38.7 ± 16.1 kg), 101visually-impaired female students (12.9 ± 3.7 years; 145 ± 16 cm; 43.2 ± 15.1 kg), 192 hearing-impaired male students (13.2 ± 2.6 years; 152 ± 15 cm; 45.0 ± 15.0 kg) and 151 hearing-impaired female students (12.9 ± 2.8 years; 150 ± 13 cm; 46.3 ± 13.8 kg) volunteered for the study. Body mass index was calculated for each student and compared to thinness, normal, overweight and obese scales for each year as introduced by Cole et al., 2000 and Cole et al., 2007. Inclusion criteria for able-bodied were age range between 6 – 18 years old, healthy and free of illness when the study were conducting and studying at public schools in order to have a reasonable comparison with those having sensory impairment. Inclusion criteria for hearing-impaired and visually-impaired were age range between 6 – 18 years old, healthy and free of illness apart of their disabilities and not to have other disabilities. For all children and adolescents

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.

2.2 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 0.1 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 (m^2)) and was calculated for each child and adolescent.

2.3 Data Analysis

The data were checked for normality using the Shapiro-Wilk test (Field, 2009). Mauchly's test was used to confirm the assumptions of sphericity for two way ANOVA (Field, 2009). Where this was not confirmed, the Greenhouse–Geisser correction factor was applied to correct the degrees of freedom (Field, 2009). All data were analyzed using the Statistical Package for Social Sciences (SPSS) for Windows, PC software, version 21. Alpha was set at $P < 0.05$.

BMI was calculated for each child and adolescent. Students were compared against the BMI cut-offs point for obesity, overweight, normal and underweight for children and adolescents between 6-18 years old as proposed by Cole et al., 2000 and Cole et al., 2007. Students were then classified as obese (≥ 30 kg/m^2), overweight (> 25 kg/m^2), normal (18.5 and < 25 kg/m2), thinness grade 1 (17 to < 18.5 kg/m^2), thinness grade 2 (16 to < 17 kg/m^2) and thinness grade 3 (< 16 kg/m^2) based on these cut offs point. Two way ANOVA (Gender; male and female and Health status; able-bodied, hearing-impaired and visually-impaired) was used to assess whether were differences in BMI data between male and female and between able-bodied, hearing-impaired and visually-impaired.

3. Results

The number of students and the percentages of students whom are obese, overweight, normal, thinness grade 1, thinness grade 2 and thinness grade 3 based on BMI data are presented in Table 1.

The mean and standard deviation of body mass index data for able-bodied males and females, hearing-impaired males and females and visually-impaired males and females are presented in Table 2.

Table 1. Shows the BMI classification of children and adolescents. Data are n and percentage of n (%) in each classification

Classification/ Health status and gender	Obese N (%)	Overweigh N (%)	Normal N (%)	Thinness grade 1 N (%)	Thinness graded 2 N (%)	Thinness grade 3 N (%)
Able-bodied male (724)	41 (5.7)	127 (17.5)	476 (65.7)	60 (8.3)	13 (1.8)	7 (1.0)
Able-bodied female (241)	7 (2.9)	38 (15.8)	150 (62.2)	34 (14.1)	9 (3.7)	3 (1.2)
Able-bodied (965)	48 (5.0)	165 (17.1)	626 (64.9)	94 (9.7)	22 (2.3)	10 (1.0)
Hearing-impaired male (192)	4 (2.1)	28 (14.6)	124 (64.6)	28 (14.6)	6 (3.1)	2 (1.0)
Hearing-impaired female (151)	6 (4.0)	24 (15.9)	110 (72.8)	8 (5.3)	3 (2)	0 (0.0)
Hearing-impaired (343)	10 (2.9)	52 (15.2)	234 (68.2)	36 (10.5)	9 (2.6)	2 (0.6)
Visually-impaired male (113)	8 (7.1)	10 (8.8)	77 (68.1)	15 (13.3)	2 (1.8)	1 (0.9)
Visually-impaired female (101)	6 (5.9)	18 (17.8)	69 (68.3)	7 (6.9)	1 (1.0)	0 (0.0)
Visually-impaired (214)	14 (6.5)	28 (13.1)	146 (68.2)	22 (10.3)	3 (1.4)	1 (0.5)

Table 2. Shows the mean and standard deviation of BMI of children and adolescents in each group. Data are mean and standard deviation (mean ± SD)

Health status and gender	BMI (mean ± SD)
Able-bodied male (724)	19.2 ± 3.9
Able-bodied female (241)●	17.9 ± 3.6
Able-bodied (965)	18.9 ± 3.9
Hearing-impaired male (192)	19.0 ± 3.6
Hearing-impaired female (151)	20.2 ± 4.0
Hearing-impaired (343)*	19.6 ± 3.8
Visually-impaired male (113)	18.5 ± 4.2
Visually-impaired female (101)	19.9 ± 4.5
Visually-impaired (214)	19.1 ± 4.4

*Significantly higher than able-bodied and visually-impaired students

● Significantly lower than visually-impaired and hearing-impaired female students

There was a significant interaction between health status and gender on BMI data ($F_{(2,1516)} = 17.891$, $P < 0.05$). Post hoc analysis using Tukey HSD for groups of different sizes showed that able-bodied female students have significantly lower BMI values compared to visually-impaired female students ($P < 0.05$) and hearing-impaired female students ($P < 0.05$). Post hoc analysis using Tukey HSD for groups of different sizes showed no significant differences between male students of the three groups ($P > 0.05$). Two way ANOVA showed that there was a main effect for health status ($F_{(2, 1516)} = 9.611$, $P < 0.05$). Post hoc analysis using Tukey HSD showed that BMI values were significantly higher for hearing-impaired students compared to able-bodied students (0.014). There was no significant difference between male and female in BMI data ($F_{(1, 1516)} = 3.184$, $P > 0.05$).

4. Physical Education Data

Schoolchildren at 7th grade and below studying at public and private schools have two physical education classes and those above the 7th grade have one physical education class per week. This physical education class is 45 minutes long. These 45 minutes are divided, with10 minutes of preparation and warming-up, 25-30 minutes for the main session and 5-10 minutes for cool-down and returning to the class. This is far below the recommend level of physical activity per week.

5. Discussion

The aim of the current study was to assess the prevalence of overweight and obesity among healthy able-bodied children and adolescents compared to their peers with visually-impairment and hearing impairment. The main advantage of the current study is that the sample used in this study is unique in its size and the disability types that were representative of a large Jordanian area. The prevalence of obesity among the three groups in the current study is low (≤ 6.5%) compared to the previous studies. However, the prevalence of thinness among the three groups is high (≥ 12.2%).

The percentages of obesity observed in the current study ranged between 2.9% for hearing-impaired children and adolescents, 5% for able-bodied and 6.5% for those with visually-impairment. These percentages of obesity are much lower compared to the previous studies in developing countries. For example, Al-Hazzaa, (2002) reported that 16% of school children in Saudi Arabia were obese. Al-Nakeep et al. (2012) also reported that 18.3% of youths were obese in Al-Ahsa region in Saudi Arabia. Furthermore, Tayyem et al. (2014) reported that 26.0% of private school children were obese and 16.7% of public school children were obese. However, the percentages of obesity in the current study among the three groups are similar to those reported by Al-Nakeep et al. (2012) in Coventry and Birmingham cities in the United Kingdom.

Lobstein & Leach, (2007) indicated that wealth is one of the environmental factors that increase body mass index. Wealth increases the purchasing power of food and also helps in adopting a more sedentary life style due to greater use of technology. School children of public schools in Jordan in the current study and in the previous study by Tayyem et al. (2014) have to walk to the schools whereas private school children and adolescents usually utilize buses that are offered by the private schools. This would give a reasonable justification of lower percentages of obesity among of public school children compared to those studying at private schools.

On the other hand, the prevalence of thinness in the current study is ranged between 12.2% -13.7% for the three groups. This confirms the idea that the families of school children studying at public schools have lower monthly income compared to those studying at private school. This is due to the higher tuition fees required for private schools compared to public schools which are almost free of charge in Jordan. We have a conversation with one of the social researcher in one of the schools for visually-impaired children where we collected some of our data and "she mentioned that most (about 88%) of families of visually-impaired children have low monthly income". This would in turn lead to less purchasing power for food and using technologies. Another possible interpretation of low incidence of obesity and higher incidence of thinness among hearing-impaired and visually-impaired children may be attributed to the fact that most of these students studying at residential schools which means that their dietary and food intake is monitored by their schools.

Visually-impairment children had higher obesity (6.5%) compared to their able-bodied peers (5%) and those with hearing impairment (2.9%). These findings are not surprising as visually impaired children, adolescents and adults had more barriers for exercising and physical activity compared to able-bodied persons (Longmuir & Bar-Or, 2000). Hearing-impaired children and adolescents had significantly higher BMI (0.7 kg/m^2) compared to their able-bodied peers. Hearing-impaired children and adolescents had less apparent challenges for exercising

and physical activity compared to able-bodied and children with other disabilities (Ellis & Karasinski, 2009), but this may attributed to the quality of physical education classes delivered to hearing-impaired children. With regard to gender and disabilities, female with hearing impairment and females with visually-impairment had significantly higher BMI (1.2 kg/m^2) and (1.4 kg/m^2) compared to their male peers, respectively. This is not surprising especially when considering that females have more restrictions to do exercising and physical activities than males in the Arab cultural. In a recent study by Al-Nakeep et al. (2012), the authors reported that 81.4% out of 531 females were inactive in Al-Ahsa region in Saudi Arabia compared to 34.5% out of 576 males were inactive in Al-Ahsa region in Saudi Arabia. In contrast, 6.5% of males were inactive and 11% of females were inactive in Coventry city in the UK. There is may be even more restrictions for disabled females compared to their able-bodied females for exercising and doing physical activities. This was reflected in significantly higher BMI values for visually-impaired and hearing-impaired females compared to their able-bodied peers.

6. Conclusion

This study assessed the prevalence of obesity among able-bodied children and adolescents compared to those with visual impairment and hearing impairment. The results showed that obesity ranged between 2.9% for hearing-impaired, 5% for able-bodied and 6.5% for those with visually-impairment. These percentages of obesity are low compared to the previous studies in developed and developing countries. The prevalence of thinness in the current study is high ranged between 12.2% -13.7% for the three groups. These findings of lower percentages of obesity and higher percentages of thinness might be attributed to the fact that able-bodied children studying at public school which lead them to walk to schools instead of using school buses. Students with sensory disabilities have low percentages of obesity and higher percentages of thinness as a result of low family monthly income. One more point regarding low incidence of obesity and higher incidence of thinness among hearing-impaired and visually-impaired children may be attributed to the fact that most of these students studying at residential schools which means that their dietary and food intake is monitored by their schools. We recommend that students with sensory disabilities should be monitored even more for the quality of their daily food intake in order to prevent being obese or being underweight.

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