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A healthy behavior and socioeconomic inequality in school-age children in the West of Iran

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Abstract:

BACKGROUND: Sufficient physical activity (SPA) in children and adolescents has an important role in health, growth, and development of persons. This study aimed to investigate the prevalence of and inequality in physical activity (PA) in 12–15-year-old students in the West of Iran, 2018.

MATERIALS AND METHODS: In this cross-sectional study, 1404 students from 14 schools of Kermanshah city were included. Data on demographic and socioeconomic status (SES) of students and their family, body mass index, moderate-to-vigorous PA of students were collected. Normalized concentration index (NC) and decomposition analysis applied to measure inequality in SPA and the contribution of affecting factors, respectively.

RESULTS: About 19% of the students had SPA. The proportion of SPA in boys was higher than girls (38.98% vs. 9.84%). There was a significant deviation from equality line (NC = 0.31; 95% confidence interval [CI]: 0.23, 0.38) and NC for boys and girls were 0.15 (95% CI: 0.04, 0.25) and 0.05 (95% CI: −0.07, 0.17). Sex of students and SES of households with 59.09% and 39.77% contribution to the measured inequality in SPA were the highest positive contributors. Household size (−2.60) had a negative contribution to inequality in SPA.

CONCLUSION: There was a significant pro-rich socioeconomic inequality in SPA and sex, and SES were the main contributors to the inequality in PA. Some interventions are needed to improve PA among children and adolescents with a focus on girls and low-SES groups to narrow the existing gaps.

Keywords:

Adolescents, children, inequality, physical activity, Iran

Introduction

Physical activity (PA) in school-age children and youth has important role in health, growth, and development of persons.[1,2] There is a positive association between the level of PA in school-age children and their health status. Good level of PA in younger ages can decrease the risk of noncommunicable diseases such as type 2 diabetes and cardiovascular diseases.[3,4] Furthermore, obesity has a significant and inverse correlation with the time that children spend on moderate-to-vigorous and vigorous physical activities.[5]

A review study suggested that gender (being male), ethnicity, obesity, perceived barriers, the history of PA, diet, access to facilities, time spent outdoors, depression, community sport, and support from parents and others are among the main determinants of PA in childhood and adolescence.[6]

The study of Kelishadi *et al*. indicated that more than 23% of Iranian children and adolescents are physically inactive. The prevalence of physical inactivity reported being higher in older age and girls. However, this study did not find any association between socioeconomic status (SES) and PA.[7] Other studies, also

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disclosed that PA of children and adolescents in Iran is lower than the required levels.[8]

Income of household and Human Development Index, the index that is representative of the development level of countries, is supposed to be associated with moderate-to-vigorous PA (MVPA) in children. Meanwhile, the infrastructure of countries is not the only factor that effects on PA of children.[9] There are disparities in the level of PA in favor of urban and advantaged areas.[10] Furthermore, the pro-rich socioeconomic inequality in sufficient PA (SPA) in children reported in different settings.[11,12] Based on some current evidence, there is intense inequality in PA among school-age children in Iran, and girls had lower PA than boys. Furthermore, maternal education, place of residence, and SES of households are known as the main determinants of inequality in PA.[13]

Some of the previous studies[13,14] focused on the inequality in PA and sedentary behaviors in Iranian children and adolescents, but the socioeconomic inequality in this health behavior and its determinants is largely unexplored in Iran. Improving the evidence in this field can facilitate designing some intervention for narrowing the potential gaps. Therefore, this study aimed to examine the socioeconomic inequality in SPA in students aged 12–15 years in Kermanshah city, Iran. An additional aim was to examine the contributors of inequality in PA in the students using a different decomposition analysis method. The findings of this study can be helpful to design programs and interventions to improve PA in vulnerable children and adolescents.

Materials and Methods

Data and variables

This study was a cross-sectional study that investigated the socioeconomic inequality in SPA among secondary school students in Kermanshah city, in the West of Iran in 2018. The study population were students in grade 1–3, between the ages of 12 and 15. For this purpose, Kermanshah City, the capital of Kermanshah Province, was divided into five geographical zones. Then, at least 1 girl's school and 1 boy's school were included in the study. Based on the number of students in each zone, the samples determined proportionally. After the random selection of a school as a sample, data were collected from all students by the census from 14 schools. If the number of samples in one school was not sufficient, more than one school from that zone included in the study. Twelve senior students of public health trained to collect the data under the supervision of the research team.

A questionnaire that compromised questions about students' characteristics (age, sex, grade, birthplace, and body mass index [BMI]) and characteristics of student's household (sex and age of head of household, household size, and SES was used for data collection. Data about the weight and height of students were gathered with measuring them. BMI was calculated using the following formula:

$$\text{BMI (kg/m}^2\text{)} = \text{weight (kg)}/(\text{height [m]})^2 \quad (1)$$

Based on the normal distribution of BMI, we categorized students to two groups of healthy and unhealthy weights. Students who their BMI was more than 26.16 kg/m^2 (mean of BMI (21.26) + one standard deviation of BMI (4.90)) were considered unhealthy weight.

For SES index, the data of assets, income of households, and education level of head of household were gathered. Then, using principal component analysis, the SES index was created. The students' households were divided to five quintiles based on SES index, from the lowest (1st quintile) to the highest (5th quintile) socioeconomic level.

PA was measured using the guideline of the Iranian preventive essential noncommunicable diseases.[15] According to the following questions, we determined the PA of the students:

1. "In average, how many minutes do you have moderate physical activities per day?"
2. "How many days per week do you have moderate physical activities (such as a vigorous walking)"
3. "In average, how many minutes do you have vigorous physical activities per day?"
4. "How many days per week do you have vigorous physical activities (such as running or walking too fast)?"

Therefore, data on active days on a week, moderate and vigorous physical activities, and duration of these activities were collected. The PA of student calculated as follow:

Physical activity (minutes/week) = (duration of moderate physical activities in a day (minutes) × number of days with moderate physical activities per week) + (2× [duration of vigorous physical activities in a day (minutes)×number of days with vigorous physical activities per week]) (2)

The outcome variable of the study was the SPA. According to the World Health Organization suggestion, at least 60 min of MVPA per day (420 min/week) was considered as SPA.[16]

Measuring socioeconomic inequality in sufficient physical activity

We used the Concentration Index (C) method to measure socioeconomic-related inequality in SPA among students of secondary schools in Kermanshah city. The C is based on a concentration curve. Concentration curve plots the cumulative proportion of population (here students) ranked according to their SES on the X-axes against the cumulative proportion of health outcome (here SPA) on the Y-axes.

The C is defined twice the area between the 45° line that is the line of perfect equality and the concentration curve. The value of C ranges between -1 and +1. A positive (negative) value of the C indicates that outcome variable (SPA) is concentrated among the groups with high (low) SES groups. The zero value for the C indicates that SPA is equally distributed among the different socioeconomic groups. The C measured using the following formula:[17]

$$C = \frac{2 * cov(y_i r_i)}{\mu} \quad (3)$$

where y_i is the dependent variable (i.e. SPA) for the student i, r_i is the fractional rank of student i in the SES distribution, and μ is the mean of the dependent variable (i.e. SPA). As per Wagstaff's suggestion,[18] we used normalized the C by multiplying the C by 1/1−μ because the outcome variable (SPA) is a binary variable.

Decomposing socioeconomic inequality in sufficient physical activity

The C was decomposed to identify the contribution of explanatory variables to the measured socioeconomic inequality in SPA among the participants of the study.[19] We regressed the SPA on a set of k explanatory variables using a logit model as:

$$y = \alpha + \sum_k \beta_k x_k + \varepsilon, \quad (4)$$

The C for y can be decomposed as follows:

$$C = \sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k + GC_\varepsilon / \mu. \quad (5)$$

where β_k is the coefficient of each explanatory (independent) variable (in here marginal effect of each explanatory variable calculated from the logit model) $\bar{x}_k$, is the mean of each independent variable, C_k is the concentration index for each independent variable, $GC\varepsilon$ is the generalized concentration index for ε.

In Equation 4, the $\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k$ component designates the proportion of the measured inequality, C, explained by the systematic variation of the independent variables across SES groups. Therefore, each of the explanatory variables contributes to socioeconomic inequality in SPA if the variable is unequally distributed by SES and the elasticity of the variable is statistically significant.

The positive (negative) contribution of an independent variable proposes that socioeconomic distribution of that variable and its relation with SPA lead to a higher likelihood of SPA among the rich (the poor).

The $\frac{GC_\varepsilon}{\mu}$ component Equation 3 formula specifies the proportion of socioeconomic inequality which is not explained by the independent variables inclouded in the regression model. Similarly, Normalized concentration index (NC), can be decomposed using the following formula:[18]

$$NC = \frac{C}{1-\mu} = \frac{\sum_k \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k}{1-\mu} + \frac{GC_\varepsilon / \mu}{1-\mu} \quad (6)$$

The analyses were performed by Stata software version 14 (StataCorp, College Station, TX, USA).

Results

The number (proportion) of students with SPA was 269 (19.16%). Of 600 participants, 449 (31.98%) were girls and other (68.02%) were boys. The proportion of SPA in boys was higher than girls (38.98% vs. 9.84%). The most number of the participants were in grade 1, and grade 3 participants had higher SPA than their counterparts. With regarding the birthplace, about 97% of students were born in the urban areas. Born in urban areas was positively correlated with better PA. While more than 86% of students had a healthy weight, only 19.02% of them were physically active. With considering the characteristics of parents and households, about 95% of students had male-headed households, and these students were more physically active than their counterparts with female-headed household (19.37% vs. 14.93%). Age of the head of most of the households ranged from 41 to 50 years, and there was no significant association between age of head of household and PA of students. On the other hand, more than 74% of the students' household had 4 to 5 members. The SES of households was significantly associated with the outcome variable. Only about 9.96% of students in the lowest SES quintile had SPA, while 33.57% of students in the highest SES quintile were physically active. Table 1

shows the distribution of SPA among the participants of the students.

The inequality analysis revealed that there was a significant deviation from equality line (NC = 0.31; 95% confidence interval [CI]: 0.23, 0.38). In addition, the subgroup analysis by gender of the students showed that NC for boys and girls were 0.15 (95% CI: 0.04 and 0.25) and 0.05 (95% CI: −0.07, 0.17) that implies a pro-rich inequality in SPA among the participants of the study [Table 2].

Table 3 shows the marginal effects, mean of independent variables, elasticity, concentration index of independent variables (C_k), and contribution of independent variables to the inequality in SPA. The marginal effects of dependent variables disclosed that the probability of being physically active in girls is 22.8% lower than boys. Furthermore, the students who were born in rural areas had 9% lower probability for SPA. With regarding the BMI, unhealthy weight students had lower SPA than their normal counterparts. With considering households' characteristics, female-headed households and lower SES decreased the probability of SPA in the study population. Decomposition analysis of the affecting factor on SPA, showed that sex of students and SES of households with 59.09% and 39.77% contribution in the measured inequality were the highest positive contributors, followed by birthplace of students (2.39%), grade (2.08%), and age of head of households (1.73%). Household size (−2.60%) had a negative contribution to inequality in SPA. Figure 1 shows the contribution of independent variables to SPA among the students.

Discussion

This is a unique study that investigated the socioeconomic inequality in PA in children and adolescents in Kermanshah City in the West of Iran. Furthermore, the contribution of characteristics of students and households to measured inequality was investigated.

Our findings indicated that there was a high level of pro-rich inequality in SPA (NC = 0.31). In addition, subgroup analysis showed that SPA was more concentrated among high-SES boys and girls. In addition, it was found that sex was the highest contributors to the measured socioeconomic inequality among the students, followed by SES. Therefore, sex and SES of household were the most important positive contributors to the inequality. The prevalence of SPA was more than 19.16% and boys were more physically active than girls. Birth in rural areas decreased the probability of SPA and students that born in rural areas were more concentrated among low-SES groups. In total, the place of birth had a small positive contribution to the measured inequality. Students in the fifth SES quintile significantly were more active than other quintiles. For example, about 9.96% of students in the first SES group had SPA in compare to 33.57% of students in the highest SES group.

Table 1: Distribution of sufficient physical activity by characteristics of students and their households in Kermanshah province, 2018

Variables			Total, *n* (%)	Insufficient physical activity, *n* (%)	Sufficient physical activity, *n* (%)
Student's characteristics	Sex	male	449 (31.98)	276 (61.02)	175 (38.98)
		female	955 (68.02)	861 (90.16)	94 (9.84)
	Grade	1	845 (60.19)	656 (77.63)	189 (22.37)
		2	249 (17.14)	231 (92.77)	18 (7.23)
		3	310 (22.08)	248 (80.00)	62 (20.00)
	Birthplace	urban	1362 (97.01)	1096 (80.47)	266 (19.53)
		rural	42 (2.99)	39 (92.86)	3 (7.14)
	BMI	healthy	1220 (86.89)	988 (80.98)	232 (19.02)
		unhealthy	184 (13.11)	147 (79.89)	37 (20.11)
Household's characteristics	Sex of head of household	male	1337 (95.23)	1078 (80.63)	259 (19.37)
		female	67 (4.77)	57 (85.07)	10 (14.93)
	Age of head of household	27-40	381 (27.14)	323 (84.78)	58 (15.22)
		41-50	786 (55.98)	630 (80.15)	156 (19.85)
		>50	237 (16.88)	182 (76.79)	55 (23.21)
	Household's size	2-3	220 (15.67)	173 (78.64)	47 (21.36)
		4-5	1049 (74.72)	854 (81.41)	195 (18.59)
		6 and more	135 (9.62)	108 (80.00)	27 (20.00)
	SES quintile	1st	281 (20.01)	253 (90.04)	28 (9.96)
		2nd	286 (20.37)	253 (88.46)	33 (11.54)
		3th	278 (19.80)	230 (82.73)	48 (17.27)
		4th	279 (19.87)	213 (76.34)	66 (23.66)
		5th	280 (19.94)	186 (66.43)	94 (33.57)
Total			1404 (100)	1135 (80.84)	269 (19.16)

Similarly, the study of Johnsen *et al*., revealed that PA of Danish adolescents was significantly associated with social class between 1991 and 2014. The prevalence of inactivity was reported to be 8% in total. However, low (10.8%)-, middle (7.8%)-, and high (5.4%)-social class had different levels of physical inactivity.[20] The study of Federico *et al*., showed that 64% of Italian children and adolescents were contributed to moderate and vigorous PA. This study also indicated that socioeconomic factors such as education level and employment status of parents can lead to differences in PA of children.[21]

The proportion of students with unhealthy weight was more than 13%. We found a negative association between higher BMI and SPA. In addition, the results showed that unhealthy weight was more concentrated among low-SES households. However, BMI had a small contribution to pro-rich inequality in SPA in our study. Based on previous evidence, 24.1% and 11.5% of children in Sanandaj city, in the West of Iran were overweight and obese, respectively. Furthermore, there was pro-rich inequality in overweight and obesity. This study found that SES as main contributors to inequality in childhood obesity.[22] Therefore, we can conclude that the SES of family is among the most important variable related to inequality in movement behaviors, overweight, and obesity in children.

A study in 12 developed and developing countries indicated that based on the Gini index, there was a high level of inequality in PA and screen time of children. Similar to our findings, the movement behavior of girls was different from boys, and on average, they spent less

Table 2: The normalized concentration index for sufficient physical activity in students, 2018

Sample	Number of observations	NC	95% CI
Total	1404	0.31	0.23-0.38
Boys	449	0.15	0.04-0.25
Girls	955	0.05	−0.07-0.17

NC= Normalized concentration Index, CI=Confidence interval

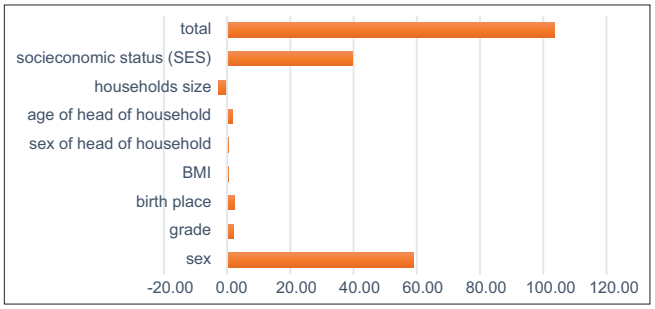

Figure 1: Contribution of explanatory variables to the inequality in sufficient physical activity in the students, Kermanshah, 2018

Table 3: Decomposition of determinants of socioeconomic inequality in SPA in students, 2018

Variables			Marginal effects	Mean	Elasticity	C_k	AC	Percentage contribution	Summed Percentage Contribution
Student's characteristics	Sex	male		0.320					
		female	-0.228	0.680	-0.810	-0.180	0.181	59.098	59.098
	Grade	1st		0.602					
		2nd	-0.069	0.177	-0.064	-0.173	0.014	4.457	2.083
		3th	-0.038	0.221	-0.044	0.134	-0.007	-2.374	
	Birth place	urban		0.970					
		rural	-0.090	0.030	-0.014	-0.423	0.007	2.393	2.393
	BMI	healthy		0.506					
		unhealthy	-0.017	0.306	-0.027	-0.051	0.002	0.562	0.562
Household's characteristics	Sex of head of household	male		0.952					
		female	-0.022	0.048	-0.005	-0.243	0.002	0.531	0.531
	Age of head of household	27-40		0.271					
		41-50	0.010	0.560	0.029	0.046	0.002	0.540	1.735
		>50	0.032	0.169	0.028	0.106	0.004	1.195	
	Household's size	2-3		0.157					
		4-5	-0.005	0.747	-0.018	0.023	-0.001	-0.165	-2.603
		6 and more	0.052	0.096	0.026	-0.230	-0.007	-2.438	
	SES quintile	1st		0.200					
		2nd	0.005	0.204	0.005	-0.396	-0.003	-0.861	39.775
		3rd	0.046	0.198	0.047	0.006	0.000	0.109	
		4th	0.052	0.199	0.054	0.403	0.027	8.814	
		5th	0.094	0.199	0.098	0.801	0.097	31.713	
Explained							0.317		103.574
Residuals							0.017		-3.574
Total							0.300		100.000

C_k=Concentration Index for independent variables, AC=Absolute Contribution

time to daily physical activities than boys. Furthermore, PA in girls was reported to be inversely associated with the level of inequality.[23] Other studies also indicated that girls are less active than boys.[24,25] The level of PA in girls and boys are multifactorial and several factors such as socioecological variables, attributes of family, school, and environmental factors are supposed to be associated with PA in both sexes. In compare with boys, the school and family have a weaker impact on PA in girls. Also, individual attributes, such as cardiorespiratory fitness and coordination of eye-hand, are less satisfactory in related to PA in girls.[26] Besides, lack of a safe place to do physical activities, barriers to access appropriate place for exercise, and lack of family support are among the reasons that limit the PA in children and adolescents in Iran.[27] Another evidence declares the importance of physical environment on PA in developing countries too.[28]

A study in Iran showed that the prevalence of physical inactivity is high among Iranian children and adolescents with higher rates in girls. In contrast of our findings, this study revealed that there was no significant correlation between PA and SES.[7] Another evidence indicated that physical inactivity is prevalent among Iranian girls.[29]

The older head of households were concentrated in high-SES groups and children and adolescents in these households had slightly higher probability to being physically active. However, households' size had negative contribution to inequality in SPA among the participants of the study.

The prevalence of SPA estimated to be more than 27% in the world in 2016, and there is a sex gap in favor of men.[30] Meanwhile, many children and adolescents in low-income countries cannot reach to the recommended level of PA that is required for a healthy lifestyle.[31] Transportation to and from school also is supposed to be more inactive than developed countries.[32]

This study was the first attempt to capture a picture of socioeconomic-related inequality in SPA among children and adolescents in Kermanshah, in the West of Iran. The Wagstaff method of decomposition was used to investigate the determinants of inequality in PA in children and adolescents that is rare in previous works in Iran. We asked participants to recall their 7 days of physical activities. Besides, the probability of recall bias, it is shown that self-reported PA is a valid and reliable way of determining PA in children and adolescents.[33] Furthermore, the senior students of public health that were familiar with types of physical activities participated in data gathering process to increase the validity of data. We included a large sample of students from all zones of Kermanshah City to improve the representativeness of the findings. However, the results should interpret with cautious for other provinces of Iran. The including rural areas was not possible for this study. Therefore, further study is needed to investigate PA in children and adolescents in rural areas of Iran.

Conclusion

The findings of this study showed that a high proportion of children and adolescents in the West of Iran have poor PA. Furthermore, there was a significant pro-rich socioeconomic inequality in SPA and sex, and SES was the main contributor to the inequality in PA. Some interventions are needed to improve PA among children and adolescents with focus on girls and low-SES groups to narrow the existing gaps.

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Conflicts of interest

There are no conflicts of interest.

Ethics statement

This study has been approved by Ethics Committee of Kermanshah University of Medical Sciences (Ethics code: IR.KUMS.REC.1397.436).

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