http:// ijp.mums.ac.ir
Original Article (Pages: 1505-1517)

Association of Dietary Behaviors with Physical Activity in a Nationally Representative Sample of Children and Adolescents: the CASPIAN- IV Study

Saeid Safiri[1], Roya Kelishadi[2], *Mostafa Qorbani [3,4], Razieh Lotfi[5], Shirin Djalalinia[6,7], Delara Salehifar[8], Mohammad Esmaeil Motlagh[9], Gelayol Ardalan[2], Morteza Mansourian[10], Hamid Asayesh[11], *Ramin Heshmat [4]

[1]Managerial Epidemiology Research Center, Department of Public Health, School of Nursing and Midwifery, Maragheh University of Medical Sciences, Maragheh, Iran. [2]Department of Pediatrics, Child Growth and Development Research Center, Research Institute for Primordial Prevention of Non-communicable Disease, Isfahan University of Medical Sciences, Isfahan, Iran. [3]Department of Community Medicine, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran. [4]Chronic Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran.[5]Department of Midwifery and Reproductive Health, School of Nursing and Midwifery, Alborz University of Medical Science, Karaj, Iran. [6]Non-Communicable Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran. [7]Development of Research & Technology Center, Deputy of Research and Technology, Ministry of Health and Medical Education, Tehran, Iran. [8]Student Research Committee, Alborz University of Medical Science, Karaj, Iran. [9]Department of Pediatrics, Ahvaz University of Medical Sciences, Ahvaz, Iran. [10]Department of Health Education and Promotion, School of health, Iran University of Medical Sciences, Tehran, Iran. [11]Department of Medical Emergencies, Qom University of Medical Sciences, Qom, Iran.

Abstract

***Background*:** Nutritional health and adequate physical activity (PA), especially in childhood and grow periods, have a substantial role in health. This study assessed the association of dietary behaviors (main courses and snacks intake) with PA in children and adolescents.

***Materials and Methods*:** Using multistage random cluster sampling method, a representative sample of 14,880 school students were selected from urban and rural areas of 30 provinces of Iran. Through a validated questionnaire, daily consumption of main course (breakfast, lunch, and dinner) as well as daily consumption of different snacks and health foods (fast foods, milk, vegetables, dry fruits, fresh fruits, sweetened beverages, salty snacks and sweets) were recorded for every participants. Information of past week weekly frequency of leisure time PA was collected.

***Results*:** Overall, 13,486 out of 14,880 students (response rate: 90.6%) participated in this survey. Participants consisted of 6,640 (49.2%) girls and 75.6% urban residents; their mean and standard deviation (SD) age was 12.47 (3.36) years. Daily consumption of fresh fruits (odds ratio [OR]: 1.35, 95%confidence interval [CI]: 1.20-1.52), dried fruits (OR: 1.21; 95%CI: 1.06-1.40), vegetable (OR: 1.39; 95% CI: 1.24-1.56), and milk (OR: 1.35; 95% CI: 1.21-1.52) increased the odds of high PA compare to low PA in adjusted model. Skipping the breakfast, lunch and dinner decreased the odds of moderate and high PA compare to low PA ($P<0.05$).

***Conclusion*:** Present study showed that dietary behaviors are associated with PA level in Iranian adolescents. Findings should be used for better evidence based planning of health promotional programs in these age groups.

***Key Words*:** Adolescents, Nutrition status, Physical activity, Snacks.

*Please cite this article as: Safiri S, Kelishadi R, Qorbani M, Lotfi R, Djalalinia Sh, Salehifar D, et al. Dietary Behaviors with Physical Activity in a Nationally Representative Sample of Children and Adolescents: the CASPIAN- IV Study. Int J Pediatr 2016; 4(3): 1505-1517.

* ***Corresponding Authors:***
Mostafa Qorbani & Ramin Heshmat, School of Medicine, Alborz University of Medical Sciences, Baghestan, Boulevard, 31485/56, Karaj, Iran; & EMRI, Dr Shariati Hospital, North Karegar St, Tehran 14114, Iran.
Email: rheshmat@tums.ac.ir & mqorbani1379@yahoo.com
Received date: Dec 11, 2015; Accepted date: Feb 15, 2016

1- INTRODUCTION

It is well known that healthy eating and regular physical activity (PA) play a substantial role in preventing chronic diseases, including cardiovascular disease, cancer, and stroke, the three leading causes of death among adults aged 18 years and more (1, 2). Adolescence is a period that the need for food increases and tendency to PA decreases (3) and also dietary habits, PA and some anthropometric characteristics track to adulthood (4). In the past two decades, PA has decreased during both childhood and adolescence (5). Over-weight and obesity in most individuals result from excessive energy consumption and/or inadequate PA (6).

Dietary and PA behaviors of children and adolescents are influenced by many diverse factors, including; genetic and personal, cultural, socioeconomic, and environmental (2). Notable from these is consumption of the main courses especially breakfast (7-9).

Breakfast is often considered to be the most important meal of the day and skipping breakfast is related to overweight and obesity (10). Evidence suggests that breakfast consumption may improve cognitive function related to memory, test grades, and school attendance (11). Systematic review of observational studies found that breakfast consumption was associated with a reduced risk of obesity and a reduced body mass index (BMI) in children and adolescents (9). Skipping breakfast leads to the consumption of the more high-fat snacks later in the day (7). However not all studies associated breakfast skipping with overweight (12). A review study concluded that they who ate more frequently had a higher total energy intake, but were less likely to be overweight than those who skip breakfast (7). It seems that breakfast intake may not solely influence body weight via energy intake, but also through balancing in calorie expenditure. Those who have un-healthy diet and skip breakfast may also do little PA. One reason for this can be in regard to lethargy and apathy due to skipping breakfast or main course food that could have an effect on tendency to PA through the day.

Some studies suggest that PA appears to play an important role in other lifestyle related behaviors, with active adolescent more likely to engage in healthy dietary behavior than their inactive peers (3). Considering the importance of problem, there is an evident gap in practical knowledge and conducted studies in Iran. This study aimed to investigate the association of dietary behaviors (main courses and snacks intake) with PA in children and adolescents.

2- MATERIALS AND METHODS

Present study has been extracted from the results of fourth national survey of "Childhood and Adolescence Surveillance and Prevention of Adult Non-communicable Disease" (CASPIAN-IV, 2011-2012). Methodological protocols and overall views have been described before (5), and here we only point to essentials in brief.

2-1. Sampling

To assess the association of main courses and snacks intake of Iranian children and adolescents with their PA, data of 13,486 students aged 6-18 years who were selected through multistage, cluster sampling method from rural and urban areas of the of 30 provinces of Iran were analyzed. The information bank of Ministry of Education considered as the base of stratification of schools then target schools were selected randomly.

2-2. Data gathering

With participation of trained teams of expert health care providers all processes of examinations and inquiry follow under standard protocols of World Health

Organization-global school-based student health survey (13, 14). Reliable and validated questionnaires were completed for all of participants. The score of content validity of questionnaire was 0.75. Cronbach's alpha coefficient of the whole questionnaires was 0.97, and the Pearson correlation coefficient of the test-retest phase was 0.94 which confirmed reliability of questionnaires. Aim to assess to the highest data quality in multi-center data gathering, all of different processes of quality assurance were exactly supervised by Data and Safety Monitoring Board (DSMB)(5).

2-3. Definition of terms

2-3-1. Demographic information

Through an interview with parents or child, demographic information, including; age, gender, residence area, family based characteristics, parental level of education, possessing a family private car , type of home and, etc. asked from all participants. Some complementary information on screen time, PA was also questioned.

2-3-2. Physical activity

Through a validated questionnaire, information of past week weekly frequency of leisure time PA outside the school was collected (15). Having PA considered as at least 30 minutes duration of exercises per day which was led to heavy sweating or large increases in breathing or heart rate. Based on this provided definition, participants described their weekly PA habits through three available response choices as follow; none, 1-2 days, 3-6 days, and every day. For statistical analysis, each weekly frequency categorized into three groups; less than two times per week (Low), two to four times a week (Moderate) and more than 4 times a week (High)(16).

2-3-3. Main courses and snacks intake

Daily consumption of main course including; breakfast, lunch, and dinner as well as daily consumption of different snacks including; fast foods, milk, vegetables, dry fruits, fresh fruits, sweetened beverages, salty snacks and sweets were recorded for every participants. Foods with high nutritional value including fresh fruits, dried fruits, vegetables and milk components were considered as healthy-food and foods with a high content of sugar, salt, saturated fats and trans-fats and low content of nutrients were placed in the junk food groups. Accordingly, junk food was categorized into four groups, including salty snacks (chips, cheese curls, popcorn, and pretzels), sweets (biscuits, cookies, cakes, chocolate, and candies), sweetened beverages (soda, soft drinks), and fast foods (hot dogs, hamburgers, cheeseburgers, fried chicken, and pizza) (17). Main course (breakfast, lunch, and dinner) frequency was categorized as skippers (eating 0-2 days/week), and non-skippers (eating breakfast 3-7 days/week).

2-3-4. Socio-economic status (SES)

The method and variables, which was used for calculating SES was approved previously in the progress in the International Reading Literacy Study (PIRLS) (18). In this study, in order to construct socioeconomic using principle component analysis (PCA) variables including parents' education, parents' job, possessing private car, school type (public/private), type of home (private/rented) and having personal computer in home were summarized in one main component. Using 25% and 75% percentiles, students were categorized into low, intermediate and high socioeconomic status.

2-3-5. Anthropometric measurements

A team of trained health care professionals and physicians conducted the physical examination under standard protocols by

using calibrated instruments. The weight measured in light clothing to the nearest 0.1 kg on a SECA digital weighing scale (SECA, Germany). Height was measured without shoes to the nearest 0.1 cm while the students were standing and the shoulders were in normal position. Body mass index was calculated as weight (kg) divided by height squared (m2) (14, 19).

Waist circumference (WC) was measured by a no elastic tape to the nearest 0.2 cm at the end of expiration at the midpoint between the top of iliac crest and the lowest rib in standing position. We used the WHO growth curves to define BMI categories, i.e., underweight as age and sex-specific BMI < 5^{th}, over-weight as sex-specific BMI 85^{th}-95^{th}, and obesity as sex-specific BMI>95^{th}. Abdominal obesity was considered as WC to height ratio more than 0.5 (5, 19, 20).

2-3-6. Screen Time (ST)

To assess the ST behaviors, the average number of hours per day that participants spent watching television or Video CDs (TV/VCDs), personal computer (PC), or electronic games (EG) asked, and then the total cumulative spent time for ST was estimated. Information recorded separately for week days and weekends. The analysis of correlates of ST, according to the international ST recommendations, ST was categorized into two groups; less than 2 hours per day (Low) , and 2 hours per day or more (High) (21, 22).

2-3-7. Ethical considerations

The study protocol was reviewed and approved by Ethics Committees of Isfahan and Tehran University of Medical Sciences. Participation in study was voluntary. After compete explaining the study aims and protocols, written consent from students and verbal assent were obtained from parents.

2-3-8. Statistical analysis

Continuous and categorical variables are expressed as mean (standard deviation) and number (percentage) respectively. Association of continuous variables across PA was assessed using one way ANOVA test. Associations of snack and meal consumption according to PA were assessed using Chi- square test. Multi-nominal logistic regression was used to assess the association of snack and meal consumption as independent variables with PA (dependent variable). These associations were assessed in three different modeling approaches; without adjusting (crude models), adjusting for age, gender, living area, ST and SES, and additionally adjusting for BMI.

Statistical measures were assessed using survey data analysis methods in the Stata version 11.1 (Stata Corporation, College Station, TX, USA). P<0.05 was considered as statistically significant.

3- RESULTS

Through present study, 13,486 participants (50.8%, boys) out of total 14,880 selected students invited completed all required data of study (participation rate: 90.6%).The average age was 12.47 ±3.36 years, without any significant difference between girls and boys. Regarding the resident area 75.6% of participants were to urban areas. Characteristics of participants according to the PA categories have been shown in (Table.1). Anthropometric measures including; height, weight, BMI and WC were significantly higher in low PA category (P<0.05). In 6-10 and 10-14 age ranges, most of children and adolescents had moderate PA. In 14-18 age group significantly majority of participants had low PA (P<0.05). There was also a significant difference between the levels of PA in two genders; so the boys significantly had more PA than the girls. They mostly had moderate (% 35.62) or high (% 35.62) levels of PA, whereas

39.61% of girls had low PA (P<0.05). There was no significant association between living area, ST, weight status, abdominal obesity, SES and PA categories. Analysis of independent variables showed that; daily consumption of fresh fruits, vegetables, and milk have significantly higher in the boys with high PA groups (P<0.05). Consumption of milk had a significant difference between nondaily and daily consumption groups. The girls with daily consumption of milk mostly (39.39%) had moderate PA whereas in non-daily consumption group 44.24% had low PA (P<0.05). Frequency of snack and meal consumption according to PA and gender, have been presented in (Table.2).

Results showed the boys had a significant difference in PA, between who were categorized in non-skipper/ skipper breakfast intake. Most of non-skippers (37%) had high PA whereas most of skippers were in low PA group (34.85%), (P<0.05). In the girls, for both categories of non-skipper/ skipper breakfast intake, most of participants, respectively with 39.54% and 35.15%, had moderate PA (P<0.05).

Regarding the lunch intake; 36.71% of non-skippers boys had high PA whereas 43.03% of skippers were in low PA category (P<0.05). In non-skippers girls 38.53% had moderate PA and from skippers 51.91% had low PA (P<0.05).

Dinner intake had also significant difference between non-skippers and skippers in two gender (P<0.001). It was estimated that 36.1% of non-skipper boys had moderate PA while 35.93% of skippers were in low group of PA. In the girls, these were 38.62% and 47.21respectively in moderate and low categories of PA.

Results of multi-nominal logistic regression model are presented in (Table.3). Daily consumption of sweet decreased the odds of moderate PA compare to low PA in crude [Odds ratio (OR): 0.89 (95% Confidence interval, CI: 0.81-0.98)] and adjusted model [OR: 0.90 (95%CI: 0.81-0.99)] (P<0.05). Similarly, daily salty snack consumption decreased the odds of moderate PA compare to low PA (P<0.05). For intake of main courses of lunch and dinner in the same manner children and adolescents with low intake, had decreased odds of moderate PA compare to low PA (P<0.05); whereas, intake of vegetable, milk had follow inverse patterns (P<0.05).

Daily consumption of fresh fruits (OR: 1.35, 95%CI: 1.20-1.52), dried fruits (OR: 1.21; 95%CI: 1.06-1.40), vegetable (OR: 1.39; 95% CI: 1.24-1.56), and milk (OR: 1.35; 95% CI: 1.21-1.52) increased the odds of high PA compare to low PA in adjusted model. At the same comparison, skipping the breakfast, lunch and dinner decreased the odds of moderate and high PA compare to low PA (P<0.05).

4- DISCUSSION

This study determined the association of dietary behaviors (main courses and snacks intake) with PA in children and adolescents as a part of a larger study entitled the CASPIAN- IV. There are few studies that have considered dietary behaviors (main courses and snacks intake) related to PA.

The results suggest that dietary behaviors are associated with PA level in Iranian adolescents. Indeed PA levels had significant relationships with the frequency of consumption of all food groups except for sugar-sweetened beverages (SSBs) and fast foods. Our finding is consistent with other studies, showing that less frequent breakfast consumption was significantly associated with lower PA (3, 10). However, there was a significant difference between the levels of PA in two genders; boy significantly had more PA

than girls especially in high activities. It is supported by previous studies that male adolescents were significantly more active than females even in different cultures (3, 23). Female gender is the most contributing factors to low level of PA in adolescents in Iran (24), and it seems that environmental issues can influence on girls more than boys by limiting their activity in community due to cultural factors. So, low levels of PA is a great concern because of the relationship between inactivity with increased cardiovascular and metabolic risk factors in adolescents (2).

As many researchers suggested, there are interactions between the level of PA and dietary habits(19, 25). Daily consumption of fresh fruits, vegetables, and milk was significantly higher in boys with high PA groups. This is consistent with other studies showing association of healthy diet and PA in adolescents (3, 10, 23), but contrary with Klesges et al., which showed a negative relationship between milk consumption and PA (26). Because of the importance of daily consumption of dairy products, fruits and vegetables and its adverse association with obesity(19), it needs more attention to promote healthy lifestyle of adolescents especially girls. The present study showed a positive relationship between daily consumption of milk, vegetables, fresh and dried fruits, and PA among girls.

It is argued that skipping breakfast is related to over-weight and obesity in adolescents (9). We also found that consumption of the main courses was associated with increased activity in both boys and girls. This is consistent with the study of Arora et al., and Duncan et al., that showed that the most active adolescents had generally healthier dietary habits than the inactive adolescents (3, 10). Although in a study there were no associations between breakfast eating and PA in boys, but for girls, less frequent breakfast consumption was significantly associated with lower PA(7).

Consumption of sweet was related to the level of PA in the girls and consumption of salty snack was related to PA in the boys. In general intake of daily snack in high in Iranian adolescents (19) and this may be related to increased time the children spend on screen such as television or games. Public health should be combat to unhealthy diet in community from childhood to achieve more efficacy (19). National control of advertisement in media may help to prevent high desire to eat junk food. The prevalence of over-weight and obesity among breakfast skippers were higher than non-skippers counterparts (8). Our study revealed that most active boys were non skipper of breakfast intake, but in the girls for both categories of non-skipper/ skipper breakfast intake, most of the participants had moderate PA. This result is supported by another study that showed breakfast consumption was associated with greater PA for boys (10). Education in term of importance of breakfast eating is a desirable matter and should be implemented for children, adolescents and their parents to promote healthier behavior. Also providing healthy festivals in schools especially in female schools to persuade children may work. Recommendations for the introduction of school breakfast programs are suggested to formation healthy habits.

As the other studies documented (3, 27), over-weight and obesity were related to lower PA in the present study. Anthropometric measures including; BMI and WC were significantly higher in low PA category, too. In term of lunch intake, there was significant difference between skipper / non skippers boys about PA. Lunch non-skipper boys had, more high physical activity compare to skippers. In both genders, dinner non skippers had more PA compare to skippers. Adolescence may be an important

occasion to fix health related behaviors and habits. In general, the most active adolescents had healthier dietary behaviors than those with moderate and low PA levels, except for the consumption of fast foods and sweetened beverages. The availability of these products may be a reason for more consumption. However, TV advertisements may lead to more consumption of these foods even in those with lower level of PA.

For intake of main courses of lunch and dinner, children and adolescents with moderate PA had low intake than participants with low, whereas intake of vegetable and milk had follow inverse patterns. Overall, we found a reverse relation between level of PA and daily consumption of salty snack and sweet in adolescents. The more PA was association with less harmful productions and more consumption of fresh fruit, dried fruits, vegetables and milk. These results are consistent with results of other researchers, that found that exercise was positively correlated with fruit, vegetable and cereal intake in both genders (23, 25).

5-1. Strengths

High number of sample size and participating adolescents from across the country can be considered the strength of the present study.

5-2. Limitation

The main limitation of present study was cross-sectional nature of study, which precludes the casual inference. In addition the potential recall bias of dietary intakes due to the retrospective data collection might occur. However, to the best of our knowledge, this is the first study in the Middle East and North Africa region (MENA) to evaluate association of main course and snacks intake with PA in a large representative sample of Iranian children and adolescents.

6- CONCLUSION

Present study showed that dietary behaviors are associated with PA level in Iranian adolescents. Indeed PA levels had significant relationships with the frequency of consumption of all food groups except for sweetened beverages and fast foods. Future population levels interventions are needed focusing on nutritional health and PA in the population of children and adolescents. Considering the features of the present study, finding should be used for better evidence based planning of health promotional programs in these age groups.

7- ABBREVIATIONS

- CASPIAN Study: Childhood and Adolescence Surveillance and Prevention of Adult Non-communicable Disease;
- PA: Physical activity;
- SES: Socioeconomic status;
- PCA: Principal component analysis;
- DSMB: Data and Safety Monitoring Board;
- PIRLS: Progress in the International Reading Literacy Study;
- WC: Waist circumference;
- BMI: Body Mass Index;
- CI: Confidence interval.

8- AUTHORS' CONTRIBUTIONS

RK, RH, MEM, GA, and MQ conceived the study design and wrote the study protocol. SS, RK,
RH, HA, RL, SD, DS, HA, and MQ Analyzed and interpreted the data. SS, RK, RH, RL, DS and
MQ have been involved in drafting the manuscript or revising it critically for important intellectual content. All authors have given final approval of the version to be published.

9- COMPETING OF INTERESTS: The authors declare that they have no competing interests

10- ACKNOWLEDGMENTS

This nationwide survey was conducted in Iran with corporation of the Ministry of Health and Medical education, Ministry of Education and Training, Child Health Promotion Research Center, Isfahan University of Medical Sciences, and Endocrinology and Metabolism Research Institute of Tehran University of Medical Sciences.

11-REFERENCES

1. Dietary Guidelines Advisory Committee. Report of the Dietary Guidelines Advisory Committee on the dietary guidelines for Americans, 2010, to the Secretary of Agriculture and the Secretary of Health and Human Services. Washington, DC: US Department of Agriculture, Agricultural Research Service; 2010.
2. School health guidelines to promote healthy eating and physical activity. MMWR Recomm Rep 2011;60(RR-5):1-76.
3. Duncan MJ, Al-Hazzaa HM, Al-Nakeeb Y, Al-Sobayel HI, Abahussain NA, Musaiger AO, et al. Anthropometric and lifestyle characteristics of active and inactive Saudi and British adolescents. Am J Hum Biol 2014; 26(5):635-42.
4. Telama R. Tracking of physical activity from childhood to adulthood: a review. Obes Facts 2009;2(3):187-95.
5. 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. International journal of preventive medicine 2013;4(12):1451.
6. Sharma M, Wagner DI, Wilkerson J. Predicting childhood obesity prevention behaviors using social cognitive theory. Int Q Community Health Educ 2005-2006;24(3):191-203.
7. Corder K, van Sluijs EM, Steele RM, Stephen AM, Dunn V, Bamber D, et al. Breakfast consumption and physical activity in British adolescents. Br J Nutr 2011;105(2):316-21
8. Ahadi Z, Qorbani M, Kelishadi R, Ardalan G, Motlagh ME, Asayesh H, et al. Association between breakfast intake with anthropometric measurements, blood pressure and food consumption behaviors among Iranian children and adolescents: the CASPIAN-IV study. Public Health 2015;129(6):740-47.
9. Szajewska H, Ruszczynski M. Systematic review demonstrating that breakfast consumption influences body weight outcomes in children and adolescents in Europe. Crit Rev Food Sci Nutr 2010;50(2):113-19.
10. Arora M, Nazar GP, Gupta VK, Perry CL, Reddy KS, Stigler MH. Association of breakfast intake with obesity, dietary and physical activity behavior among urban school-aged adolescents in Delhi, India: results of a cross-sectional study. BMC Public Health 2012;12:881.
11. Hoyland A, Dye L, Lawton CL. A systematic review of the effect of breakfast on the cognitive performance of children and adolescents. Nutr Res Rev 2009;22(2):220-43.
12. Rampersaud GC, Pereira MA, Girard BL, Adams J, Metzl JD. Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. J Am Diet Assoc 2005;105(5):743-60.
13. Group WMGRS. WHO Child Growth Standards based on length/height, weight and age. Acta Paediatrica (Oslo, Norway: 1992) Supplement 2006;450:76.
14. Lasserre AM, Viswanathan B, Bovet P. Global School-based Student Health Survey. 2008. Available at: http://www.who.int/chp/gshs/Seychelles_GSHS_2008_short_report.
15. Kelishadi R, Majdzadeh R, Motlagh M-E, Heshmat R, Aminaee 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. International journal of preventive medicine 2012;3(10):699.
16. Drenowatz C, Carlson J, Pfeiffer K, Eisenmann J. Joint association of physical activity/screen time and diet on CVD risk factors in 10-year-old children. Frontiers of medicine 2012;6(4):428.
17. Zahedi H, Kelishadi R, Heshmat R, Motlagh M, Ranjbar S, Ardalan G, et al. Association between junk food consumption and mental health in a national sample of Iranian children and adolescents: The

CASPIAN-IV study. Nutrition (Burbank, Los Angeles County, Calif) 2014;30(11-12):1391.
18. Caro DH, Cortés D. Measuring family socioeconomic status: An illustration using data from PIRLS 2006. 2012. Available at: http://www.ierinstitute.org/fileadmin/Documents/IERI_Monograph/IERI_Monograph_Volume_05_Chapter_1.
19. Kelishadi R. Childhood overweight, obesity, and the metabolic syndrome in developing countries. Epidemiologic reviews 2007;29:62.
20. Kelishadi R, Heshmat R, Motlagh ME, Majdzadeh R, Keramatian K, Qorbani M, et al. Methodology and early findings of the third survey of CASPIAN study: A national school-based surveillance of students' high risk behaviors. International journal of preventive medicine 2012;3(6):394.
21. Salmon J, Campbell K, Crawford D. Television viewing habits associated with obesity risk factors: a survey of Melbourne schoolchildren. The Medical journal of Australia 2006;184(2):64.
22. Pediatrics AAo. American Academy of Pediatrics: Children, adolescents, and television. Pediatrics 2001;107(2):423.
23. Al-Hazzaa HM, Al-Sobayel HI, Abahussain NA, Qahwaji DM, Alahmadi MA, Musaiger AO. Association of dietary habits with levels of physical activity and screen time among adolescents living in Saudi Arabia. J Hum Nutr Diet 2014 Apr;27 Suppl 2:204-13.
24. 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.
25. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. Int J Behav Nutr Phys Act 2011;8:140.
26. Klesges RC, Harmon-Clayton K, Ward KD, Kaufman EM, Haddock CK, Talcott GW, et al. Predictors of milk consumption in a population of 17- to 35-year-old military personnel. J Am Diet Assoc 1999;99(7):821-6; quiz 827-8.
27. Motlagh M, Kelishadi R, Amirkhani M, Ziaoddini H, Dashti M, Aminaee T, et al. Double burden of nutritional disorders in young Iranian children: findings of a nationwide screening survey. Public health nutrition 2011;14(4):605.

Table 1: Characteristics of participants according to the PA categories: the CASPIAN-IV study

Variables	Physical Activity Mean(SD)			
	Low	Moderate	High	P- value
Height (cm)	150.16(17.95)	146.14(17.68)	144.51(18.29)	0.001
Weight (Kg)	45.46 (17.64)	41.49(16.51)	40.10(16.60)	0.001
BMI (Kg/m^2)	19.42(4.54)	18.67(4.33)	18.41(4.28)	0.001
WC (cm)	68.34(12.23)	66.55(11.93)	66.19(11.55)	0.001
Age categories (years)				
6-10	1180(27.5)	1623(37.82)	1488(34.68)	
10-14	1431(30.84)	1794 (38.66)	1415 (30.5)	0.001
14-18	1942(43.96)	1493(33.79)	983(22.25)	
Gender				
Boy	1945 (28.75)	2410(35.62)	2410(35.62)	0.001
Girl	2608(39.61)	2500(37.97)	1476(22.42)	
Living area				
Urban	3519(34.87)	3683 (36.5)	2889(28.63)	0.147
Rural	1034(31.74)	1227(37.66)	997(30.6)	
Screen time				
≤2 h/day	3658(33.75)	4072(37.57)	4072(28.67)	0.003
>2h/day	883(35.65)	828(33.43)	766 (30.92)	
Weight status				
Underweight	519(32.44)	610(38.13)	471(29.44)	
Normal	2983(34.06)	3205(36.6)	2570(29.34)	0.667
Overweight	434(34.15)	483(38.00)	354(27.85)	
Obese	551(35.23)	567(36.25)	446(28.52)	
Abdominal obesity				
No	3610(33.70)	3990(37.24)	3113(29.60)	0.220
Yes	891(35.29)	890(35.25)	744(29.47)	
SES				
Low	1424(34.68)	1584 (38.58)	1098(26.74)	
Intermediate	1342(33.09)	1470(36.24)	1244(30.67)	0.014
High	1436(34.89)	1468(35.67)	1212(29.45)	

BMI: Body Mass Index; WC: Waist Circumference; WHR: Waist Height ratio; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; SES: Socioeconomic status.
1 Mean± 95%CI, 2 N (%). P<0.05 is significant.

Table 2: Frequency of snack and meal consumption according to PA and gender: the CASPIAN-IV study

Variables	PA in Boy				PA in Girl			
	Low	Moderate	High	P-value	Low	Moderate	High	P-value
Sweet								
Nondaily	1313(67.54)	1632(68.11)	1561(64.93)	0.093	1649(63.35)	1675(63.07)	951(64.43)	0.043
Daily	631(32.46)	764(31.89)	843(35.07)		954(36.65)	824(32.97)	525(35.47)	
Salty snack								
Nondaily	1682(28.39)	2134(36.02)	2109(35.59)	0.043	2211(39.02)	2171(38.31)	1285(22.68)	0.102
Daily	259(31.90)	257(31.65)	296(36.45)		391(43.11)	327(36.05)	189(20.48)	
Sweetened beverages								
Nondaily	1485(28.42)	1871(35.81)	1869(35.77)	0.524	2133(39.35)	2069(38.17)	1219(22.49)	0.734
Daily	459(30.06)	529(34.64)	539(35.30)		1219(40.67)	430(37.13)	257(22.19)	
Fast food								
Nondaily	1854(28.51)	2320(35.67)	2330(35.82)	0.087	2539(39.49)	2443(38.00)	1447(22.51)	0.527
Daily	85(35.56)	79(33.05)	75(31.38)		62(43.36)	54(37.76)	27(18.85)	
Fresh fruits								
Nondaily	969(31.47)	1119(36.34)	991(32.19)	0.001	1132(41.69)	1037(38.20)	546(20.11)	0.001
Daily	938(26.40)	1237(34.82)	1378(38.78)		1427(37.94)	1425(37.89)	909(24.17)	
Dried fruits								
Nondaily	1409(29.59)	1692(35.54)	1660(34.87)	0.038	1847(39.43)	1812(38.68)	1025(21.88)	0.051
Daily	343(25.69)	480(35.96)	512(38.35)		487(37.06)	492(37.44)	335(25.49)	
Vegetables								
Nondaily	1348(30.56)	1585(35.93)	1478(33.51)	0.001	1680(40.91)	1557(37.91)	870(21.18)	0.011
Daily	587(25.38)	805(34.80)	921(39.82)		918(37.39)	936(38.13)	601(24.48)	
Milk								
Nondaily	1116(32.28)	1206(34.89)	1135(32.83)	0.001	1648(44.24)	1375(36.91)	702(18.85)	0.001
Daily	824(25.17)	1187(36.26)	1263(38.58)		950(33.44)	1119(39.39)	772(27.27)	
Breakfast intake								
Non skipper	1275(26.30)	1779(36.70)	1794(37.00)	0.001	1545(36.62)	1668(39.54)	1006(23.84)	0.001
Skipper	665 (34.85)	629(32.97)	614(32.18)		1061(44.94)	830(35.15)	470(19.91)	
Lunch intake								
Non skipper	1673(27.38)	2194(35.91)	2243(36.71)	0.001	2264 (38.28)	2264(38.53)	1372(23.20)	0.001
Skipper	244(43.03)	186(32.80)	137(24.16)		313(51.91)	195(32.34)	95(15.75)	
Dinner intake								
Non skipper	1721(28.04)	2210(36.01)	2206(35.95)	0.001	2191(38.45)	2201(38.62)	1307(22.93)	0.001
Skipper	212(35.93)	190(32.20)	188(31.86)		406(47.21)	291 (33.84)	163(18.95)	

Table 3: Association of snack and meal consumption and PA in Multinominal logistic regression model: the CASPIAN-IV study

Variables	Physical Activity		
	Low Reference group	Moderate OR (95% CI)	High OR (95% CI)
Sweet (daily/nondaily)			
Model I[1]	1	0.89 (0.81-0.98)*	1.01(0.91-1.13)
Model II[2]	1	0.90 (0.81-0.99)*	1.00(0.89-1.12)
Model III[3]	1	0.89(0.81-0.99)*	0.99(.88-1.11)
Salty snack (daily/nondaily)			
Model I	1	0.81(0.71-0.92)*	0.85(0.74-0.98)*
Model II	1	0.82(0.72-0.95)*	0.89(0.76-1.04)
Model III	1	0.82(0.71-0.94)*	0.89(0.76-1.04)
Sweetened beverages (daily/nondaily)			
Model I	1	0.94(0.84-1.05)	1.00(0.88-1.13)
Model II	1	0.97(0.86-1.09)	0.99(0.87-1.12)
Model III	1	0.97(0.86-1.09)	0.99(0.87-1.13)
Fast food (daily/nondaily)			
Model I	1	0.83(0.65-1.06)	0.80(0.60-1.07)
Model II	1	0.89(0.69-1.15)	0.79(0.58-1.08)
Model III	1	0.87(0.68-1.13)	0.78(0.57-1.06)
Fresh fruits (daily/nondaily)			
Model I	1	1.09(0.99-1.20)	1.32(1.1-1.47)*
Model II	1	1.09(0.99-1.21)	1.34(1.20-1.51)*
Model III	1	1.09(0.99-1.21)	1.35(1.20-1.52)*
Dried fruits(daily/nondaily)			
Model I	1	1.08(0.96-1.22)	1.23(1.08-1.41)*
Model II	1	1.07(0.94-1.21)	1.20(1.05-1.38)*

Model III	1	1.07(0.95-1.21)	1.21(1.06-1.40)*
Vegetable (daily/nondaily)			
Model I	1	1.11(1.01-1.22)*	1.30(1.17-1.45)*
Model II	1	1.14(1.03-1.26)*	1.38(1.23-1.55)*
Model III	1	1.15(1.04-1.27)*	1.39(1.24-1.56)*
Milk (daily/nondaily)			
Model I	1	1.39(1.26-1.53)*	1.72(1.54-1.92)*
Model II	1	1.21(1.09-1.34)*	1.35(1.20-1.51)*
Model III	1	1.21(1.10-1.34)*	1.35(1.21-1.52)*
Breakfast intake (skipper/non-skipper)			
Model I	1	0.69(0.62-0.75)*	0.63(0.56-0.70)*
Model II	1	0.76(0.69-0.84)	0.74(0.65-0.83)*
Model III	1	0.76(0.69-0.84)	0.74(0.66-0.83)*
Lunch intake (skipper/non-skipper)			
Model I	1	0.60(0.51-0.69)*	0.45(0.38-0.54)*
Model II	1	0.65(0.56-0.77)*	0.50(0.41-0.61)*
Model III	1	0.66(0.56-0.77)*	0.51(0.42-0.62)*
Dinner intake (skipper/non-skipper)			
Model I	1	0.69(.60-0.79)*	0.63(0.54-0.73)*
Model II	1	0.80(0.69-0.93)*	0.81(0.69-0.96)*
Model III	1	0.80(0.69-0.93)*	0.82(0.69-0.97)*

[1]Without adjusted (crude models), [2]Adjusted for age, gender, living area, screen time and socioeconomic status,[3]Additionally adjusted for BMI.

SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; BP: Blood Pressure; *P<0.05.