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Physical Fitness and Body Composition among People with Mild Level Intellectually Impairment, with and without Additional Disabilities: A Cross-Sectional Study

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ABSTRACT

Background: Having an additional impairment similar to Down Syndrome (DS) might increase defects in motor development in people with intellectual impairments (II) and, therefore, affect their physical fitness and body composition. Thus, this study compared the physical fitness and body composition of people with II who did not have additional impairments with those who had additional impairment.
Methods: This cross-sectional study included N= 272 young people with II, aged 18 to 30 (19.67 ± 2.66 years). According to Wechsler Intelligence Test, their IQ was in the range of 55 to 70. Participants were allocated purposefully to three different II groups, including II without additional disabilities (n= 90), II with DS (n= 89), and II with other disabilities such as Cerebral Palsy (CP), ADHD, Hydrocephaly, Microcephaly, Speech Disorders, or Behavioral Disorders (n= 93). Eurofit Battery Tests assessed physical fitness, and body composition was measured by Biospace (In Body 230).
Results: The results of one-way ANOVA showed significant differences in all physical fitness factors among the three groups ($P \leq 0.05$), except for the endurance of abdominal muscles (P= 0.463). There were significant differences in BMI, body fat percentage, and body fat mass among the three II groups ($P \leq 0.05$), but not in skeletal muscle mass nor in the waist to hip ratio (WHR) among groups ($P > 0.05$).
Conclusion: People with II who also have DS have the lowest physical fitness and exhibit a weaker body composition than their peers with other impairments or without additional impairment. Improving and maintaining physical fitness have to become a critical part of care and support for these people.

1. Introduction

People with intellectual impairments (II) have more deficient motor skills than other children because cognitive and learning delays can affect reaction time, basic motor learning patterns, physical fitness, and complex motor skills (Frey & Chow, 2006). Moreover, it has been indicated that the body composition status and physical fitness of people with II are lower than others; these may include cardiorespiratory endurance, muscle strength and endurance, balance, and motor coordination (Cowley et al., 2010; Frey & Chow, 2006; Golubović, Maksimović, Golubović, & Glumbić, 2012; Hale, Bray, & Littmann, 2007; Skowroński, Horvat, Nocera, Roswal, & Croce, 2009). These factors are essential for a person's physical independence and crucial in the functional appraisal of an individual's abilities. It should be noted that the low physical fitness levels of people with II may influence their life expectancy (Oppewal & Hilgenkamp, 2019).

From the health point of view, low physical fitness is one of the most critical problems to solve when we consider people with II. Their low level of muscular strength and resistance causes high energy use during daily activities, which brings about tiredness anda sedentary lifestyle (Cunha et al., 2018). Physical inactivity, in turn, frequently entails overweight and obesity among the majority of this population. On the other hand, since physical abilities are the prerequisite of many daily activities such as eating, dressing, getting up from a chair, and walking, the physical fitness of individuals with mild II has attracted many researchers' attention (Cowley et al., 2010). However, despite researchers' interest in studying the physical fitness of individuals with II and clarifying its relationship with influential variables, this issue still needs further studies, especially among people with mild II who have additional disabilities.

The low level of physical fitness and body composition in these people seems to be related to limitations to motor development (Frey & Chow, 2006; Hartman, Houwen, Scherder, & Visscher, 2010; Vuijk, Hartman, Scherder, & Visscher, 2010), inactive lifestyle, less chance of participating in recreational and social activities (Guidetti, Franciosi, Gallotta, Emerenziani, & Baldari, 2010), lack of motivation to try hard during the test, and tendency to stop the test in times of distress (Graham & Reid, 2000). Therefore, having additional disabilities might affect these limitations and lead to lower physical fitness. In this regard, a few cross-sectional studies showed that having an additional disability, similar to Down Syndrome (DS), in people with II can affect their physical fitness (Baynard, Pitetti, Guerra, Unnithan, & Fernhall, 2008; Fernhall et al., 2001; Pitetti & Fernhall, 2004). Despite the knowledge produced by studies that investigated DS as an additional impairment, there is a lack of knowledge regarding many

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other kinds of impairments that may be accompanied by II. To the best of our knowledge, no study has previously investigated the physical fitness and body composition of people with mild II, with and without additional impairments. Such knowledge may help practitioners and sports science experts to tailor physical activity programs to improve physical capacity, leading to increased quality of life among people with II who may have additional impairments.

Therefore, the current study aimed to compare the physical fitness and body composition of people with mild II, with and without additional impairments. Thus, the main problem of the present study may be stated as whether individuals with mild II who also have DS or any other impairment have different physical fitness and body composition compared to those who do not have multiple impairments.

2. Materials and Methods

2.1. Subjects

A total of 272 young people (138 males and 134 female) with II aged 18 to 30 were invited from special educational schools, associations, and foundations for II in Tehran, Iran. The inclusion criteria included mild II, which psychologist diagnosed according to the Wechsler Intelligence Test (their IQ was in the range of 55 to 70). Exclusion criteria were having severe physical disability resulting from a history of surgery, illness, or injury that could prevent or interfere with physical activity.

Participants' required educational and medical information (e.g., additional impairments, physical characteristics, drugs used, educational status, and IQ certificate) were extracted from documented profiles in their educational schools, associations, and foundations. Then participants were allocated into three different II groups, including II without additional impairments (II without AI), II with DS, and II with multiple impairments (II with MI), based on their profile information and physicians' reports. The MI contained different impairments such as Cerebral palsy, Attention Deficit Hyperactivity Disorder (ADHD), Hydrocephaly, Microcephaly, Speech disorders, and Behavioral disorders. Participants' demographic characteristics included age (19.67 ± 2.66 years), height (158.62 ± 12.55 cm), weight (62.51 ± 17.03 Kg), gender (male 53.3%, female 46.7%), and IQ score (63.25 ± 6.59).

2.2. Procedure

The current study was cross-sectional, comparing the physical fitness and body composition of individuals with mild II, with and without additional impairments who have the same IQ level. This study was a part of a large project approved by the Ethics Committee of the Physical Education Research Institute in Tehran (IR.SSRI.REC.1397.360), Iran. All participants and their parents/ guardians filled out the consent form before inclusion. The study was reported following the rigor of the 'Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline (Vandenbroucke et al., 2009).

2.2.1. Physical fitness tests

Participants' physical fitness was assessed by the Eurofit battery test. These tests determine health and movement related physical fitness factors and are specially designed for people with II. The Eurofit battery test includes muscular strength, speed, cardiorespiratory endurance, muscular endurance, flexibility, and balance (Skowroński et al., 2009; Van de Vliet et al., 2006). According to the research findings, the Eurofit battery test can detect functional differences in physical fitness among people with different II levels (Van de Vliet et al., 2006).

This standardized battery is a set of physical fitness tests, including two different walking tests on the balance board to assess balance; the movement hand-speed and running tests for evaluating speed; sit and reach test to assess flexibility; long jump and vertical jump for determining the explosive leg power; throwing medicine ball test to evaluate the strength of the hands; sit-up test for muscular endurance; and 20-meter shuttle for assessment of cardiorespiratory endurance (Skowroński et al., 2009). All tests were measured according to the methods described in previous studies (Giagazoglou et al., 2013; Salaun & Berthouze-Aranda, 2012; Skowroński et al., 2009; Van de Vliet et al., 2006). The test battery requires 35-40 minutes to administer and uses simple equipment. This battery's reliability is adequate for people with mild intellectual disability (ID) (ICC=0.94 to 0.99) (Mac Donncha, Watson, McSweeney, & O'Donovan, 1999).

2.2.2. Body composition measurment

Body composition evaluation included height, weight, BMI,body fat percentage, body fat mass, and skeletal mass measured byBody Composition Scale (Manufacturer: Biospace; Model: InBody 230; USA).

2.3. Data analysis

Data analysis was performed using Statistical Package for Social Sciences (SPSS) software (version 21, SPSS, Inc, Chicago, IL, USA). Descriptive statistics, including central tendency and dispersion measures, were calculated for all outcome measures. Normal distribution was evaluated with the Kolmogorov–Smirnov's test. The one-way analysis of variance (ANOVA) was used to compare the research variables among three groups. Data analysis was performed at a significance level of $P \leq 0.05$

3. Results

The results of one-way ANOVA showed that there was no significant difference in demographic characteristics including gender ($F_{(2, 269)} = 0.696$, P= 0.126), age ($F_{(2, 269)} = 0.615$, P= 0.098) and IQ level ($F_{(2, 269)} = 0.728$, P= 0.484) between groups. Also, results show a significant difference in BMI (P= 0.001), body fat percentage (P= 0.001), and body fat mass (P= 0.001) among the three II groups. There was no significant difference in skeletal muscle mass (P= 0.857) and WHR (P= 0.392) among groups (Table 1).

Moreover, there were significant differences in all physical fitness factors among the three II groups ($P \leq 0.05$). However, the score for endurance abdominal muscles ($P>0.05$) did not significantly differ between the II groups. The post hoc test results showed significant differences among three II groups in dynamic balance, long jump, and vertical jump variables so that II without AI scored better than II with MI. In turn, II with MI scored better than II with DS. Also, in terms of hand movement speed, 25 meters' dash, arm strength, handgrip strength, and Vo2max values, II with DS was weaker than II without AI and also weaker than II with MI. However, II with DS had more flexibility scores than II without AI and II with MI. Regarding body composition, the post hoc test showed that II with DS has more BMI, body fat percentage, and body fat mass compared to II without AI or II with MI (Table 2).

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Table 1.
Results of ANOVA for comparing body composition factors in different II groups

Variables	Group	Mean ± SD	F	P-value	Post-hoc Comparison
BMI	ID without AD ID with DS ID with MD	23.69 ± 6.26 28.55 ± 6.32 22.14± 5.53	25.17	0.001*	ID without AD < II with DS ID with DS > II with MD
Body fat (%)	ID without AD ID with DS ID with MD	31.96±11.27 35.71±11.81 26.49±12.16	11.29	0.001	ID without AD > II with MD ID with DS > II with MD
Body fat mass	ID without AD ID with DS ID with MD	20.59±12.27 24.50±11.89 16.55±10.20	9.78	0.001*	ID with DS > II with MD
Skeletal muscle mass	ID without AD ID with DS ID with MD	23.31±7.11 22.76±5.75 22.92±6.80	0.15	0.857	----------
WHR	ID without AD ID with DS ID with MD	1.15±2.64 0.88±0.06 0.86±0.08	0.941	0.392	----------

Table 2.
Results of ANOVA for Comparing physical fitness in different II groups

Variables	Group	Mean ± SD	F	Sig	Post-hoc Comparison
Flexibility (cm)	ID without AD ID with DS ID with MD	19.63±10.07 30.70±10.41 17.25±11.04	40.87	0.001*	ID without AD < II with DS ID with DS > II with MD
Dynamic Balance (Score)	ID without AD ID with DS ID with MD	5.88±0.35 5.19±0.79 5.46±0.70	25.41	0.001*	ID without AD > II with DS ID without AD > II with MD ID with DS < II with MD
Endurance abdominal muscles (Number)	ID without AD ID with DS ID with MD	11.35±4.42 10.60±4.37 10.61±4.46	0.773	0.463	----------
Long jump (cm)	ID without AD ID with DS ID with MD	111.74±45.96 73.02±30.48 90.55±41.61	19.33	0.001*	ID without AD > II with DS ID without AD > II with MD ID with DS < II with MD
Vertical jump (cm)	ID without AD ID with DS ID with MD	21.58±14.04 12.41±6.01 16.63±9.68	16.64	0.001*	ID without AD > II with DS ID without AD > II with MD ID with DS < II with MD
Hand Movement Speed (s)	ID without AD ID with DS ID with MD	25.87±7.71 31.75±7.59 28.99±9.94	10.39	0.001*	ID with DS > II without AD
Arm strength	ID without AD ID with DS ID with MD	314.70±116.76 258.76±85.13 308.71±107.16	7.13	0.001*	ID without AD > II with DS ID with DS < II with MD
Speed- 25m running (s)	ID without AD ID with DS ID with MD	6.01±1.25 7.41±1.68 6.43±1.73	16.31	0.001*	ID without AD < II with DS ID with DS > II with MD
Hand grip strength	ID without AD ID with DS ID with MD	23.31±9.30 17.06±6.46 21.73±10.13	11.93	0.001*	ID without AD > II with DS ID with DS < II with MD
VO₂ max	ID without AD ID with DS ID with MD	26.18±4.23 19.97±2.72 25.23±6.49	94.854	0.001*	ID without AD > II with DS ID with DS < II with MD

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4. Discussion and conclusion

In the present study, the physical fitness profile and body composition of young people with II was described and compared based on having and not having the additional impairments. The results showed significant differences in physical fitness factors and body composition between three II groups at an equal level of IQ, including people with II who had not an additional impairment, people with II who also had DS, and people with II and multiple impairments. As hypothesized, the II people without additional impairments were better in physical fitness tests or body composition than those with an additional disability (i.e., DS or MI). It is generally known that people with II have sedentary lifestyles and undertake deficient physical activity levels; therefore, they have a low level of physical fitness (Bossink, van der Putten, & Vlaskamp, 2017). The possibility exists that some social and environmental barriers to physical activity in adults with II, including issues related to transport and finances, negative support, and lack of awareness of options, could be related to their low level of physical fitness(Bossink et al., 2017). Therefore, people with II and additional impairment might be more affected by such problems. In this regard, some cross-sectional studies confirm that people with II and severe motor impairments are at an incredibly high risk of being sedentary, consistent with an overall picture of inactivity(Stancliffe & Anderson, 2017; van der Putten, Bossink, Frans, Houwen, & Vlaskamp, 2017). One reason for inactivity of these individuals could be related to problems regarding performing physical activities independently; therefore, they are at particular risk of total inactivity. They have limited internal drive to move by themselves, and consequently, they usually depend on others (van der Putten et al., 2017). These factors seem to be more potent among Iranian II people because, according to the recorded data of our participants, about 70% of them live in families with low cultural and economic levels.

Interestingly, our results verified that in most physical fitness factors, group of II with DS had weaker scores not only than the AI group but also than the group with MI group. These findings are consistent with previous studies that reported that II with DS present high levels of overweight or obesity and lower levels of physical fitness compared with the II group without DS (Bertapelli, Pitetti, Agiovlasitis, & Guerra-Junior, 2016). Also, regarding body composition, longitudinal studies found that participants with DS presented overweight and obesity at the 1-year follow-up (46%) and 2-year follow-up (47%). In contrast, this phenomenon was different in II without AI (Only 15% and 17%) (Suarez-Villadat et al., 2019). However, it is still surprising that people with II and DS had weaker physical fitness scores than their peers with MI. Literature has already mentioned that people with II are a special population concerning their physical fitness and body composition (González-Agüero et al., 2010). To the best of our knowledge, there is no previous study comparing II with DS and II with MI; therefore, it is impossible to compare the results of the current research with the previous one. In most previous studies, people with multiple disabilities were excluded either in the recruitment phase, because of their assumed inability to be physically active or their associated impaired mobility, or in the data analysis, because of the low number of participants (Bossink et al., 2017; van der Putten et al., 2017). On the other hand, many studies have indicated that the rate of physical activity varies with the level of impairment: in general when the intellectual disability is more severe the level of physical inactivity increases (van der Putten et al., 2017). Therefore, it seems the level of IQ might be more effective than having multiple impairments in physical fitness and body composition. In our study, there was not significant difference in IQ level between participants. However, some body composition variables like higher body fat might justify why people with II and DS had weaker physical fitness scores than their peers with MI.

Another finding of the current study demonstrated that people with II and DS had more flexibility scores than the other two groups. According to the evidence, one of the leading clinical characteristics of people with DS is muscle hypotonicity and hypermobility of the joints or ligamentous laxity (González-Agüero et al., 2010). Therefore, augmented flexibility is predominant in these people and could justify more flexibility scores than theirs. This condition should be considered by experts and all practitioners when prescribing physical or sports activities. One of the main concerns for people with II and DS regarding sports participation is their atlantoaxial instability, as participation in contact sports activities is contraindicated in those cases.

Generally, people with II need to maintain their functional status to lead healthy and satisfying lives without being institutionalized, especially when they have additional impairments. Therefore, improving and maintaining physical fitness has to become a critical part of care and support for these people. Moreover, physical activity prescriptions targeted at people with II, especially those with other impairments, would be of particular importance to possibly boost their work power throughout their lifespan.

There are strengths and limitations to the current study. The main strength is the relatively large sample size of people with II in different categories of additional impairments with the same IQ level. Moreover, our study is the first one focusing on people with II and other impairments and excepted them from II with DS to compare their physical fitness abilities. Our study also has several limitations: the main one is the cross-sectional study design that excludes the possibility of examining the variables' temporal relationships and making causal inferences. Also of concern is the potential bias caused by those who refused to participate in the study.

The current study demonstrated the II people without additional impairments were better in physical fitness tests or body composition than those with an additional disability (i.e., DS or MI). Thus, it seems really important to consider the additional disability, especially DS, among people with intellectual disabilities, when professionals are designing physical training for improving their physical fitness. Also, further studies are needed to investigate the mechanisms and genetic links responsible for reducing physical fitness abilities in people with II and DS compared to their peers with MI.

Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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