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Health-related Physical Fitness in Children with Mental Retardation

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ABSTRACT

Human health is highly dependent on the condition of health-related physical fitness and particularly body composition. Adolescence is unique in this regard, especially when the adolescents are mentally retarded, about whom information on physical fitness is limited. Thus, the objective of this paper was to study the components of health-related physical fitness with emphasis on body composition and weight gain and loss in mentally retarded students of Roodbar. Statistical sample included 91 mentally retarded male students with mean age of 13.44±1.56, mean height of 167±6.97, and mean IQ of 68.7±7.8. Physical fitness components were assessed using modified Brockport Physical Fitness Test (BPFT) including cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition (by calculation of body mass index). The results indicated that in terms of body mass index, 40% of participants were underweight, 10% were overweight, and 10% were obese. In addition, body fat percentage was high in 11.9% of subjects and very high in 13% of them. The mean aerobic power of mentally retarded boys aged 12-14 was measured 31.5% (ml/kg/min), indicating 25% and 35% lower physical fitness, respectively, compared to their normal peers and the reference values. The present study revealed that a significant proportion of mentally retarded adolescents in Roodbar are suffering from either underweight or overweight. Moreover, their physical fitness in all components is not desirable compared to their normal peers.

Key Words: Anthropometric Parameters, Physical Fitness, Mentally Retarded Adolescents, Overweight, Obesity.

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INTRODUCTION

Adolescence is a critical period of life which has an undeniable impact on human life, especially health status (1). Various diseases often have their roots in childhood and adolescence (1), that's why it is generally stated that lifestyle change is the most effective way for the prevention of many diseases (2). Obviously, mentally retarded adolescents and children need to develop their physical fitness and motor abilities. Most of them have a weak physical status and low physical vitality. They usually take steps unbalanced and unstable, indicating a weak overall coordination of body movements. In comparative studies, mentally retarded students always gain lower scores than their normal peers in terms of strength, endurance, agility, balance, running speed, flexibility and reaction time (1). Hence, primary prevention strategies are mainly focused on lifestyle risk factors such as fitness, physical activity, diet, and body composition that should be taken into account childhood and adolescence (2, 3). Nevertheless, due to the low levels of health-related fitness, mentally retarded children are more exposed to secondary complications than normal ones (3). Several studies suggest a close relationship of fitness and body composition with health (4), as reduced physical fitness is associated with an increased risk of various diseases. Epidemiological studies in the last 50 years have shown that low fitness in childhood and adolescence is associated with overall mortality, cardiovascular diseases, and type 2 diabetes in adulthood (5, 6). On the other hand, longitudinal studies have shown that poor fitness is associated with an increase in chronic diseases in adulthood (2, 3). It has been also found that People who enjoy a high level of fitness would live longer and are less susceptible to diseases (7). In addition, it has been reported that the risk of cardiovascular diseases is higher in adolescents with low levels of cardiovascular and respiratory fitness, high body fat, and large amount of upper body fat, especially visceral adipose tissue. Studies back a strong relationship between cardiorespiratory fitness and risk factors of cardiovascular diseases, as it is stated that low cardiorespiratory fitness is strongly associated with risk factors of cardiovascular diseases in children and adolescents, regardless of their country, age, and gender (8, 9). Nowadays, fitness is divided into two categories of health-related fitness and fitness related to motor skills. Health-related fitness emphasizes on the development of required features for a good performance and leading healthy life and involves muscular strength and endurance, cardiorespiratory endurance, flexibility, and body composition (10, 11). Additionally, anthropometric parameters (such as height, weight, body composition, and fat percentage) have a close association with health and longevity (11, 12). Hence, measurement of body composition and fitness is one of the scientific and valid methods for investigating the health of people of all ages (4). Thus, researchers believe that measurement of anthropometric parameters and fitness should be considered as an index of health and healthy life for development of national standards for growth of children and adolescents (5, 13). Hence, developed countries have conducted extensive research on this subject. Unfortunately, few studies have been conducted in Iran in this regard, most of which are about normal children. Previous studies have shown that overweight and obesity are increasingly getting prevalent in Iran Prevalence of underweight, overweight, and obesity has been reported to be 13.9%, 8.82%, and 4.5%, respectively, among Iranian adolescents (14). It has been also stated that prevalence of underweight, overweight, and obesity in primary school students aged 7-12 in Babol, Mazandaran Province, Iran is 13.5%, 12.3%, and 5.8%, respectively (15). A survey on fitness of

normal children and adolescents in the US showed that obesity prevalence and fitness level, respectively, are following an increasing and decreasing trend. In addition, it has been reported that low level of cardiorespiratory fitness is frequently seen among American normal American adolescents, as about 33.6% of them have a low cardiorespiratory fitness (16). Studies in Australia suggest that Australian children have a lower fitness than previous generations, while their body fat level is following an increasing level (17). Twisk, Kemper, and van Mechelen (2002) stated that level of aerobic fitness in adolescence is inversely associated with risk factors for cardiovascular disease (cholesterol, lipoprotein-C, and systolic and diastolic blood pressure) in adulthood (9). Therefore, according to the role of anthropometric parameters and fitness in the health of people, especially in adolescence, the study and investigation of these factors seem to be essential for any society. This has been extensively done on in the North American and European societies, while its importance for mentally retarded children and adolescents has not been well understood in Iran at all. Hence, the present paper aims to study the health-related fitness in children and adolescents with mental retardation in order to provide families, officials, and researchers with required information for future planning through explaining the existing conditions and comparing the status of such individuals with their normal peers.

MATERIALS AND METHODS

This research was a field, sectional descriptive-analytic study

Participants. Statistical population included all exceptional students in Roodbar, Guilan Province, Iran with a mean IQ of 68.7±7.8 (N=91). Personal information and medical records were collected using the students' health records. All students participated in this study with full consent of their parents and with the help principals and exercise teachers.

Data Collection. Measurements were performed by the examiner and data were recorded in special forms. Examines were performed in the mornings at school yard. To measure the parameters of physical fitness, adjusted tests for mental retardation were used (18). Examines included flexibility test (Sit and Reach), cardiovascular endurance (600 Yard Run/Walk), muscular strength (Hand Grip Strength), and muscular endurance (Crunch). Proper warm-up and cool-down was performed before and after each examine and the subjects were allowed to relax between examines (18). Height and weight were measured using the standard methods and body composition was evaluated by BMI (Body Mass Index) (18). In order to determine the status of subjects in terms of underweight, overweight, and obesity, BMI percentiles proposed by the National Center for Disease Control and Prevention, United States were used. According to this center, a BMI less the percentile 5, higher than the percentile 95, between the 85 and 95, respectively, denote underweight, obesity, and overweight (19, 20). Waist circumference at the level of the umbilicus and neck circumference at the maximum diameter were measured in cm. To obtain body fat percentage, 2-round measurement by Siri Formula was applied (19).

Statistical Analysis. Data were described by descriptive statistics (mean and standard deviation) and Pearson correlation coefficient was used for testing the correlation between data. All statistical analyses were performed in SPSS software at a significance level of $p<0.05$.

RESULTS

The results indicated weight, height, MBI, and body fat percentage somewhat increase with age. Also, mean BMI of subjects has an increasing trend. On the other hand, body fat percentage (as one of the most important factors of body composition and health) follows the same trend and its values from

age 12 to 15 were obtained 20.18, 19.20, 22.32, and 21.56, respectively. Logically, height and weight of subjects showed in increasing trend with age, as the mean height and weight them from 162 centimeters and 57 kilograms in at the age of 12 reached 170 centimeters and 65 kilograms at the age of 15 (Table 1).

Table 1. Mean of anthropometric parameters in mentally retarded students of Roodbar aged 12-15

Age (Years Old)	12	13	14	15
Frequency	27	20	28	16
Height (cm)	162.81± 8.86	162.81± 8.86	162.81± 8.86	162.81± 8.86
Weight (kg)	57.62± 16.93	59.80± 17.62	62.67± 15.26	65.81± 11.99
Body Fat (%)	20.18± 5.19	19.20± 7.97	22.32± 6.30	21.56± 5.42
Body Mass Index (BMI) (kg/m^2)	21.54± 4.93	22.01± 6.11	21.98± 4.33	22.77± 3.97

Muscular strength (Hand Grip Strength), as one of the main factors of health-related fitness, showed an increase from 7.49 kilograms at the age of 12 to 9.81 kilograms at the age of 15. Abdominal muscular endurance (Crunch), which is a function of muscle strength [28], increased from 23 to 26 repetition of Sit-up from the age of 12 to 14 and then decreases to 25 repetitions at the age of 15. Flexibility also showed an increasing trend from the age of 12 to 14 from 16 to 23 cm in Sit and Reach test and an increasing trend at the age of 14 and 15 from 23 to 21 cm. In terms of cardiovascular endurance (VO_{2max}), it shows a dramatic decrease at the age between 12 and 14, as decreased from 32.5 ml/kg/minute at the age of 12 to 28 ml/kg/minute at the age of 13 in 600 Yard Run/Walk. However, with age, this value increases and leads to a better respiratory volume, as it was observed that this value increased to 34.5 ml/kg/minute at the age of 15 (Table 2).

Table 2. Mean of health-related fitness in mentally retarded students of Roodbar aged 12-15

Age (Years Old)	12	13	14	15
Frequency	27	20	28	16
Hand Grip Strength (kg)	7.49 ± 4.47	7.55 ± 4.54	9.51 ± 9	9.81 ± 6.75
Crunch (repeat)	23.25 ± 10.48	23.70 ± 12.67	26.57 ± 15.56	25.87 ± 12.17
Flexibility (cm)	16.96 ± 5.95	18.45 ± 7.51	23.03 ± 7.60	21.37 ± 10.76
VO_{2max} (ml/kg/minute)	32.5 ± 5	28 ± 3.4	31 ± 2	34.5 ± 3

According to the study findings, percentage ranking of anthropometric measurements is considered 50 50 times more the mean of each variable. In addition, the percentiles 5 and 95 can be considered as lower limit and higher limit (Table 3).

Table 3. The norm of height, weight, body composition, and body fat percentage in mentally retarded students of Roodbar aged 12-15

Percentage Ratings	Height (cm)	Weight (kg)	BMI (kg/m^2)	BF (%)
5	150	36	15	9
10	155	40.5	16.32	15
50	162	59.12	24.01	20.81
90	174	78	30	26.5
95	176	88.5	30.6	30

It was found that 55% of mentally retarded students aged 12-15 have a height equal or lower than 150 cm and 20% of them were 170.5 cm or taller. It was observed that mean body fat percentage of subjected is equal to 20.81%. This values in 10% of subjects was 15% or less and 30% or more in 10%of them. About Body Mass Index (BMI), 5% of subjects had a BMI equal to or more than 30, which indicates sever overweight and obesity (Table 4).

Table 4. Percentage rankings of health-related physical fitness parameters in mentally retarded students of Roodbar aged 12-15

Percentage Ratings	Hand Grip Strength (kg)	Crunch (repeat)	Flexibility (cm)	VO_{2max} (ml/kg/minute)
5	1.1	3	5	25.5
10	2.2	4	12.1	28.5
50	8	28	20	31.5
90	14.1	39	29	33.5
95	16	45	32	36.5

Mean muscular endurance subjects was equal to 28 repetitions in Sit-up test. Muscular endurance in 10% of subjects was equal to or less than 4 repetitions and equal to or more than 39 repetitions in 10% of them. Muscular strength was equal to or less than 2.2 kg and equal to or more than 14.1 km in 10% of subjects. According to table 5, age has a significant relationship and correlation only with cardiovascular fitness (r=0.595, p=0.001). Also, height has a significant relationship and correlation only with muscular strength (r=0.524, p=0.001). In addition, weight, body composition, and body fat percentage have a significant relationship and correlation with muscular strength, muscular endurance, and cardiovascular.

Table 5. Correlation between anthropometric factors and health-related physical fitness parameters in mentally retarded students of Roodbar aged 12-15

	Hand Grip Strength (kg)	**Crunch** (repeat)	**VO_{2max}** (ml/kg/minute)	**Flexibility** (cm)
Age (Years Old)	r = 0.057 p = 0.593	r = 0.179 p = 0.089	r = 0.899** p = 0.001	r = 0.057 p = 0.593
Weight (kg)	r = 0.524** p = 0.001	r = 0.489** p = 0.002	r = 0.632** p = 0.001	r = 0.055 p = 0.603
Height (cm)	r = 0.595** p = 0.001	r = 0.066 p = 0.534	r = 0.087 p = 0.46	r = 0.066 p = 0.652
Body Mass Index (BMI) (kg/m^2)	r = 0.328** p = 0.002	r = 0.322** p = 0.002	r = 0.899** p = 0.001	r = 0.06 p = 0.571
Body Fat (%)	r = 0.524** p = 0.001	r = 0.525** p = 0.001	r = 0.775** p = 0.001	r = 0.106 p = 0.315

****:** Significant level at $p<0.01$.

DISCUSSION

The results of the present study provide us with basic information on anthropometric status, physical fitness, obesity, and underweight about mentally retarded students of Roodbar aged 12-15. According to Table 3, at least more than 40% of subjects have a BMI equal to or less than 18, which is lower than the normal weight. Also, 10% of them have a BMI between 24.9 and 29.9, which is classified as overweight. In addition, other 10% of subjects have a BMI equal to or higher than 30, representing obesity. In total, 20% of participants in this study are at risk of obesity. However, it can be stated that more than 60% of these people are exposed to excessive weight loss and gain, while only 40% of them have a normal weight. According to Kavak (2006) (21), Janssen *et al*. (2005) (4), and de Onis *et al.* (2001) (10), BMI of normal boys aged 13 years old and 14 years old has been reported to be equal to 18.6±1.2 and 18.8±1.2, 21.1 and 22.5, and 15.5±2.5 and 16.3±2.2, respectively. If these figures are compared with the findings of the present study on mentally retarded students aged 13 and 14 years old, it can be observed that MBI of the subjects in this study is more than their normal peers in the US by 3.57 and 3.06, Turkey by 3.40 and 3.10, West Bengal by 5.04 and 5.68, Isfahan by 3.81 and2.68, and Sabzevar 3.4 and 2.7, but equal to American normal boys. Other references show that mentally retarded male students in Roodbar are more obese and overweight than their normal peers in other regions and areas. Rapid changes in dietary patterns, high calorie intake, sedentary lifestyle, and lack of appropriate eating patterns (imbalance of calories and macronutrient) (14) have been generally mentioned as factors for prevalence of overweight and obesity in adolescents.

BMI and Body Fat Percentage. Mean body fat percentage of subjects in this study was obtained 20.81 (Table 1). Kavak (2006) reported that body fat percentage of boys aged 12 to 14 years old in Turkey is equal to 21.4% (21), which is approximately equal to that of mentally retarded subjects in this study. In study of Twisk, Kemper, and van Mechelen (2002), mean and standard deviation of body fat percentage in boys aged 8.5 to 15.5 were reported to be 20.7 and 10.4 (9), which are almost equal to those of subjects in the present study. Comparison of body fat percentage of mentally retarded students in Roodbar with their peers in Turkey and Sabzevar shows that body fat percentage is higher in mentally retarded male students in Roodbar than their normal

peers in Turkey and Sabzevar. Body composition and body fat percentage are determinants of optimal weight and according to the Association of Surgeons of America, high BMI and body fat are closely associated with_diseases such as type 2 diabetes, high blood pressure, and cardiorespiratory diseases (19). The results showed that mentally retarded children have a higher body fat percentage than their normal peers and the main reason for skyrocketing of fat mass and body composition in such individuals is fewer opportunities for participation in physical activities than normal peers. Hence, in order to reduce fat percentage and increase fat-free mass, exercise and sports activities could have positive and increasingly effects for such individual, because such activities improve physical fitness, reduce LDL, and increase HDL of mentally retarded individuals and prepare them to go to next stages of life with better conditions (19, 20).

Cardiorespiratory Fitness. According to the results, cardiorespiratory fitness of subjects at ages of 12, 13, 14, and 15 was obtained 32.5, 28, 31.5, and 34.5 (ml per kilogram of body weight per minute), respectively. In addition, the subjects in the present study have a VO2max less than their normal peers in Sabzevar by 17±6 (ml per kilogram of body weight per minute). Taylor *et al*. (2003) (22) obtained VO2max of boys aged 12-13 and 14-15 in the US 44.6 and 47.1 (ml per kilogram of body weight per minute), respectively. Twisk, Kemper, and van Mechelen (2002) reported that VO2max of boys aged 13 and 16 in Amsterdam is equal to 59.6±6 and 58.8±4.5 (ml per kilogram of body weight per minute), respectively (9). Previous studies have shown that VO2max has an inverse significant relationship with body composition and body fat percentage in adolescents (7). According to the standards of reference criterion (Fitness Gram) which proposes a maximum VO2max of 42 ml per kilogram of body weight per minute for boys, about 33% of normal American adolescents (9), about 10% of normal adolescents in Sabzevar, and 80% of mentally retarded children and adolescents in this study do not reach this level. Cardiorespiratory fitness in mentally retarded children and adolescents is less than normal peers by 25%. Meanwhile, according to rankings of VO2max percentage, all age groups have lower rankings than their normal peers. As cardiorespiratory fitness, which is the ability to pump more oxygenated blood to muscles and more consumption of oxygen by muscles, is an important factor of physical fitness, increased cardiorespiratory fitness level enhances the ability of blood circulation system and respiratory system for compatibility with a specific activity, recovery, and faster restoring of lost energy (18). The results of this study showed that cardiorespiratory fitness in mentally retarded children is less than that of their normal peers, regarding the fact that heart diseases, type 2 diabetes, and respiratory conditions are associated with low cardiorespiratory fitness. Therefore, mentally retarded children are more susceptible to such diseases in adulthood than their normal peers. Long-term physical activity accompanied by proper nutrition should be taken serious in order to increase cardiorespiratory fitness in such individuals (19, 20).

Flexibility. Mean flexibility of subjects at ages of 12, 13, 14, and 15 was obtained 16.69, 18.45. 23.03, and 21.37 cm, respectively. Cauderay, Narring, and Michaud (2000) reported that mean flexibility of normal adolescents aged 12, 13, and 14 years old in Switzerland is equal to 25.6, 24.5, and 26 cm, respectively (23). The values related to the first three age are, respectively, 9, 6, and 3 cm more than those obtained for mentally retarded students in this study at the same ages. The values of flexibility obtained in the present study for mentally retarded students are about 6, 17, 10, 8, and 7 cm less than those of normal peers in Tehran, Ardebil,

Mazandaran, Isfahan, and Khorasan Razavi provinces, respectively. Huang and Malina (2002) reported that mean flexibility of Taiwanese boys aged 12-14 is equal to 26.7±4.3 cm (24). This is about 7.5 cm more than the mean flexibility obtained in the present study. According to percentage rankings, in all three age groups of 12, 13, and 14, mentally retarded male students in Roodbar have a better flexibility at the percentile 10 but weaker at percentiles 50 and 90 than American adolescents. According to results, it can be stated that mentally retarded individuals have a weaker flexibility than their normal peers. Therefore, this factor should be improved in such people.

CONCLUSION

The results of the present study showed that a major proportion of mentally retarded adolescents in Roodbar are afflicted with overweight and obesity from one hand and weight loss and slimming on the other hand. In addition, compared with their normal Iranian and foreign peers, mentally retarded adolescents obtained worrying lower scores in all fitness factors. This makes clear the necessity of exercise and sports activities and also proper nutrition at these ages and before it. However, physical education is one of the key areas of education which plays indispensable role in realization of educational objectives. Although people with mental retardation are less talented than normal individuals, they are not less interested in participating sports activities and learning than others (3, 19).

In this study, the author was faced with some constraints that can be divided into two categories of controllable and uncontrollable. Controllable constraints included the age range of subjects (12-15), the gender of subjects (mentally retarded male students and their normal peers), IQ of subjects (55-75), no history of cardiovascular diseases and lung conditions among subjects, and the applying the same research method for all subjects. Uncontrollable constraints also included motivation level and attitude of subjects towards the tests, the extent to which the subjects were familiar with the tests, nutrition pattern of subjects, and out-of-school activities. To identify and understand the physical fitness of all groups of exceptional students, it is recommended that health-related physical fitness of mentally retarded children related to various groups such as people with autism or Devon syndrome to be studied, in order to provide authorities of education with useful information to plan for physical activities of mentally retarded children and prepare them to go to next stages of life with better conditions. In this regard, a variety of exercises and physical activities can be helpful in improving physiological and physical fitness factors in such children and ensuring their health (19, 20).

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آمادگی جسمانی مرتبط با تندرستی کودکان کم توان ذهنی

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چکیده

سلامتی انسان تا حدود زیادی بستگی به وضعیت آمادگی جسمانی مرتبط با تندرستی به ویژه ترکیب بدن دارد. دوره نوجوانی از این حیث منحصر به فرد می‌باشد، خصوصاً اینکه این نوجوانان افراد، کم توان ذهنی باشند، که اطلاعات در مورد آمادگی جسمانی این افراد محدود می‌باشد. هدف این مطالعه بررسی عوامل آمادگی جسمانی مرتبط با تندرستی با تأکید بر ترکیب بدن کاهش و افزایش وزن در دانش آموزان پسرکم توان ذهنی شهرستان رودبار می‌باشد. نمونه آماری این پژوهش شامل ۹۱ دانش آموز کم توان ذهنی با میانگین سنی ۱/۵۶±۱۳/۴۴ سال، قد ۶/۹۷±۱۶۷/۵ سانتی متر، بهره هوشی ۷/۸±۶۸/۷ به عنوان آزمودنی که شامل همه دانش آموزان کم توان ذهنی پسر شهرستان رودبار انتخاب شدند. سپس متغییرهای آمادگی جسمانی با آزمون‌های تعدیل شده شامل استقامت قلبی و عروقی، قدرت عضلانی، استقامت عضلانی، انعطاف‌پذیری و ترکیب بدنی با محاسبه شاخص توده بدن مورد ارزیابی قرار گرفتند. نتایج مطالعه حاکی از این بود که بر اساس شاخص توده بدن بدست آمده،۴۰ درصد آزمودنی‌ها لاغر، ۱۰ درصد اضافه وزن و ۱۰ درصد چاق بودند. همچنین بر اساس درصد چربی بدن نیز ۱۱/۹ درصد از نمونه‌های پژوهش درصد چربی زیاد و ۱۳ درصد چربی خیلی زیاد داشتند. میانگین توان هوازی کودکان کم توان ذهنی پسران ۱۲ – ۱۵ ساله شهرستان رودبار ۳۱/۵ (میلی لیتر/ کیلوگرم/دقیقه) به دست آمده که در مقایسه با همسالان عادی خود ۲۵ درصد میزان آمادگی کمتری داشتند و نسبت به مقادیر مرجع ۳۵ درصد آمادگی هوازی کمتری دارند. مطالعه حاضر نشان داد که درصد مهمی از نوجوانان کم توان ذهنی شهرستان رودبار از کمبود وزن از یک سو و اضافه وزن از سوی دیگر رنج می‌برند. همچنین آن‌ها وضعیت آمادگی جسمانی مرتبط با سلامتی در تمامی فاکتورهای جسمانی نسبت به همسالان عادی خود و مقادیر مرجع در سطحی پایین‌تر و شرایط مطلوبی قرار ندارند.

واژگان کلیدی: عوامل آنتروپومتریک، آمادگی جسمانی، نوجوانان کم توان ذهنی، اضافه وزن، چاقی.

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