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Socioeconomic Status, Physical Activity, Physical Fitness and Sedentary Activity in 7-to 11-year-old Iranian Children

Samad Esmaeilzadeh

153 Nasim 1, part III of Sabalan, Ardabil, Iran. (Postal code: 5619888457)

ABSTRACT

This study aimed at Evaluating the socioeconomic status (SES), physical activity (PA), physical fitness and sedentary activity in Iranian children aged 7-11 years. We analysed the following cross-section data from a selected sample of children (N=766) aged 7 to 11 years: age, anthropometric characteristics, SES, PA, ten physical fitness tests and sedentary activities. 29.4% and 31.3% of the children reported TV watching and video playing daily time (TVVPT) higher than 3 and 4 hours/day, respectively. Fat mass (FM) was significantly related to PA (r=-0.165; P<0.01), cardiorespiratory fitness (CRF) (r=-0.793; P<0.01), and TVVPT (r=0.200; P<0.01), after controlling for age and SES. Although, the children by high-SES represented higher height, weight, body mass index, waist circumference, FM and fat free mass than the children by mid-SES and low-SES, but the differences were not significant among them. Although, PA was not different among the children by SES, however, the children by high-SES represented significant higher TVVPT than the children by mid-SES and low-SES (p<0.05); and had significant lower CRF than the children by mid-SES (p<0.05). The results of this study indicated higher sedentary activities and lower CRF in the children by high-SES in comparison to the children by mid-SES and low-SES. Furthermore, regarding the relationship between FM with PA, CRF and sedentary activity, increased PA and decreased sedentary behavior in children as much as possible should be considered.

Keywords: Fat mass, body mass index, TV watching, cardiorespiratory fitness

INTRODUCTION

Regular physical activity (PA) is associated with improved physical and psychosocial well-being in children (Boreham and Riddoch, 2001), while frequent television viewing appears detrimental (Bar-on, 2000).

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E-mail addresses:
Esmaeilzadesamad@yahoo.com, samad.esmaeilzade@yahoo.com

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The family is a potentially important source of influence on children's PA and television viewing (Ritchie *et al*., 2005). There is inconsistent evidence for an association between socioeconomic status (SES), the most commonly investigated aspect of family circumstance, and the physical activity of preadolescent children. A 1999 review (Sallis *et al*., 2000) of studies considering SES and PA associations in 4–12 year olds found positive, negative and no associations were reported. On the balance of evidence the review concluded there was no association. Even recent studies, using objective assessments of PA (e.g., accelerometer, pedometer) still report equivocal results (Kelly *et al*., 2006; Eisenmann and Wickel, 2009).

On the other hand, speed-agility, muscular fitness, and cardiorespiratory fitness (CRF) are considered important health related markers already in youth (Pavon *et al*. 2010; Ortega et al., 2008b). Genetics greatly determines physical fitness (Bray *et al*., 2009), but there is little doubt that environmental factors also play an important role. Socioeconomic status is associated with several health outcomes (e.g., birth weight, obesity, diet, etc.) as mentioned by Ramsay *et al*., (2008), and with mortality rate (Berkman, 2005). To better understand the specific role of different indicators of socioeconomic status on health-related fitness markers will enable a more efficient physical fitness promotion. In this regard, the association between socioeconomic status and fitness was investigated in different areas (Freitas *et al*., 2007; Pavon *et al*., 2010 21; Mutunga *et al*., 2006) with contradictory results. These studies concluded that studies from a widespread vision and including populations from different countries (by different Social and cultural contexts) are required to facilitate a better understanding.

Moreover, the prevalence of child obesity is rapidly increasing worldwide (World Health Organisation, 1998). The specific causes of overweight and obesity are varied and complex but, at a population level, are consistent with sustained positive energy balance. Sedentary behavior and low levels of PA may, in part, explain the rising prevalence of childhood overweight and obesity (Wang and Lobstein, 2006).

A simultaneous assessment of weight status, anthropometric variables, PA, physical fitness and sedentary behavior among children by different SES especially in Iran is scanty. Therefore, the primary aim of this study is to assess comparison of anthropometric characteristics, physical fitness tests, PA and sedentary behavior of the sample of 7-11 year old boys in Ardabil, Iran by different SES. Furthermore, the secondary aim is to evaluate possible relationship between adiposity with PA, CRF and sedentary behavior in the selected sample of children.

METHODOLOGY

Participants

The present analyses included data from 766 school boys, aged 7 - 11 years (mean 9.2 ± 3.4 years), attending the 1th- 5th grade classes of primary schools which were selected with stratified sampling in urban areas of Ardabil's capital, North West of the Iran. Ardabil's capital stands about 70 km from the Caspian Sea with an area of 18011 km², and 537920 inhabitants. The nature and purpose of the study were explained to parents before consent was obtained, and participation was on a voluntary basis. The measurements and the tests that the children underwent were carried out during regularly scheduled physical education classes. The age of the subject was determined from their date of birth in their school register. The age was rounded off to the nearest whole number. This study was approved by the Ethical Committee of the Ardabil Department of Education, Iran (?).

Anthropometric variables

Weight was measured in underwear and without shoes with an electronic scale (Type SECA 861) to the nearest 0.1 kg, and height was measured barefoot in the Frankfort horizontal plane with a telescopic height measuring instrument (Type SECA 225) to the nearest 0.1 cm. Body mass index (BMI) was calculated as body weight in kilograms divided by the square of height in meters. Cut-off points for BMI defining, underweight, normal weight, overweight and obesity were identified by using the International Obesity Task Force (IOTF) BMI cut-off points (Cole et al., 2005; Cole et al., 2000). Waist (at the level of the umbilicus and the superior iliac crest) was measured to the nearest centimeter using flexible tape rule, while the subject was standing erect. In order to fat% evaluation, Tricipital skin folds (TSF) and subscapular skin folds (SESF) were measured three times on the right side of the body using an adipometer (Lange, Beta Technology Incorporated, Cambridge, USA) and the mean of all three measurements was used for analysis. Body adiposity was then estimated using the equation and sex-specific reference values proposed by (Lohman, 1986; Lohman, 1987), based on summing the two skin-fold measurements. Body Fat percentage and then Fat mass calculated according to the following equations:

Prepubescent white males:
$\%BF = 1.21(SS^*) - .008(SS)^2 - 1.7$
*SS= Sum of triceps and subscapular skinfolds

For a sum of triceps and subscapular > 35mm
All males: $\%BF = 0.783(SS) + 1.6$

Fat mass (FM) = weight * fat percentage/100

TV watching and video playing daily time (TVVPT)

Children and their parent(s) were given a written questionnaire, which was filled out by the parent(s) only if the child was aged less than 8 years, and both parent and child together if the child was between the ages of 8 and 11. If completed by parent and child together, they were instructed to agree on and record a single estimate of average daily time spent watching TV (time spent watching TV, videotapes, or DVDs) and playing video game (time spent on a home computer or video game). Parent estimates of child viewing and playing time have been shown to be reliable predictors of child screen time (Anderson et al., 1985). In order to further ensure the validity of TVVPT estimates, we verbally reviewed and confirmed the time estimate obtained from the questionnaire during the clinical interview with the parent(s) and, if aged over 8 years, the child.

Physical activity (PA)

Physical activity for children was measured using the PA Questionnaire - Children (PAQ-C) (Kowalski et al., 1997). The PAQ-C is used to assess the PA behaviors of the participants at different times and places (i.e., during school, after school, recess, weekend, etc.) during the previous seven days. Scoring is based on a 5-point Likert type scale, with an overall PA score derived from the mean of each scored item. Greater levels of PA are indicated by higher scores and vice versa. The PAQ-C has been tested and re-tested and results have shown that the instrument is reliable and valid measure of PA for children during the school year. Kowalski *et al*. (1997) reported moderately high validity coefficients for the PAQ-C when compared to a variety of criterion measures, including activity ratings, recall questionnaires, and activity monitors (r = .39 to .63,). The test retest reliability for the PAQ-C ranged from r = 0.75 to 0.82 and internal consistency reliability values (coefficient alpha) ranged from 0.81 to 0.86 (Crocker et al., 1997). This instrument is widely used in research in order to assess PA of large and small populations at low cost (Kowalski *et al*., 2007).

Physical fitness measurements

Physical fitness was determined using ten physical fitness tests which were completed during regularly scheduled physical education classes. At the beginning of taking each test, the examiner explained the testing procedures to the participants in details.

1. **Cardiorespiratory fitness (CRF):** The 1-mile run test was used to assess VO_{2max} (Welk and Meredith, 2008). The objective of the mile run was to cover a mile in the shortest time possible. Students were encouraged to run throughout the test and to take walking breaks only as needed. Physical education instructor also reminded children to avoid starting too fast to avoid premature fatigue. This test has shown to be valid and reliable for the prediction of the VO_{2max} in children (Welk and Meredith, 2008). The CRF is then calculated according to the following formula (Welk and Meredith, 2008):

   VO2max = (0.21 * age * gender) – (0.84 * BMI) – (8.41 * time) + (0.34 * time * time) + 108.94
   Gender = 1 for males and 0 for females; Time is in minutes

2. **Sit ups:** Maximum number of sit ups achieved in 60 seconds. This test measures the endurance of the abdominal muscles (Welk and Meredith, 2008).

3. **Modified pull ups:** To measure upper arm and shoulder girdle strength and muscular endurance (Welk and Meredith, 2008).

4. **Pushups:** This test measures upper arm and shoulder girdle strength/endurance (Welk and Meredith, 2008).
5. **Sit and reach:** Reaching as far as possible from a sitting position. This test measures the flexibility of the hamstrings, buttocks, and lower back (EUROFIT, 1988).
6. **Standing long jump**: Jumping for distance from a standing start. This test measures explosive strength (EUROFIT, 1988).
7. **Hand grip**: Squeezing a calibrated hand dynamometer as forcefully as possible with the dominant hand. Static strength is assessed (EUROFIT, 1988).
8. **Vertical jump:** The vertical difference in centimeters (cm) between the original trace (extension, standing on the toes), before jumping, and the trace after the jump. This test measures explosive strength (EUROFIT, 1988).
9. **4×10m shuttle run test**: Speed of movement, agility and coordination assessment (Ortega et al., 2008a).
10. **30-meter sprint (from standing position):** This test measures speed.

Socioeconomic status

The socioeconomic status (SES) of the families was estimated by using the Hollingshead 4-Factor Index of Social Status (Hollingshead, 1975; Cirino et al., 2002). SES was calculated on the basis of education and occupation levels. SES index values (range: 8–66) were categorized as high (values of 48–66), moderate (values of 28–47), or low (values of 8 –27) (Hassan *et al*., 2006).

Data Analysis

Data were screened for problems of skew, kurtosis, and outliers. Descriptive statistics were run on all variables. The primary independent variable was socioeconomic status defined as high-SES (values of 48–66), mid-SES (values of 28–47), and low-SES (values of 8 –27) which was estimated by using the Hollingshead 4-Factor Index of Social Status (Hollingshead, 1975; Cirino *et al*., 2002, Hassan *et al*., 2006). The dependent variables were physical fitness tests, PA, anthropometric variables, and TVVPT. Chi-square analyses were used to detect differences of underweight, normal weight, overweight and obesity rates among the children by SES. One-way analyses of variances (ANOVA) were carried out to assess differences in the anthropometric variables, TVVPT, physical fitness tests, and PA scores among the children by low-SES, mid-SES, and high-SES of this study. The Scheffe correction was used for multiple comparisons. Pearson correlation coefficient was used to assess the relationship between fat mass and selected variables. For further evaluation, Partial correlation coefficient was used to assess relationship between fat mass, VO_{2max}, PA, and sedentary behavior by controlling for age and SES. All calculations were performed using SPSS v.18.0 software for Windows. The significance level was set at $p < 0.05$.

FINDINGS AND DISCUSSION

All variables approximated a normal distribution (skew: <3, kurtosis: <10). The Hollingshead Index indicated that 9.7% families were of high-SES, 66.4% of mid-SES, and 23.9% of low-SES (see Table 1). Table 1 shows the prevalence of underweight, normal weight, overweight and obesity according to SES. The results of this table show that the prevalence of underweight, normal weight, overweight and obesity is 10.7%, 71%, 14.1% and 4.2%, respectively. Chi-square analyses indicated significant difference for the prevalence of underweight, overweight and obesity among the children by SES ($P<0.05$).

The primary aim of this study was to evaluate anthropometric characteristics, PA, physical fitness and sedentary activity in a sample of 7-11 year boys by different SES. Although the results (Table 2) showed that the children by high-SES had higher weight, FM, BMI and WC than the other counterparts, however, ANOVA analyses indicated that there was no significant difference for the anthropometric variables (height, weight, BMI, WC, FM and FFM) ($p>0.05$). Nonetheless, the results showed significant difference for the overweight/obesity and underweight prevalence among the children by SES (see Table 1). By referring to Table 1 of this study it was showed that the rate of underweight in the children by low-SES and high-SES was 9% and 1.9%, respectively; and in contrast the rate of obesity in the children by low-SES and high-SES was 0% and 9.7%, respectively. Tharkar and Viswanathan (2009) found that high-SES children had higher height, weight and waist circumference than low-SES group. Furthermore, they reported that Prevalence of overweight and obesity was significantly higher among the high-SES children. In contrast, McMurray *et al*. (2000) and Poskitt *et al*. (1993) found low-SES adolescents were more likely to be overweight and obese than their high-SES counterparts. Wang (2002) reported that children by higher SES were more likely to be obese in China and Russia, but in the US low-SES children were at a higher risk. He concluded that prevalence of obesity varied remarkably across countries with different socioeconomic development levels.

The present study results showed that except VO_{2max} and sit ups all the other physical fitness variables were not different among the children by different SES (see

TABLE 1
Prevalence of underweight, normal weight, overweight and obesity among the children by SES

	Low-SES (n=183)	Mid-SES (n=509)	High-SES (n=74)
Underweight (n=82)	9% (n=16.5)	14% (n=71.3)	1.9% (n=1.4)
Normal weight (544)	70% (n=128.1)	67.4% (n=343.1)	69.2% (n=51.2)
Overweight (n=108)	21% (n=38.4)	14.5% (n=73.8)	19.2% (n=14.2)
Obese (n=32)	0% (n=0)	4.1% (n=20.8)	9.7% (n=7.2)

TABLE 2
Comparison of various anthropometric variables among the children by different SES

	Low-SES (1) † (n=183)	Mid-SES (2) (n=509)	High-SES (3) (n=74)	F	P
Height(cm)	131.5±8.8	132.8±8.8	132.1±6.3	1.06	NS
Weight(kg)	29.8±8.5	30.3±8	31.3±5.1	0.62	NS
BMI(kg/m^{2})	16.9±2.7	17±2.9	17.9±2.6	2.8	NS
Fat Mass(kg)	7.8±4.9	7.7±4.9	8.4±3.8	0.5	NS
FFM(kg)	22.1±4.1	22.7±3.9	22.9±3	1.3	NS
Waist circumference (cm)	59.6±8.6	59.5±8.1	61.7±6.7	1.65	NS

Significance of differences was evaluated by ANOVA for all variables. *Significant at <0.05; **Significant at <0.01.
† Numbers show groups: Low-SES (Group 1), Mid-SES (Group 2), High-SES (Group 3)

Table 3 and 4). The children by high-SES did significantly better sit ups than the children by low-SES ($p<0.05$); however, had lower VO_{2max} than the children by mid-SES ($p<0.05$). Contradictory results between SES and physical fitness have been reported (Freitas et al. 2007; Pavon *et al*. 2010 21; Mutunga *et al*. 2006). Freitas *et al*. (2007) reported adverse relationship between socioeconomic status and CRF (12 min walk-run) and muscular strength (standing long jump and bent arm hang); and positive association between socioeconomic status and speed-agility performance (5 x 10 m shuttle run test) in boys. They also reported a higher upper-body muscular strength (handgrip) in those boys with medium socioeconomic status compared to those with lower socioeconomic status (Freitas et al., 2007). Pavon et al. (2010) found positive associations between socioeconomic status and CRF (20 m shuttle run test), lower-body muscular strength (standing long jump, squat jump, counter movement jump, Abalakov jump) and one upper-body muscular strength test (bent arm hang), while no associations for speed-agility (4 x 10 m shuttle run test) and other upper-body muscular strength (handgrip) were found (Pavon et al., 2010). Mutunga et al. (2006) reported higher CRF (20 m shuttle run test) in boys and girls with higher socioeconomic status compared to those with lower socioeconomic status. Therefore, discrepancies among the studies might be due to the specific social and cultural contexts of each country, together with the different methodologies used to assess socioeconomic status and physical fitness. Furthermore, it should be stated that the means of CRF among the children by SES are close to each other, and the significant difference of CRF between the children by mid-SES and high-SES might be because of high sample size.

The results of this study found no difference for PA among the children by SES (see Table 4). However the previous literatures have reported equivocal findings concerning the relationship between SES and PA levels in children and adolescents (Inchley *et al*., 2005; Kelly *et al*., 2006).

TABLE 3
Comparison of physical fitness variables among the children by SES

	Low-SES (1) † (n=183)	Mid-SES (2) (n=509)	High-SES (3) (n=74)	F	P
One-mile(s)	664.8±116	646.9±111	667.3±113	1.2	NS
Sit and reach(cm)	29.5±6.1	28.2±5.9	27.2±6.7	3	NS
Vertical jump(cm)	21.2±4.6	22±4.2	20.5±4.6	2.7	NS
Standing long jump(cm)	114.2±21.6	119.2±23.2	115.6±29.4	1.9	NS
Hand grip(kg)	19±6	19.2±6.2	18.1±4.5	0.8	NS
Time in run speed (s)	6.8±0.7	6.7±0.8	6.7±0.6	1.7	NS
Time in 4×10m shuttle run (s)	13.8±1	13.9±1.2	13.8±1.2	0.2	NS
Pull ups(n)	10±6	9.4±6.9	8.5±6.4	0.8	NS
Pushups(n)	13.1±10.1	13.2±10.2	9.5±6.9	2.95	NS
Sit ups(n)	17.3±9.3	19.2±10.7	21.8±11.5	3.2	1≠3*

Significance of differences was evaluated by ANOVA for all variables**.** *Significant at <0.05; **Significant at <0.01.
† Numbers show groups: Low-SES (Group 1), Mid-SES (Group 2), High-SES (Group 3).

Even recent studies, by using objective assessments of PA (e.g., accelerometer, pedometer) reported equivocal results (Eisenmann and Wickel, 2009). There are several possible reasons for differences in habitual PA to exist across socio-economic backgrounds, including behavioral, socio-cultural, and/or biological factors. For example, socio-environmental influences may include accessibility to sports/exercise facilities as well as safety (Lovasi *et al*., 2009). However, some studies have argued that SES does not influence overall PA levels in children and adolescence despite a higher participation in formal sports in children and adolescents with a higher SES (Macintyre and Mutrie, 2004). For example, Macintyre and Mutrie (2004) indicated that total energy expenditure was not higher in higher SES youth, due to lower participation in unstructured activities. Besides the often cited socio-environmental reasons, biological aspects have also been shown to influence habitual PA (Lightfoot, 2008).

The results of this study (see Table 4) showed that TVVPT of the high-SES subjects was significantly higher than both low-SES and mid-SES subjects (p<0.05). Furthermore, in our study, Ardabilian schoolboys reported higher TVVPT (29.4% >3 h/day; and 31.3% >4 h/day) than adolescents from some developed countries, where a 24.7% of US (Eisenmann et al., 2002) and 22–24% Finnish (Tammelin *et al*., 2007); or less than some other countries such as 36–38% of Welsh (Vereecken *et al*., 2006) which reported watching TV >4 h/day. In contrast to this study some studies reported that children from a low SES show a trend of lower PA levels and spend more time in sedentary behavior (TV viewing) than high SES children (Drenowatz *et al*., 2010). Not also TV watching time, but also, video playing daily time was taken

TABLE 4
Comparison of TVVPT, physical activity and VO2max among the children by SES

	Low-SES (1) † (n=183)	Mid-SES (2) (n=509)	High-SES (3) (n=74)	F	P
TVVPT (min)	180.7±88	180.6±86.7	218.1±70.1	4.45	1≠3*, 2≠3*
Physical activity (score)	3.2±1.6	3.1±1.75	3.25±1.55	0.3	NS
VO_2max (ml/kg/min)	46.3±3.2	46.5±3	45.1±3.6	3.7	2≠3*

Significance of differences was evaluated by ANOVA for all variables**.** *Significant at <0.05; **Significant at <0.01.
† Numbers show groups: Low-SES (Group 1), Mid-SES (Group 2), High-SES (Group 3)

TABLE 5
Pearson correlation and Partial correlation (controlling for age and SES) between fat mass and selected variables

	Pearson correlation Fat mass	Partial correlation (controlling for age) Fat mass	Partial correlation (controlling for age and SES) Fat mass
Age (year)	0.397**	*********	*********
Physical activity (score)	-0.120**	-0.130*	-0.165**
VO_2max (ml/kg/min)	-0.700**	-0.792**	-0.793**
TVVPT (min)	0.162**	0.169**	0.200**

*Significant at <0.05; **Significant at <0.01.

in this study. So, it is probable that higher accessibility for having video playing instruments in the high-SES group might be the cause of having higher cumulative TVVPT than their mid-SES and low-SES counterparts. Moreover, specific social and cultural contexts of each country should be considered. However, the results of this study showed significant direct relationship between fat mass with TVVPT, and adversely significant negative relationship with PA and CRF, even after controlling for age and SES (see Table 5). Physical activity (PA) is a health enhancing behavior: when practiced regularly, PA reduces the risk for a range of chronic disease. It helps building strong bones, healthy joints, a strong heart, a good mental health and prevents today's major public health concern – obesity (Ferreira et al., 2007; Strong et al., 2005). It has been reported that Physical inactivity is a strong contributor to overweight. Sedentary activities such as excessive television viewing, computer use, video games, and telephone conversations should be discouraged. Reducing sedentary behaviors to <2 hours per day is important to increasing PA and to health (Strong *et al*., 2005).

Nonetheless, the main limitation of this study is its cross-sectional nature. Moreover, this study couldn't take subjects of both sexes, and, couldn't have a direct measure of body composition. Future similar studies should consider using such a measure to provide a more complete assessment.

CONCLUSION

In summary, this study showed that although anthropometric characteristics of 7-11 year Old Iranian boys were not significantly different among the children by SES, but higher sedentary behavior and lower CRF was observed in the children by high-SES. Furthermore, by considering the sedentary behavior, PA and VO_{2max}'s significant relationship to adiposity, it should be stated that increasing PA and decreasing sedentary behavior in children as much as possible should be considered. In addition to home and parents important role, school can be a good place and its managers and teachers can be good advisors for reminding and encouraging the children to have higher PA and adversely lower sedentary behaviors. However, because social and cultural contexts are often country-specific; therefore, studies from a widespread vision and including populations from different countries are required to facilitate a better understanding about the relationship between socioeconomic status with anthropometric characteristics, PA, physical fitness and sedentary activity.

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