

## SCHOOL-BASED PHYSICAL ACTIVITY INTERVENTION IMPROVES THE PHYSICAL FITNESS OF THE ADOLESCENT GIRLS AND THEIR MOTHERS

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### ABSTRACT

**Objective:** To evaluate the effectiveness of a school-based exercise program on the body composition and physical fitness of girls and their mothers.

**Methodology:** In a semi-experimental study we included 70 subjects (35 high-school girl students as well as their mothers) in 2007. All the students, whose mothers volunteered to take part in the study, were in first to third grades of high school and randomly selected from five high schools in the city. The study was run at Neda high school in Sanandaj-Iran. Eligible subjects participated in an exercise program for 12 weeks, ninety minutes per session, two times per week. The subjects followed the same exercise programme, at the same time in the same place. Measurements included cardiovascular endurance, muscle strength, flexibility, height, weight, body-mass index (BMI), waist and hip circumference.

**Results:** Age mean (standard deviation) for girls and mothers was 15.00(1.60) and 40.00(3.80) respectively. In girls, the intervention had significant effect on weight, BMI, waist and hip circumference ( $p < 0.05$ ). Physical fitness tests including muscle strength, flexibility and cardiovascular endurance were significantly different between the pre-test and post-test measurements ( $p < 0.05$ ). In mothers body weight, BMI, waist and hip circumference declined significantly ( $p < 0.05$ ). Flexibility test was not significantly affected over time, despite an increase in muscle strength and cardiovascular endurance ( $p < 0.05$ ). The highest correlations were found between the mother's participation index and the girl's participation index ( $r: 0.48, p < 0.001$ ).

**Conclusions:** The exercise program was effective in improving physical fitness.

**KEY WORDS:** Obesity, Physical activity, Physical fitness.

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## INTRODUCTION

Over the recent decades, physical inactivity has become one of the main risk factors for non-communicable diseases such as obesity, diabetes, cardiovascular disease, osteoporosis and psychosocial constraints.<sup>1</sup>

There is evidence that an insufficient amount of physical activity (PA) begins in the childhood and tracks into adult life.<sup>2</sup> Despite widespread attempts to increase PA in the general popula-

tion, only a minority of adults and children in developed countries engage in PA to a degree sufficient to maintain or increase healthy status.<sup>3</sup> Dramatic reductions in PA are also occurring in developing countries because of urbanization and increased availability of motorized transportation.<sup>4</sup> Based on national surveys in all categories of physical activity, women have reported lower percentage of physical activity.<sup>5</sup> PA participation tends to decline with age<sup>6</sup> and several studies have reported a decline in PA in girls.<sup>7</sup> Girls, at all ages, are less active than boys, and this difference is particularly large during the adolescent years.<sup>1</sup> Surveys have shown that more than 80% of the Iranian population is physically inactive.<sup>8</sup> Age and gender have been shown to be strong correlates of physical activity among youth, with older children being less active than younger children and girls less active than boys.<sup>9,10</sup>

The decrease in physical activity levels is suggested to be a result of decrease in opportunities for physical activity in schools and communities.<sup>11</sup> Adolescent girls are less active and place less value on participating in physical activity compared to adolescent boys. Barriers to PA for adolescent girls are numerous and varied, include the lack of required PE in the schools, religiosocial factors in a Muslim society, family and peer habits that do not support PA, the failure of PE or community recreation programs to promote lifetime PA<sup>12</sup> inactive parents who do not support children to be active and large amounts of time spent in front of the television and/or a computer.<sup>13</sup>

Mothers' participation in physical activity and assistance are important in sustaining activity levels of adolescent girls.<sup>14</sup> Girls with parental support are more likely to participate in moderate and vigorous physical activity.<sup>15,16</sup>

Adolescent Iranian girls are at high risk for physical inactivity due to cultural barriers such as restrictions on public exercise.<sup>17</sup> Efforts to change PA patterns and other aspects of lifestyle have traditionally attempted to educate individuals through schools. Schools offer a potentially ideal channel for communicating a preventive programme. However, few

interventional studies have been set up to increase the PA participation rates among both adolescent girls and their mothers. We sought to evaluate the effectiveness of a school-based exercise program on the body composition and physical fitness with a participatory method including girl high-school students and their mothers for about three months.

## METHODOLOGY

*Participants:* In a semi-experimental study which took place over the period of one school year, we included 70 subjects (35 high-school girl students as well as their mothers) in 2007. All the students, whose mothers volunteered to take part in the study, were in first to third grades of high school and had been randomly selected from five high schools in the city. The sampling frame consists of the list of all girl students acquired from the local education affair included 300 students. Participants were eligible if they met the following criteria: participating in three hours of extra-school sports activity per week, free of any known disease, age < 55 year (for mothers) and not participating in other studies.

*Setting:* Since this study was a community-based program we used available services and existing facilities of the school climate in Sanandaj-Iran. Therefore the study was run at Neda high school which was easily accessible to the participants.

*Intervention:* Based on mentioned criteria, there were 70 eligible subjects who participated in an exercise program for 12 weeks, ninety minutes per session, two times per week. After 12 weeks, the effects of exercise were compared between pre-test and post-test in each group.

The subjects including girls and mothers agreed to follow the same PA programme, at the same time in the same place. All participants proceeded according to the same curriculum, prepared by an expert physical education teacher. The PA programme involved highly interactive sessions with girls and mothers.

The intervention consisting of physical education lesson was based on important fitness or activity components, including motor skills,

aerobic fitness and strength. Lessons generally included five minutes of warming up and cooling down each, 20 minutes of moderate to vigorous physical activity, and 15 minutes of strength training and impact loading.

Outcome measurements included cardiovascular endurance, muscle strength, flexibility, height, weight, body-mass index (BMI), waist and hip circumference. Leisure-time physical activity, active commuting to school and socio-economic status were assessed, too. The PA questionnaire was filled out by the participants themselves. To get desired performance, verbal instructions and demonstrations were given to the participant before and during every trial. The indices were collected at the beginning and three month after the intervention with the same procedure as in follows:

*Muscle strength (Sit-Ups test):* The sit up assessment test measures the muscular strength and endurance of the abdominal muscles for adults. Maximum number of sit-ups achieved in 60 seconds were observed by (the physical education teacher). Subjects performed as many bent knee sit-ups as possible within 60 seconds while Knees bent, back on the floor, rise to 90 degree angle, and lower the back to the floor. Subjects were encouraged to perform one or two trial repetitions before test.

*Cardiovascular Endurance:* An accurate measurement of the heart rate is necessary if the results form this test, are to be meaningful. For this purpose the pulse was counted for 30-second counts while remaining seated. It was taken manually in the area of the inside wrist, just below the base of the thumb. Heart rate is described as beats per minute.

*Flexibility (Sit and Reach test):* This test involved sitting on the floor with legs stretched straight . Feet (shoes off) were placed with the soles flat against the box, shoulder-width apart. Both knees were held flat against the floor by the tester. With hands on top of each other and palms facing down, the subject reached forward along the measuring line as far as possible. After three practice reached, the fourth reach was held for at least two seconds while the distance was measured in cm. In this study the test was

preceded by the endurance test because achieving the best results depends on previous warm-up.<sup>18</sup>

*Body weight* was taken without shoes or belts and in light clothing, and recorded to the nearest 0.05 kg with a portable digital scale. Height was measured without shoes using a standing stadiometre and recorded with a precision of 1mm.

*Body Mass Index (BMI)* was calculated as body weight in kilograms divided by the square of the height in meters (kg/m<sup>2</sup>).

*Waist circumference* was measured in a standing position with feet about 25-30 cm apart by a constant tension tape at the mid-point between the free head of the lower rib and the anterior superior iliac spine. The measurer should stand beside the individual and fit the tape snugly, without compressing any underlying soft tissues. The circumference should be measured to the nearest 0.5 cm, at the end of a normal expiration.

*Hip circumference* was measured as the maximal circumference over the buttocks. The grid lines on the mirror are used to verify that the constant tension tape position is horizontal all around the body.<sup>19</sup>

*Statistical Analysis:* Analyses were carried out using the SPSS 12.0 for Windows package (IBM). Statistical significance was set at a  $\alpha$  level of 0.05. The comparisons between means of variables among the groups were examined by paired t-test. The Spearman correlation coefficient was calculated to examine the relationship between daughters and mothers regarding the anthropometric indices.

Approval for research project was obtained from the medical ethics committee of Medical University of Kurdistan (MUK). All participants gave written informed consent for the questionnaires and all measurements after receiving written information.

## RESULTS

The data gathered was from 35 families, including only one daughter and mother from each family. Age mean ( $\pm$  standard deviation) for girls and mothers was 15.00 $\pm$ 1.60 and

Table-I: Physical measurements in the baseline and after the intervention.

Variables	Girls		Mothers	
	Baseline	Post-Intervention	Baseline	Post-Intervention
Weight(kg)	51.00(8.30)	50.00(6.80)	69.60(7.40)	68.10(6.30)
Waist circumference(cm)	66.50(9.20)	64.60(8.70)	88.30(8.50)	86.40(6.90)
Hip circumference(cm)	89.30(8.20)	86.20(5.20)	108.00(4.90)	104.00(5.70)
BMI(kg/m <sup>2</sup> )	20.50(3.00)	19.90(2.80)	28.00(4.40)	27.40(3.60)
Muscle strength (times)	20.30(6.10)	23.50(5.40)	13.50(2.60)	18.50(5.80)
Cardiovascular Endurance (beats per minute)	150.80(18.00)	166.40(15.80)	132.00(13.70)	144.80(14.30)
Flexibility (cm)	30.40(9.40)	33.20(6.30)	35.70(8.60)	36.80(5.80)

Values are means (standard deviation)

40.00±3.80 respectively. During the 3-month intervention the follow-up rate was 100% so the analyzed sample consisted of 70 subjects with no dropouts.

The anthropometric characteristics of the participants are presented in Table-I. As presented in Table-II baseline anthropometric data in girls revealed significant differences after the intervention. In girls, the intervention had significant effect on all anthropometric indices such as weight, waist circumference, hip circumference and BMI ( $p < 0.05$ ). Mean body weight decreased in the girls (51.00 kg to 50.00 kg,  $p = 0.001$ ). According to the results physical fitness tests including muscle strength, flexibility and cardiovascular endurance were significantly different between the pre-test and post-test measurements in girls after the 12-week exercise program (Table-II).

Among the mothers body weight, waist and hip circumference declined significantly over time (Table-III). BMI was significantly different in mothers after the 12-week exercise program. Results showed that flexibility test was not significantly affected over time, despite an in-

crease in muscle strength ( $t = -8.3$ ,  $df = 34$ ,  $p = 0.001$ ) and cardiovascular endurance ( $t = -1.3$ ,  $df = 34$ ,  $p = 0.002$ ).

The highest correlations were found between the mother's participation index and the girl's participation index. Spearman's correlations between these two indices were significant ( $r: 0.48$ ,  $p < 0.001$ ).

## DISCUSSION

Our results firmly support the benefits of PA program in terms of improving the anthropometric indices and physical fitness. These findings are consistent with other studies that have identified positive association between higher physical activity and lower BMI levels and between sedentary activities and waist circumference in girls.<sup>20,21</sup>

The results from this study suggest that schools and other existing areas are good targets for PA interventions. Most PA interventions have not been effective in increasing the PA levels of youth outside of PE class,<sup>22</sup> these were confirmed by the data demonstrating that PA may positively affect physical fitness.<sup>23-25</sup>

Table-II: Physical measurements after the intervention in girls group

Variables	Mean of Diff's	95% Confidence Interval	t-score	df	P Value
Weight(kg)	1.33	0.60 2.10	3.90	34	0.001
BMI(kg/m <sup>2</sup> )	0.60	0.60, 2.10	3.60	34	0.001
Waist circumference(cm)	1.93	1.30, 2.50	6.20	34	0.001
Hip circumference(cm)	3.07	2.20, 3.80	7.90	34	0.001
Flexibility (cm)	2.80	0.90, 4.60	3.10	34	0.005
Muscle strength (times)	3.27	2.20, 4.30	6.30	34	0.001
Cardiovascular Endurance (beats per minute)	15.60	2.80, 27.60	2.50	34	0.02

Table-III: Physical measurements after the intervention in mothers group.

Variables	Mean of Diff's	95% Confidence Interval	t-score	df	P Value
Weight(kg)	1.50	0.90, 2.10	2.50	34	0.001
BMI(kg/m <sup>2</sup> )	0.60	0.20, 1.50	1.60	34	0.02
Waist circumference(cm)	1.90	0.50, 3.20	2.90	34	0.007
Hip circumference(cm)	4.20	2.60, 5.70	5.70	34	0.001
Flexibility (cm)	1.10	-2.80, 0.70	-1.30	34	NS*
Muscle strength (times)	5.00	3.80, 6.20	-8.30	34	0.001
Cardiovascular Endurance (beats per minute)	12.80	5.20, 21.60	-3.40	34	0.002

\*NS: not significant,  $p > 0.05$ (Footnotes)

Girls and mothers had a similar pattern of response related to our PA programme. In fact, the changes in anthropometric measurements proceeded similarly. Moreover, it is worth noting that the change in flexibility (sit and reach test) for mothers was not significant despite an increase in muscle strength and cardiovascular endurance. This opposite response between mothers and girls could be explained as follows: First, because of household responsibilities, mothers are less physically active and have limited free time, and second, the post exercise eating behaviors may have been different between girls and mothers.

As noted in the current analysis the highest correlations were found between the mother's participation index and the girl's participation index. Similar finding was noted by several studies indicated increasing PA of youth by increasing family support.<sup>14,15, 26-28</sup>

Social supports from mothers, fathers, and friends are significantly related to PA in normal-weight youths,<sup>16</sup> although the evidence on the effectiveness of family components is inconclusive.<sup>29</sup>

Our study is one of the few to evaluate these relationships and the authors couldn't find any comparable study on mothers support and its effects on PA in girls, despite the importance of the issue. Therefore it is important to understand exactly what factors are associated with PA for girls based on their family support and weight status.

*Limitations of the study:* Daily dietary intake was not recorded. Consequently the favorable changes cannot solely be attributed to the PA programme itself. Another limitation is that the project was not run as a complete randomized trial; however, the strengths of the research outweigh these limitations.

## CONCLUSIONS

A public school-based PA intervention offers a good opportunity to work with mothers and girls. The results from this study suggest that enhanced family support, associated with higher PA, could be effective intervention for improving physical fitness in girls. Future research should focus on explaining interactions between physical activity, and sports participation with availability of recreational facilities, and environmental supports for access and use of them.

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2. Final approval of the version to be published.
3. Drafting the article or revising it critically for important intellectual content.
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