

Original Article

Socioeconomic Disparities in Dietary and Physical Activity Habits of Iranian Children and Adolescents: the CASPIAN-IV Study

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Abstract

Background: This study aims to compare the dietary and physical activity (PA) habits in a nationally representative sample of Iranian children and adolescents based on their family and regional socioeconomic status (SES).

Method: This nationwide study was conducted on 14,880 students, aged 6-18 years, and one of their parents living in urban and rural areas of 30 provinces in Iran. Data regarding PA, screen time and dietary habits were recorded using two sets of questionnaires for both students and their parents. The results were compared according to the SES of the family and the living region.

Result: Overall, 13,486 students completed the study (90.6% participation rate) with a mean age of 12.5 (95% CI: 12.3–12.6) years. Comparing family SES, the level of PA was similar in the three SES groups. The total screen time, working computer with and watching TV was significantly higher in those with higher family SES ($P < 0.05$). Consumption of meat, dairy products, rice, fruit, and vegetables was significantly higher in families with higher SES. Consumption of salty snacks and sweet drinks was significantly lower in families with higher SES level. Sedentary lifestyle was more prevalent in regions with higher SES. The dietary habits of inhabitants of regions with low SES was similar to that reported for individuals with low family SES.

Conclusion: Both family and regional SES might impact lifestyle habits from early life. Participants with higher SES had healthier dietary habits but lower PA level than their counterparts with lower SES. Socioeconomic disparities should be considered for public health interventions aiming to improve lifestyle habits.

Authors have no conflict of interest

Keywords: Adolescents, children, dietary habits, physical activity, socioeconomic status

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Introduction

The increasing trend of non-communicable diseases (NCDs), mainly due to demographic and epidemiological changes, is considered a potential emerging health problem in developing countries.¹ The problem seems more challenging in the pediatric age group because NCD-related behavioral and biological risk factors extend from childhood to adulthood.² NCD-related risk factors affect the public health burden of the pediatric age group because lifestyle, dietary and health behavior patterns

are formed and established during early life.³

As reported by the World Health Organization (WHO), high blood pressure, hyperlipidemia, inadequate fruit and vegetable intake, physical inactivity, and overweight or obesity are the most important risk factors of NCDs.⁴ Most of these risk factors are mainly related to inappropriate lifestyle habits including dietary and physical activity patterns.^{4,5}

Several studies worldwide have reported an alarming increasing rate of unhealthy dietary habits among children and adolescents, e.g. skipping breakfast, insufficient consumption of fruits and vegetables, as well as high intake of sweet soft drinks, fast foods and energy-dense snacks.^{6–8} Moreover, many studies have reported that unhealthy lifestyle choices such as physical inactivity and sedentary behaviors are highly prevalent in this age group.^{9–12}

A growing body of evidence supports the interaction and the possible synergetic effect of unhealthy lifestyle and dietary habits. They indicate that sedentary behaviors and physical inactivity are associated with the above-mentioned unhealthy dietary habits.^{13,14}

Early life interventions could potentially prevent the NCD epidemic and yield better short- and long- term health protective effects.¹⁵

Health-related behavior is a complex process influenced by social, cultural, biological, ecological, and personal factors.¹⁶ The associations between socioeconomic status (SES) and health

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behaviors for both individual and regional level characteristics have been considered in some previous studies and different results have been reported.^{17–19}

The aim of the current study is to compare the dietary and physical activity habits of a nationally-representative sample of Iranian children and adolescents based on family and regional SES at national and subnational levels.

Materials and Methods

This nationwide study was conducted in 2011–2012 in the framework of the fourth survey of a national school-based surveillance program entitled Childhood and Adolescence Surveillance and Prevention of Adult Non-communicable disease (CASPIAN-IV) study.

This survey was conducted on 14,880 students, aged 6–18 years, and one of their parents living in urban and rural areas of 30 provinces in Iran. The detailed methodology of the study is reported elsewhere,²⁰ and here we describe it in brief.

The study population consisted of students from elementary, intermediate, and high schools from rural and urban areas of Iran who were selected through multistage, cluster sampling from 30 provinces of the country (48 clusters of 10 people in each province). Stratification was performed in each province according to living area (urban/rural), and level of education (elementary/intermediate/high school) proportional to size and with equal sex ratio. Selection of students from urban and rural areas was proportionate to the population of urban and rural students. In this way, the number of samples in rural/urban areas and in each school grade was divided proportionally to the population of students in each grade. Cluster sampling with equal clusters was used in each province to achieve the sample size of interest. The clusters were determined at the level of schools, containing 10 sample units in each cluster.

Trained health care professionals obtained data regarding physical activity (PA) including the screen time (ST) and the dietary habits using two sets of validated questionnaires,²¹ which were completed for students and their parents.

The questionnaires were obtained from the World Health Organization- Global School-based Student Health Survey (WHO-GSHS), with adding more questions. The validity and reliability of questionnaires have been assessed previously.²¹ To evaluate dietary habits, a self-administered quantified food frequency questionnaire (FFQ) was applied to both parents and students to evaluate the family intake of following food groups: dairy products, meat, fruits, vegetables, sweets, sugar-sweetened drinks, rice, bread, potato and french fries, fast foods, salty/fatty snacks, nuts and grains.

The PA classification was based on times per week PA they had spent for at least 30 minutes. Level of PA was classified as low (<2 times/week), moderate (2–4 times/week), and high (>4 times/week).

Students were asked about the time (hours/day) spent on ST including watching TV, working with computer and playing video games. Watching TV and working with computer more than 2 hours per day and ST more than 2 hours per day were considered as components of sedentary lifestyle.

Subnational analysis

Classification of Iran into four sub-national regions was based

on the previously defined criteria consisting of a combination of geography and SES determined using principal component analysis (PCA). According to this classification, the SES regions, from low to high, are as follows: southeast, north-northeast, west, and central regions.²²

Family SES

For estimating family SES, variables including family assets (processing private car and personal computer), type of home (rented/ personal), occupation of parents and their education level using PCA were summarized in one main component. This component explained 59% of variance. The main component was categorized into tertiles, i.e., the first tertile was considered as low, the second as intermediate, and the third as high family SES.

Statistical analysis

Data were analyzed using survey data analysis methods in the STATA Corp. 2011 (Stata Statistical Software: Release 12. College Station, TX: Stata Corp LP. Package). Mean of continuous variables are reported with 95% confidence intervals (CI), and categorical variables as percentage (95%CI).

The mean values of continuous and categorical variables according to gender, living area, family SES and regions' SES were compared using the Student *t* and Chi-square tests, respectively. *P*-values under 0.05 were considered as statistically significant.

Results

The study population consisted of 13,486 children and adolescents out of 14,880 invited students (participation rate of 90.6%) and one of their parents. Students consisted of 6,640 (49.2%) girls and 6,846 (50.8%) boys; 75.6% from urban and 24.4% from rural areas, with a mean age of 12.5 (95% CI: 12.3–12.6) years.

The general characteristics of study participants according to gender are presented in Table 1. The mean BMI of studied population was 18.85 (95% CI: 18.70–18.99) kg/m². The frequencies of both underweight and overweight/obesity were higher in boys than girls (*P* < 0.05). The frequency of abdominal obesity was higher among boys (*P* < 0.05). Girls had lower level of PA as well as computer working and ST than boys (*P* < 0.05). Family SES was similar in boys and girls.

The frequencies (%) of different components of dietary intakes and physical activity habits of participants in the four classified socioeconomic sub-national regions of Iran are presented in Table 2. The findings show that in the entire population, daily use of fruits, vegetables, rice, dairy products, grains and meat increased linearly with increasing regional SES (*P* < 0.05). Daily use of sugar-sweetened drinks and sweets decreased linearly with increasing region's SES. Daily use of cakes and sweets were highest in the West region (*P* < 0.05). Daily use of salty/fatty snacks was significantly higher in the Southeast and West regions. Daily use of fast foods was significantly lower in the Southeast and Central regions. Low PA level was most prevalent in the Central region with highest SES (*P* < 0.05). Higher PA level was most prevalent in the Southeast and North-northeast regions. Sedentary lifestyle increased linearly with increasing region's SES.

Among urban inhabitants, daily consumption of fruits, vegetables, rice, dairy products, grains, and meat was significantly higher in regions with higher SES. Consumption of salty/fatty

Table 1. The general characteristics of study participants according to gender: the CASPIAN-IV study

	Boys	Girls	Total	P-Value
Age (years)*	12.36(12.12–12.60)	12.58 (12.34–12.82)	12.47(12.29–12.64)	0.20
Weight (Kg) *	43.07(41.92–44.21)	41.71(40.77–42.65)	42.40(41.64–43.15)	0.06
Height (cm) *	148.17(146.83–149.51)	145.77(144.69–146.85)	146.99(146.10–147.88)	<0.01
BMI (Kg/m ²)*	18.73(18.53–18.94)	18.97(18.76–19.17)	18.85(18.70–18.99)	0.10
Waist circumference(cm) *	67.83(67.15–68.51)	66.19(65.62–66.76)	67.02(66.57–67.48)	<0.0001
Waist to height ratio*	0.45(0.45–0.46)	0.45(0.45–0.45)	0.45(0.45–0.45)	0.03
Wrist circumference (cm) *	15.01(14.89–15.13)	14.51(14.42–14.60)	14.76(14.68–14.84)	<0.0001
Hip circumference (cm) *	80.05(79.21–80.90)	81.52(80.65–82.40)	80.78(80.16–81.40)	0.01
Waist to hip ratio*	0.19(0.18–0.19)	0.18(0.17–0.18)	0.18(0.18–0.18)	<0.0001
Abdominal obesity **	20.41(19.09–21.79)	17.79(16.56–19.09)	19.12(18.22–20.06)	<0.01
BMI categories**				
Underweight	13.03(12.06–14.08)	11.28(10.38–12.23)	12.17(11.5–12.87)	
Normal	64.11(62.78–65.42)	68.52(67.14–69.87)	66.28(65.31–67.24)	
Overweight	9.28(8.56–10.05)	10.06(9.3–10.86)	9.66(9.14–10.21)	<0.0001
Obesity	13.58(12.59–14.63)	10.15(9.28–11.09)	11.89(11.22–12.59)	
Family size**				
≥4	50.17(48.43–51.91)	47.64(45.83–49.45)	48.92(47.76–50.07)	
<4	49.83(48.09–51.57)	52.36(50.55–54.17)	51.08(49.93–52.24)	0.06
Family History **				
-Obesity	43.34(41.85–44.84)	47.66(46.07–49.26)	45.47(44.38–46.57)	<0.001
-Diabetes	36.53(35.14–37.93)	38.00(36.59–39.43)	37.26(36.32–38.21)	0.16
-Hypertension	52.4(50.97–53.82)	54.92(53.38–56.45)	53.64(52.62–54.67)	0.02
-Dyslipidemia	43.51(42.09–44.93)	44.64(43.22–46.06)	44.07(43.08–45.05)	0.28
Socioeconomic status **				
Poor	33.18(31.14–35.29)	33.77(31.73–35.87)	33.47(32.04–34.94)	
Moderate	32.67(31.13–34.24)	33.52(32.03–35.06)	33.09(32.01–34.19)	
Good	34.15(31.81–36.57)	32.71(30.45–35.04)	33.44(31.82–35.09)	0.57
Physical activity**				
-low(<2 times/week)	28.75(26.86–30.72)	39.61(37.54–41.72)	34.11(32.66–35.58)	
-Moderate(2–4 times/week)	35.62(34.11–37.17)	37.97(36.36–39.61)	36.78(35.66–37.92)	
-High (>4 times/week)	35.62(33.66–37.63)	22.42(20.82–24.10)	29.11(27.79–30.47)	<0.0001
TV watching**				
>2h	51.18(49.55–52.81)	50.11(48.47–51.76)	50.66(49.49–51.82)	0.31
Computer working**				
>2h	12.27(11.24–13.38)	6.94(6.25–7.70)	9.63(8.99–10.32)	<0.0001
Screen time **				
>4h	21.93(20.53–23.40)	15.22(14.12–16.40)	18.62(17.71–19.57)	<0.0001

BMI = body mass index; *Data are presented as mean (95% CI); ** Data are presented as percent (95%CI)

snacks and fast foods was similar to that mentioned above for the entire population. Daily use of bread, potato and sweets was lowest in the Southeast region, i.e. the region with the lowest SES ($P < 0.05$). Low and High PA levels were highest and lowest in the Central region, i.e., the region with the highest SES ($P < 0.05$). Sedentary lifestyle in the Southeast region was in the lowest level ($P < 0.05$). Watching TV and working with computer were higher in the North-northeast and Central regions ($P < 0.05$). Dietary habits were similar in rural and urban inhabitants, except for lower consumption of nuts, fast foods, and milk ($P < 0.05$). Daily use of milk had an increasing trend with increase in the regional SES, whereas in urban population, it was higher in the West and lower in the North-northeast region ($P < 0.05$). The frequency of daily fast food consumption was lowest in the Central and highest in the North-northeast regions ($P < 0.05$). The frequency of low PA level was lower in the Central and West regions and high PA level was

higher in the Southeast and Central regions ($P < 0.05$). Sedentary lifestyle was higher in regions with better SES ($P < 0.05$).

The frequencies (%) of different components of dietary intakes and physical activity habits of participants according to the family socioeconomic status are presented in Table 3. The daily consumption frequency of fruits, vegetables, milk, meat, rice and dairy products was higher in boys with better SES than those with low SES, whereas the corresponding figure was lower for daily consumption of cakes, salty/fatty snacks, sweet drinks, fast foods, and potato ($P < 0.05$). The frequency of low PA was lower in boys with better SES ($P < 0.05$). Sedentary lifestyle including watching TV, working with computer and the whole ST were higher in boys with better SES ($P < 0.05$). Among girls with higher family SES, daily consumption of fruits, vegetables, milk, meat, rice, and dairy products was higher, whereas daily consumption of salty/fatty snacks and potato was lower than other participants ($P < 0.05$).

Table 2. Frequency of different components of dietary intakes and physical activity habits of participants according to the socioeconomic status of the living region: the CASPIAN-IV Study

	Southeast			North-northeast			West			Central			National			P-Value**
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	
	Dietary habits(students' report on their daily use) ¹															
- Cake, biscuit , sweets/chocolates	28	32.43	30.36	29.27	31.71	30.48	36.13	37.96	37.03	32.87	33.19	33.02	33.31	35.02	34.15*	<0.001
- Salty/fatty snacks	18.28	15.61	16.85	8.41	8.81	8.61	13.91	18.16	16.02	9.7	9.05	9.39	12.06	13.76	12.90*	<0.001
- Sugar-sweetened drinks	12.91	11.15	11.97	9.27	7.62	8.45	8.46	5.95	7.22	8.13	4.64	6.47	8.86	6.38	7.64*	<0.001
- Fresh fruits	26.79	41.40	34.61	54.44	54.12	54.28	52.74	58.32	55.50	61.44	66.03	63.64	53.47	58.07	55.74*	<0.001
- Dried fruits	8.38	16.41	12.69	18.47	18.49	18.48	25.02	24.03	24.53	23.09	22.55	22.83	21.89	21.86	21.88	0.004
- Industrial juice	14.31	17.22	15.87	17.64	12.93	15.30	17.75	14.82	16.3	16.11	9.33	12.89	16.97	13.21	15.12*	<0.001
- Fresh or cooked vegetables	19.38	28.93	24.49	32.18	31.74	31.96	36.03	40.03	38.01	37.18	39.52	38.29	34.35	37.36	35.84*	0.01
- Milk	43.27	41.81	42.49	47.43	37.21	42.37	48.25	47.38	47.82	51.48	40.90	46.45	48.65	43.27	46.00*	0.47
- Fast foods	1.83	2.71	2.3	3.79	2.48	3.14	3.59	2.37	2.99	3.69	1.44	2.62	3.51	2.17	2.85*	
Dietary habits (parents' report on daily use of their children) ¹																
-High-fat dairy products	21.15	27.66	24.61	37.5	32.73	35.13	32.65	32.23	32.44	38.91	34.55	36.84	34.43	32.53	33.49	<0.001
-Dairy products	44.99	48.97	47.11	65.46	62.36	63.92	61.06	62.4	61.72	71.05	69.44	70.28	63.46	63.04	63.25	<0.001
- Grains and soya	10.97	13.22	12.17	15.85	17.37	16.6	19.04	20.81	19.92	23.25	25.94	24.53	19.07	20.88	19.96	<0.001
- Fast foods	1.45	2.39	1.95	2.78	1.63	2.21	3.32	2.46	2.89	1.91	0.94	1.45	2.66	1.89	2.28*	<0.001
- Meat(red meat, chicken, fish)	17.09	26.91	22.33	29.93	31.74	30.83	29.71	33.85	31.76	40.27	44.06	42.07	31.87	35.61	33.70*	<0.001
- Bread	97.08	94.90	95.68	98.32	97.77	98.05	97.19	96.41	96.08	97.34	97.79	97.55	97.42	96.88	97.16	0.004
- Rice	55.17	53.19	54.12	71.59	68.09	69.17	66.95	70.35	68.64	81.93	83.39	82.62	71.21	71.89	71.54	<0.001
- Potato and French fries	13.84	13.69	13.76	19.07	19.54	19.3	21.15	19.98	20.57	17.18	18.34	17.73	19.03	18.85	18.94	<0.001
-Cake, biscuit , sweets/chocolates	30.13	38.40	34.52	41.35	40.36	40.86	40.18	45.32	42.73	40.54	42.67	41.55	39.67	43.06	41.34*	0.004
- Salty/fatty snacks	17	19.46	18.31	13.37	11.82	12.6	17.9	21.29	19.58	9.96	10.42	10.18	14.70	16.46	15.57*	<0.001
- Sugar-sweetened drinks	11.31	11.8	11.57	10.57	8.65	9.61	7.82	6.78	7.3	6.33	5.0	5.7	8.15	7.10	7.63	<0.001
- Fruits(fresh, juice, dried)	24.59	33.92	29.56	53.79	54.93	54.36	52.38	57.85	55.09	61.73	66.22	63.87	53.11	57.36	55.21*	<0.001
- Fresh or cooked vegetables	22.18	34.66	28.83	40.27	42.69	41.47	43.63	50.23	46.91	47.11	50.64	48.79	42.33	47.53	44.90*	<0.001
- Nuts	7.83	9.09	8.5	9.53	11.46	10.48	12.06	13.71	12.88	9.44	9.31	9.38	10.50	11.67	11.08	<0.001
Physical activity ¹																
-low(<2 times/week)	23.23	34.45	29.23	25.32	35.33	30.28	31.78	37.96	34.85	27.69	46.90	36.79	28.75	39.61	34.11	
-Moderate(2-4 times/week)	36.28	44.02	40.43	36.46	39.54	37.98	34.39	38.10	36.23	36.83	34.65	35.79	35.62	37.97	36.78	0.01
-High (>4 times/week)	40.52	21.53	30.34	38.23	25.13	31.73	33.83	23.94	28.92	35.48	18.46	27.42	35.63	22.47	29.11	
TV watching ¹																
>2 h	43.56	38.06	40.63	50.84	50.21	50.53	50.84	48.68	49.77	54.0	56.61	55.24	51.18	50.11	50.66	<0.001
Computer working*																
>2 h	7.61	4.32	5.84	13.21	7.28	10.25	12.31	7.13	9.74	12.93	7.33	10.27	12.27	6.94	9.63*	0.004
Screen time ¹																
>4 h	13.25	7.95	10.42	22.14	12.84	17.53	22.16	15.5	18.83	23.84	18.81	21.45	21.93	15.22	18.62*	<0.001

¹Data are presented as percentage; *P<0.05 between boys and girls in national level; ** between classified national and subnational levels

Table 3. Frequency of different components of dietary intakes and physical activity habits of participants according to the family socioeconomic status: the CASPIAN-IV study.

	Family socioeconomic status										P-Value*
	Weak			Moderate			Good			Total	
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total		
Dietary habits(students' report on their daily use) ¹											
- Cake, biscuit , sweets/chocolates	34.8	35.88	35.34	34.2	34.95	35.58	30.9	34.5	32.64	0.06	
- Salty/fatty snacks	15.7	17.3	16.38	10.8	13.78	12.25	9.19	9.76	9.47	<0.001	
- Sugar-sweetened drinks	10.11	6.5	8.31	8.87	6.28	7.57	7.47	6.42	6.96	0.09	
- Fresh fruits	40.59	46.71	43.64	58.0	59.52	58.76	62.52	68.02	65.18	<0.001	
- Dried fruits	17.83	18.79	18.31	23.46	21.31	22.37	24.36	25.79	25.06	<0.001	
- Industrial juice	17.63	13.4	15.51	17.21	13.34	15.27	15.67	12.9	14.34	0.35	
- Fresh or cooked vegetables	27.45	32.55	29.99	36.42	36.58	36.5	38.81	43.03	40.85	<0.001	
- Milk	46.54	40.58	43.57	47.12	42.56	44.84	53.35	46.92	50.24	<0.001	
- Fast foods	4.3	2.0	3.16	2.8	2.26	2.55	3.05	2.45	2.76	0.21	
Dietary habits (parents' report on daily use of their children) ¹											
-High-fat dairy products	29.25	29.61	29.43	33.53	31.4	32.46	39.21	36.08	37.69	<0.001	
-Dairy products	56.4	57.49	56.93	64.39	61.18	62.78	69.67	70.42	70.03	<0.001	
- Grains and soya	17.68	22.56	20.12	19.88	20.47	20.18	19.63	19.49	19.56	0.58	
- Fast foods	2.42	1.99	2.21	2.70	1.81	2.25	2.43	1.70	2.08	0.87	
- Meat(red meat, chicken, fish)	19.96	23.92	21.94	32.38	32.94	32.66	43.37	49.22	46.2	<0.001	
- Bread	97.29	97.14	97.22	97.84	97.31	97.58	97.61	96.44	97.05	0.36	
- Rice	57.97	59.41	58.69	73.37	74.18	73.77	82.08	82.05	82.06	<0.001	
- Potato and French fries	22.27	19.66	20.97	18.58	18.9	18.74	16.18	17.9	17.02	0.04	
-Cake, biscuit , sweets/chocolates	38.77	40.33	39.54	39.41	44.1	41.76	40.06	45.38	42.63	<0.001	
- Salty/fatty snacks	20.66	21.15	20.91	13.51	17.07	15.29	9.77	11.05	10.39	<0.001	
- Sugar-sweetened drinks	9.13	7.83	8.48	8.17	7.21	7.69	7.23	6.73	6.99	0.05	
- Fruits(fresh, juice, dried)	38.35	42.17	40.26	56.5	59.75	58.13	64.57	70.24	67.31	<0.001	
- Fresh or cooked vegetables	33.03	37.51	35.26	43.57	48.61	46.09	49.79	56.43	53.0	<0.001	
- Nuts	10.31	10.72	10.52	9.67	12.33	11.00	11.39	11.82	11.6	0.32	
Physical activity ¹											
-low(<2 times/week)	28.31	41.12	36.68	26.72	39.44	33.09	30.82	39.22	34.89		
-Moderate(2-4 times/week)	38.73	38.42	38.58	35.90	36.58	36.24	33.03	38.47	35.67	0.01	
-High (>4 times/week)	32.96	20.46	26.74	37.38	23.98	30.67	36.15	22.32	29.45		
TV watching ¹											
>2 h	46.28	44.76	45.52	51.38	52.36	51.87	55.1	51.83	53.52	<0.001	
Computer working ¹											
>2 h	6.1	3.19	4.64	12.27	6.93	9.59	17.36	10.79	14.18	<0.001	
Screen time ¹											
>4 h	11.42	7.47	9.45	21.77	15.53	18.65	31.4	22.21	26.96	<0.001	

¹Data are presented as percentage; *Compared according to the categories of family socioeconomic status.

Participants from families with better SES had higher level of sedentary lifestyle. PA level was not different based on family SES. In the entire population studied, consumption frequency of fruits, vegetables, milk, meat, rice, and dairy products was higher in those with better family SES, while they had lower daily consumption of salty/fatty snacks and potato ($P < 0.0.5$). Students with moderate and good family SES had lower level of mild PA and higher frequency of high level of PA than families with low SES ($P < 0.0.5$).

Discussion

In this nationwide study, which to the best of our knowledge is the first of its kind in the Middle East and North Africa, we compared the dietary and physical activity habits of children and adolescents according to the SES of the living region, as well as the SES of their families. We found that low level of PA and sedentary lifestyle were more prevalent in regions with higher SES. Although the students in regions with higher SES had healthier eating habits, some healthy dietary behaviors, such as low frequency of fast food consumption, were similar in regions with the lowest and highest SES. This can be due to higher nutritional knowledge in high SES region, and limited access and affordability for some fast foods in low SES regions.

Children of families with higher SES had healthier dietary habits, but more sedentary lifestyle than those with lower SES. Consumption of meat, dairy products, fruits, and vegetables was higher in families with higher SES, whereas the frequency consumption of salty snacks and sweet drinks was lower in children of families with higher SES.

Schoolchildren in rural area were more physically active, but had less healthy dietary habits than urban inhabitants. Some healthy dietary habits, including daily use of milk and low consumption of fast foods, were more frequent in rural areas. Differences between urban and rural areas were more significant in regions with lower SES.

Girls were less physically active and had longer duration of sedentary activities than boys. Daily use of fruits, vegetables, meat, salty/fatty snacks and sweets was more frequent in girls, whereas the consumption of fast food and sweet drinks was higher in boys. This pattern was found at national and subnational levels in regions with different SES. The latter might be due to greater access of boys to junk food through eating more out of home.

The lifestyle habits of students living in regions with low SES were similar to those of low SES families.

Eating habits and lifestyle pattern are multifactorial and influenced by a complex of individual, socioeconomic, cultural, biological and ecological factors.^{16,23} Thus, analyzing the dietary, PA and lifestyle patterns could provide valuable insight for planning action-oriented preventive programs.

In this nationwide study, we investigated the role of both regional and familial SES on dietary and PA patterns of schoolchildren, whereas most previous studies have considered either the SES of the living area or that of family.^{17,19,24,25}

Although the definition of SES used in different is was not similar and various number of indicators have been used, a general agreement exists on the fact that lifestyle characteristics, SES and its determinants as family income, parental education and occupation have significant effects on children's dietary habits and lifestyles.²⁶ In the Nord-Trøndelag Health Study (HUNT)

study, the association between parental SES and adolescents' health-related dietary habits were investigated. Accordingly, parental educational level, especially mother's education, had the highest impact on adolescents' healthier dietary habits, but family income did not show any significant gradients in this regard.²⁷

Some studies have reported that higher SES is associated with healthy dietary habit and higher PA level, and sedentary behavior is associated with low parental education and family income.^{17,18}

Our findings are consistent with a study conducted in eight European cities, the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study, which indicated that schoolchildren with higher educated parents were more likely to have healthy eating habits, low PA and low sedentary behavior.¹⁹

A few studies have not documented a significant relationship between SES and healthy dietary and lifestyle habits.^{24,25} A study that evaluated the influence of individual- and area-level measures of SES in unhealthy eating and physical inactivity among Canadian adolescents indicated that the area-level SES had a modest association with unhealthy eating habits, but not with physical inactivity. Individual SES was positively associated with physical inactivity. It concluded that area-level SES is a weak predictor for unhealthy eating and physical inactivity compared to individual SES.²⁸

A review on the associations between SES and health behaviors during adolescence indicated that efforts to curb poor diet and inactivity are more prevalent among low SES adolescents.²⁹

In a previous survey of the current surveillance program, we found that lower parental education was associated with unhealthy diet and physical inactivity in their children.³⁰

The present study showed that 34.1% of students had low PA level, with boys being more active than girls. High level of PA was more frequent in regions with better SES, whereas students of families with better SES had more physical activity than those with low SES. We did not find any significant difference in PA level based on living in rural or urban area.

Comparison of our findings with other studies should be made with caution because different methods have been used for definition of lifestyle habits in various studies. Nevertheless, making a comparative estimate according to health-enhancing PA recommendations,³¹ it seems that PA levels are higher in European countries than developing countries including Iran.³² However, it is reported that American children and adolescents have low PA level.³³ Previous regional studies in Iran also showed high prevalence of physical inactivity among children and adolescents.^{34,35}

Higher rate of PA with vigorous intensity in boys has been reported in many previous studies. The findings were explained differently according to different cultures and social conditions of the communities.³⁶⁻³⁸

The higher physical inactivity in girls in our studied population may be due to cultural and environmental barriers including: culture, societal norms, attitudes, built environment and climate.

In the current study, half of our studied population reported to watch TV more than two hours a day. The frequency of watching TV more than 2 hours a day was not different between girls and boys. It was significantly higher in both families and regions with higher SES. Moreover in the present study, the frequencies of leisure time computer working more than 2 hours a day and screen time more than 4 hours a day were 9.6% and 18.62%, respectively. Both categories were significantly higher in boys

than girls and in urban than rural populations. The rates were higher in schoolchildren with higher SES. They were lowest in the Southeast region, with low SES, but were not significantly different between the other three regions.

It seems that these technologies should be used in a way to reduce their related non-desirable effects and more active computer game or educational TV programs should be encouraged.

The total daily consumption of fast foods in the current study was 2.85%. The rate was higher in schoolchildren with lower SES. In sub-national regions, it was lowest in low SES area and highest in regions with highest SES.

Although in comparison with other countries,^{36,39} this frequency is not high in our community, its increasing rate should be prevented.

The reported daily use of fresh fruits and vegetables in this study was 55.7% and 35.7%, respectively. These frequencies were higher in individuals with higher family and regional SES. The rate was significantly lower in the southeast, with low SES, than in the other three regions.

Our results regarding daily fruits and vegetables consumption were similar to reports from Turkey, Kingdom of Tonga and Europe³⁹⁻⁴¹ and was higher than that reported from Saudi Arabia.³⁶ Our results were similar to the findings of HUNT study.²⁷

Daily use of milk was reported in 46.0% of schoolchildren and dairy products in 63.25% of population.

It seems that daily consumption of milk and its products is low in our school children. According to the recommendation of Dietary Guidelines Advisory Committee Report, daily use of these products should be promoted.⁴² It is documented that adequate use of dairy products helps children and adolescents to provide their nutrient requirements and to improve their overall diet quality. A lower intake of dairy products is associated with increased risk of CVD, type 2 diabetes, poor bone health and other metabolic disorders.⁴³

Daily use of bread and rice was significantly high (97.2% and 71.5%, respectively). Daily use of bread was high in all studied populations regardless of their SES, but daily rice consumption was higher in students with high family and regional SES.

Overall, daily use of sugar-sweetened drinks and artificial juice was 28%. It was lower in students with low family and regional SES.

Daily use of cake, biscuit, sweets /chocolates was reported to be 34.1%. The rate had decreasing trend in higher SES regions.

Our results regarding soft drink use and sweets were similar to HUNT study.²⁷

Total daily use of salty/fat snacks was 12.9%. It was lower in families with higher SES. The lowest rate in subnational regions was seen in the northeast region and highest in the southeast.

Daily use of meat was 33.7% in the total population with a higher frequency in individuals with high familial and regional SES.

Study limitations and strengths

The main limitation of this study is its cross-sectional nature. The other limitation is using self-reported data for dietary and PA habits. Although the validity and reliability of the questionnaire was examined, it seems that factors such as recall bias, response bias and under- or over reporting might influence the records.

The strength of this study, which might overcome its limitations, was its nationwide coverage, large sample size, and comparisons made for different SES levels at familial and regional levels

In conclusion, this study provided background information indicating a considerably high prevalence of sedentary lifestyle and some unhealthy dietary habits among Iranian children and adolescents. In general, the PA level was low, whereas the daily ST was high. Physical inactivity was more prominent in girls whereas leisure time computer working and ST were more prominent in boys. The most important unhealthy dietary habits were high consumption of carbohydrates, sweets, soft drinks, and fast foods as well as low intake of milk, fruits and vegetables. Unhealthy dietary habits were more prevalent in boys and in students with low familial and regional SES. Both families and regions with higher SES had better dietary habits but more sedentary lifestyle than their other counterparts.

Both family and regional SES have impact on lifestyle pattern from early life. Socioeconomic disparities should be considered for public health interventions aiming to improve lifestyle habits.

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Authors' Contribution

All authors contributed to the study concept and design; conduct, drafting the manuscript, its revision and approving the final draft of the paper. All authors have assisted in preparation of the first draft of the manuscript or revising it critically for important intellectual content. All authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work. All authors accept the responsibility of the paper content.

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References

1. Alwan A, Maclean D. A review of noncommunicable diseases in low- and middle-income countries. *Int Health*. 2009; 1(1): 3 – 9.
2. Craigie AM, Lake AA, Kelly SA, Adamson AJ, Mathers JC. Tracking of obesity-related behaviours from childhood to adulthood: A systematic review. *Maturitas*. 2011; 70(3): 266 – 284.
3. Lake AA, Mathers JC, Rugg-Gunn AJ, Adamson AJ. Longitudinal change in food habits between adolescence (11–12 years) and adulthood (32–33years): the ASH30 study. *J Public Health (Oxf)*. 2006; 28(1): 10 – 16.
4. The World Health Report 2002: Reducing Risks, Promoting Healthy Life; World Health Organization: Geneva, Switzerland; 2002.
5. Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Advisory Committee Report; U.S. Department of Health and Human Services: Washington, DC, USA, 2008. *Int J Environ Res Public Health*. 2012; 9: 1504.
6. Currie C, Gabhainn SN, Godeau E, Roberts C, Smith R, Currie D, et al. Inequalities in young people's health: HBSC international report

- from 2005/2006 survey: Health Policy for Children and Adolescents. Volume 5. World Health Organization Regional Office for Europe; 2008: 208.
7. Collision KS, Zaidi MZ, Subhani SN, Al-Rubeaan K, Shoukri M, Al-Mohanna FA. Sugar-sweetened carbonated beverage consumption correlates with BMI, waist circumference, and poor dietary choices in school children. *BMC Public Health*. 2010; 10: 234.
 8. Mikki N, Abdul-Rahim HF, Shi Z, Holmboe-Ottesen G. Dietary habits of Palestinian adolescents and associated sociodemographic characteristics in Ramallah, Nablus and Hebron governorates. *Public Health Nutr*. 2010, 13(9): 1419 – 1429.
 9. Kilani H, Al-Hazzaa H, Waly MI, Musaiger A. Lifestyle Habits: Diet, physical activity and sleep duration among Omani adolescents. *Sultan Qaboos Univ Med J*. 2013; 13(4): 510 – 519.
 10. Leech RM, McNaughton SA, Timperio A. The clustering of diet, physical activity and sedentary behaviour in children and adolescents: a review. *Int J Behav Nutr Phys Act*. 2014; 11: 4.
 11. Gubbels JS, van Assema P, Kremers SP. Physical Activity, Sedentary Behaviour, and Dietary Patterns among Children. *Curr Nutr Rep*. 2013; 2(2): 105 – 112.
 12. Pearson N, Biddle SJ. Sedentary behaviour and dietary intake in children, adolescents, and adults. A systematic review. *Am J Prev Med*. 2011; 41(2): 178 – 188.
 13. Pronk NP, Anderson LH, Crain AL, Martinson BC, O'Connor PJ, Sherwood NE, Whitebird RR. Meeting recommendations for multiple healthy lifestyle factors-Prevalence, clustering, and predictors among adolescent, adult, and senior health plan members. *Am J Prev Med*. 2004, 27(2 Suppl): 25 – 33.
 14. Sanchez A, Norman GJ, Sallis JF, Calfas KJ, Cella J, Patrick K. Patterns and correlates of physical activity and nutrition behaviours in adolescents. *Am J Prev Med*. 2007; 32(2): 124 – 130.
 15. Musaiger AO, Al-Hazzaa HM. Prevalence and risk factors associated with nutrition-related noncommunicable diseases in the Eastern Mediterranean region. *Int J Gen Med*. 2012;5:199-217.
 16. Kittler PG, Sucher KP. Food and culture in America: a nutritional handbook. 2nd ed. West/Wadsworth; 1998
 17. Boone-Heinonen J, Gordon-Larsen P, Adair LS. Obesogenic clusters: multidimensional adolescent obesity-related behaviours in the U.S. *Ann Behav Med*. 2008 ;36(3):217-30.
 18. Liu J, Kim J, Colabianchi N, Ortaglia A, Pate RR. Co-varying patterns of physical activity and sedentary behaviours and their long-term maintenance among adolescents. *J Phys Act Health*. 2010 ;7(4):465-74.
 19. Ottevaere C, Huybrechts I, Benser J, De Bourdeaudhuij I, Cuenca-Garcia M, Dallongeville J, et al. Clustering patterns of physical activity, sedentary and dietary behaviour among European adolescents: The HELENA study. *BMC Public Health*. 2011; 11: 328.
 20. Kelishadi R, Ardalan G, Qorbani M, Ataie-Jafari A, Bahreynian M, Taslimi M, et al. Methodology and early findings of the fourth survey of childhood and adolescence surveillance and prevention of adult non-communicable disease in Iran: The CASPIAN-IV study. *Int J Prev Med*. 2013; 4(12): 1451 – 1460.
 21. Kelishadi R, Majdzadeh R, Motlagh ME, Heshmat R, Aminae T, Ardalan G, et al. Development and Evaluation of a Questionnaire for Assessment of Determinants of Weight Disorders among Children and Adolescents: The Caspian-IV Study. *Int J Prev Med*. 2012; 3(10): 699 – 705.
 22. Farzadfar F, Danaei G, Namdaritabar H, Rajaratnam JK, Marcus JR, Khosravi A, et al. National and subnational mortality effects of metabolic risk factors and smoking in Iran: a comparative risk assessment. *Popul Health Metr*. 2011; 9(1): 55.
 23. Caprio S, Daniels SR, Drenowski A, Kaufman FR, Palinkas LA, Rosenbloom AL, et al. Influence of race, ethnicity, and culture on childhood obesity: implications for prevention and treatment. *Obesity (Silver Spring)*. 2008; 16(12): 2566 – 2577
 24. Vereecken C, Inchley J, Subramanian S, Hublet A, Maes L. The relative influence of individual and contextual socioeconomic status on consumption of fruit and soft drinks among adolescents in Europe. *Eur J Public Health*. 2005; 15(5): 224 – 232.
 25. Kourlaba G, Panagiotakos DB, Mihos K, Alevizos A, Marayiannis K, Mariolis A. Dietary patterns in relation to socio-economic and lifestyle characteristics among Greek adolescents: a multivariate analysis. *Public Health Nutr*. 2009; 12(2): 1366 – 1372.
 26. Shavers VL. Measurement of socioeconomic status in health disparities research. *J Natl Med Assoc*. 2007; 99(9): 1013 – 1023.
 27. Nilsen SM, Krokstad S, Holmen TL, Westin S. Adolescents' health-related dietary patterns by parental socio-economic position, the Nord-Trøndelag Health Study (HUNT). *Eur J Public Health*. 2010; 20(3): 299 – 305.
 28. Janssen I, Boyce WF, Simpson K, Pickett W. Influence of individual- and area-level measures of socioeconomic status on obesity, unhealthy eating, and physical inactivity in Canadian adolescents. *Am J Clin Nutr*. 2006; 83(1): 139 – 145.
 29. Hanson MD, Chen E. Socioeconomic status and health behaviours in adolescence: a review of the literature. *J Behav Med*. 2007; 30(3): 263 – 285.
 30. Kelishadi R, Gouya MM, Adeli K, Ardalan G, Gheiratmand R, Majdzadeh R, et al. Factors associated with the metabolic syndrome in a national sample of youths: CASPIAN Study. *Nutr Metab Cardiovasc Dis*. 2008; 18(7): 461 – 470.
 31. Riddoch CJ, Bo Andersen L, Wedderkopp N, Harro M, Klasson-Heggebo L, Sardinha LB. Physical activity levels and patterns of 9- and 15-yr-old European children. *Med Sci Sports Exerc*. 2004; 36(1): 86 – 92.
 32. Kelishadi R, Ardalan G, Gheiratmand R, Gouya MM, Razaghi EM, Delavari A, et al. Association of physical activity and dietary behaviours in relation to the body mass index in a national sample of Iranian children and adolescents: CASPIAN Study. *Bull World Health Organ*. 2007; 85(1): 19 – 26.
 33. Eaton DK, Kann L, Kinchen S, Shanklin S, Ross J, Hawkins J. Centers for Disease Control and Prevention (CDC). Youth risk behaviour surveillance - United States, 2009. *MMWR Surveill Summ*. 2010; 59(5): 1 – 142.
 34. Ziaee V, Kelishadi R, Ardalan G, Gheiratmand R, Majdzadeh SR, Monazzam MM. Physical activity in Iranian students: caspian study. *Iran Pediat J*. 2006; 16: 157 – 164.
 35. Shokrvash B, Majlessi F, Montazeri A, Nedjat S, Rahimi A, Djazayeri A, et al. Correlates of physical activity in adolescence: a study from a developing country. *Glob Health Action*. 2013; 6: 20327.
 36. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Physical activity, sedentary behaviours and dietary habits among Saudi adolescents relative to age, gender and region. *Int J Behav Nutr Phys Act*. 2011; 8: 140.
 37. Allafi A, Al-Haifi AR, Al-Fayez MA, Al-Athari BI, Al-Ajmi FA, Al-Hazzaa HM, et al. Physical activity, sedentary behaviours and dietary habits among Kuwaiti adolescents: gender differences. *Public Health Nutr*. 2013; 17(9): 1 – 8.
 38. Al-Nakeeb Y, Lyons M, Collins P, Al-Nuaim A, Al-Hazzaa H, Duncan MJ, et al. Obesity, Physical Activity and Sedentary Behaviour Amongst British and Saudi Youth: A Cross-Cultural Study. *Int J Environ Res Public Health*. 2012; 9(4): 1490 – 1506.
 39. Smith BJ, Phongsavan P, Havea D, Halavatau V, Chey T. Body mass index, physical activity and dietary behaviours among adolescents in the Kingdom of Tonga. *Public Health Nutr*. 2007; 10(2): 137 – 144.
 40. Akman M, Akan H, Izbirak G, Tanriöver Ö, Tilev SM, Yildiz A, et al. Eating patterns of Turkish adolescents: a cross-sectional survey. *Nutr J*. 2010; 9: 67.
 41. Vereecken C, Inchley J, Subramanian S, Hublet A, Maes L. The relative influence of individual and contextual socioeconomic status on consumption of fruit and soft drinks among adolescents in Europe. *Eur J Pub Health*. 2005; 15: 224 – 232.
 42. Van Horn L; 2010 Dietary Guidelines Advisory Committee. Development of the 2010 US Dietary Guidelines Advisory Committee Report: perspectives from a registered dietitian. *J Am Diet Assoc*. 2010; 110(11): 1638 – 1645.
 43. Gidding SS, Dennison BA, Birch LL, Daniels SR, Gillman MW, Lichtenstein AH, et al. Dietary recommendations for children and adolescents: a guide for practitioners: consensus statement from the American Heart Association. *Circulation*. 2005; 112(13): 2061 – 2075.