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Relationship between Physical Activity and Blood Pressure Levels in Iranian Female Children

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ABSTRACT

Elevated blood pressure (BP) during childhood and adolescence is not so rare and increases the risk of hypertension in adulthood. Physical activity (PA) is considered a key component for the prevention and treatment of hypertension in children and adolescents. Thus, the purpose of the present study was to examine the relationship between physical activity and blood pressure in Iranian female children. One hundred female students with the age of 12 to14 years were randomly chosen and took part in the study. All children were subjected to blood pressure and heart rate measurement in the morning during a routine school day. Information of PA was obtained by the physical activity questionnaire for older children (PAQ-C). Results showed that systolic blood pressure ($r_=$-0.214, $p_=$0.03), diastolic blood pressure ($r_=$-0.220, $p_=$0.02) and mean arterial pressure($r_=$-0.242, $p_=$0.03) are inversely associated with physical activity. In contrast no significant relationship was observed between physical activity, pulse pressure ($r_=$-0.024, $p_=$0.812) and heart rate ($r_=$-.08, $p_=$0.429). **Conclusion**: Higher levels of Physical activity were associated with lower systolic BP, diastolic BP and mean arterial pressure in healthy female children. As early adolescence is a critical period for the development of physical characteristics factors that determine lifelong physical activity habits, physical activity should be practiced in everyday life of children.

Keywords: Female Children; Blood Pressure; Heart Rate; Physical Activity

1. INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of global mortality. There is evidence indicating that the precursors of CVD have their origin in childhood and adolescence and adverse CVD risk factors during childhood seem to track into adulthood (Ruiz et al.2009). For example, elevated blood pressure (BP), one of the major adult risk factors for CVD, has been reported in childhood, and BP levels have been shown to track into adulthood. Furthermore, BP measured in late adolescence and early adulthood predicts CVD mortality many decades later (Leary et al.2008). Moreover, inactive children and adolescents are likely candidates to become inactive adults (Guerra et al. 2002). Therefore, the early detection of health risks and establishment of positive health promotion may be the link to lower morbidity and health care costs (Guerra et al. 2002). The childhood years provide a unique opportunity for promotion of cardiovascular health (Williams et al.2002). The health benefits associated with a physically active lifestyle in children include weight control, lower blood pressure, improved psychological well-being, and a predisposition to

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Table 1
Characteristics of Participants

Variable	Mean	SD
Age (years)	12.61	0.99
Height(cm)	153.46	5.88
Weight(kg)	46.57	9.61
Body fat %	22.27	4.94
Body mass index(kg/m^2)	19.67	3.31
Systolic pressure(mm Hg)	102.60	11.73
Diastolic pressure(mm Hg)	62.94	10.31
Pulse pressure(mm Hg)	39.66	10.05
Mean arterial pressure(mm Hg)	76.16	9.71
Heart rate (beat.min^{-1})	87.70	16.94

increased physical activity in adulthood (Williams et al.2002). Exercise, or increased habitual physical activity, has been widely established as a cornerstone therapy for the primary prevention, treatment, and control of hypertension (Sarzynski et al.2010). Nevertheless, physical activity has been diminished in Iranian children and adolescents for a variety of reasons and reliance on sedentary entertainment has increased. Although this is true for both sexes, it is a very important problem for girls. The relationship between physical activity (PA) and BP in adults is well-established, but findings in children have been inconsistent, so the purpose of our study was to assess the level of PA in Iranian female children and its relation to blood pressure levels.

2. SUBJECTS AND METHODS

2.1. Subjects

A total of 100 children at a guidance school in Sepidan, a city in the south of Iran, with the age of 12.61±0.99 years, standing height of 153.46±5.88cm, body weight of 46.57±9.61 and body mass index of 19.67±3.31 (Mean±SD), took part in the study. Before entering the study they were informed about the experimental procedure and all children gave verbal assent. Then the anthropometric and blood pressure measurements were done.

2.2. Anthropometric measures

Standing height stretch stature without shoes, was measured to the nearest 1mm using a wall mounted stadiometer (Seca Model 242, Hanvor). Weight in light clothing was measured using an electronic scale (Seca Model 840, Hanvor) to the nearest 0.1kg. The average of two measurements of height and weight was used in statistical analysis. Body mass index (BMI) was calculated as participants' weight in kilograms divided by the square of their height in meters (Kg/m^2). Body fat percentage (BF %) was calculated by following formula : BF% = 1.51×BMI–0.70×age–3.6×sex+1.4 (Deurenberg et al.1991). Trained research assistants took all measurements.

2.3. Blood pressure

Blood pressure was taken on the left arm in the sitting position after 5 to 10 minutes quiet rest, using an automated sphygmomanometer and an appropriate-sized cuff for children (Beurer,Germany). Subjects bend their arm to bring their elbow to heart level. Systolic blood pressure, diastolic blood pressures, pulse pressure and heart rate were recorded. The Mean arterial pressure was computed by following formula: MAP=DBP+1/3(SBP-DBP) (Mittal et al. 2011). If elevated blood pressure was noted (systolic blood pressure >130 mmHg or diastolic blood pressure > 85mmHg based on the upper limit of normal blood pressure in adults), the second measurement was done after resting for 10 minutes. The same researcher took all blood pressure measurements.

2.4. Physical activity

Physical activity was determined using a Physical Activity Questionnaire for Older Children (PAQ-C) (Crocker et al.1997). The PAQ-C is a 7-day self-report questionnaire designed to assess those activities that they participated in over the previous week .General physical activity scores were calculated as an average physical activity score (PA score) in a continuous range from 1 (low active) to 5 (high active).

2.5. Statistical analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS,V.15).Descriptive statistics including mean and SD were calculated (Table 1). Relationship between physical activity, blood pressure and heart rate were assessed using partial correlation coefficients, adjusted for age. Results were considered significant at $P < 0.05$.

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Table 2
Correlation coefficients for association between Physical Activity , Blood Pressure and Heart Rate

	Systolic Blood Pressure	Diastolic Blood Pressure	Pulse Pressure	Mean Arterial Pressure	Heart Rate
Physical Activity	**-0.214***	**-0.220***	**-0.024**	**-0.242***	**-0.080**

*p<0.05

3. RESULTS

The study included 100 subjects. The mean age was 12.61±.99 years. Partial correlation coefficients between physical activity, blood pressure and heart rate were presented in table 2. The results showed that Systolic blood pressure, Diastolic blood pressure and Mean arterial blood pressure were inversely associated with physical activity ($p<0.05$).In contrast no significant relationship was observed between physical activity, pulse pressure and heart rate ($P>0.05$).

4. DISCUSSION AND CONCLUSION

This study analyzed the association between physical activity, blood pressure and heart rate in Iranian female children.Cardiovascular disease (CVD) is a major cause of morbidity and mortality and elevated blood pressure, one of the major adult risk factors for CVD, has been reported in childhood and shown to track into adulthood(Leary et al.2008).Early antihypertensive treatment may significantly reduce subsequent cardiovascular sequel (Alpay et al.2009).The main outcome of this study was that greater physical activity was significantly and inversely related to blood pressure in female children. With regard to children, our results are consistent with some data reported in the literature. Leary et al examined the relationship between physical activity and blood pressure in 5505 children aged 11 to 12 years and found that higher levels of PA are associated with lower BP. Similarly Gidding et al analyzed the association of physical activity with systolic blood pressure in 663 children (362 boys, 301 girls) and their results showed that children that are more physically active has lower systolic blood pressure. Gaya et al, examined the relationship between leisure time physical activity (LTPA) and sport competition activities (SCA) with high blood pressure (HBP) in 503 boys and 572 girls, aged 8-17 years old, they concluded that children and adolescent who are not engaged in SCA and LTPA are more likely to be classified as having HBP.

These results are in contrast with Guerra et al who reported that the relationship between physical activity and blood pressure are significant in boys, whereas in girls no significant association is found. This difference may be attributed to some cultural features, methodological differences, body size and body fatness that are important determinants of blood pressure in children (Jenner et al.1992) and should be taken into account. Also it is possible that activity was overestimated or underestimated by children because they may change their behavior as they knew they were being studied.

Inadequate physical activity of all ages is a serious public health problem (Okasha et al.2000). Physical activity habits, and specifically, inactivity, track significantly from adolescence to young adulthood (Gordon-Larsen et al. 2000), so positive exercise habits can help to reduce the risk of dying from heart disease, cancer and other medically related maladies (McArdle et al. 2010). Therefore it is important that children and adolescents are encouraged to be physically active by doing things that interest them. But Lack of safe outdoor play areas in many portions of cities especially for girls limits their ability to engage in active physical play or recreational sports, so girl's level of physical activity decreases consistently, and further attention to this issue should be provide. Also tightening school budgets and changing curriculum priorities have resulted in a de-emphasizing on regular physical education programs in many schools.

Children spend many hours at school, so physical education classes could be an important way to increase their physical activity and physical fitness. Physical education classes are an ideal way to encourage activity and develop fitness among children and, for many children, will be their only preparation for an active lifestyle. Finally prevention of declines in physical activity during adolescence is potentially a cost-effective strategy for preventing higher blood pressure in youth.

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