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Propensity Score Application in the Relationship of Screen Time and Metabolic Syndrome in Adolescents: the CASPIAN-III Study

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Abstract

Aim: This study aimed to assess the relationship of screen time and metabolic syndrome (MetS) among Iranian adolescents.

Materials and Methods

In this nationwide study, the propensity score (PS) was used in a matched case-control study design. The data was obtained from 5,625 students aged 10-18 years, who participated in a national school-based surveillance program. MetS was defined according to the criteria of the International Diabetes Federation (IDF). In addition, the continuous MetS score (cMetS) was calculated and the best cutpoint for cMetS was selected based on the receiver operator characteristic (ROC) curve estimate of sensibility and specificity. Data analysis was performed by a conditional logistic regression in 2014.

Results

Screen time increased the risk of MetS by 44% with a near significant P- value (P=0.052). The time spent on computer during leisure time was significantly associated with MetS and waist circumference (P<0.05). Moreover, the time spent on watching TV had significant relationship with elevated serum triglyceride levels (P<0.05).

Conclusion

The current findings serve as confirmatory evidence on the adverse health effects of prolonged ST, including the association of leisure time computer use with increase in the risk of MetS and excess weight, as well as the relationship of the time spent on watching TV with serum triglycerides levels. Reducing sedentary leisure time activity, notably ST, should be considered as a health priority for the pediatric age group.

Key Words: Adolescents, Metabolic syndrome, Propensity score, Screen time.

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1- INTRODUCTION

Metabolic syndrome (MetS) origins from early life, and increases the risk of many chronic diseases in adulthood (1-3). The prevalence of sedentary life-style, childhood overweight and MetS are highly increasing all over the world (4). Some ethnic groups as Asian are more prone to MetS (5). Different criteria are used for MetS in the pediatric age group, and various prevalence rates are reported in different communities (6-9). Different factors such as genetic, socio-economical and environmental factors, unhealthy diets, urbanization and increasing sedentary lifestyle are mentioned as the main determinants of MetS (10-12). A large amount of sedentary lifestyle results from prolonged screen time (ST), which is the sum of the time spent on watching television (TV) and computer use. It is advised to limit ST to a maximum of 2 hours a day (13). A nationwide study in Iran reported that the ST of 33.4% and 53% of Iranian students exceeded this limit on weekdays and weekends, respectively. Almost half of the urban students and a quarter of rural students used personal computers (14). It is well documented that sedentary life-style is a cardio metabolic risk factor in adults (15), however limited experience exists in the pediatric age group (8, 16-19).

This study aimed to assess the relationship between ST and two types of definition for MetS in a national sample of Iranian adolescents by using the propensity score method.

2- MATERIALS AND METHODS

2-1. Participants and study design

Data of this matched case-control study were obtained from the third study of a national school-based surveillance program entitled Childhood and Adolescence Surveillance and Prevent Ion of Adult Non-communicable disease (CASPIAN-III) study (2009-2010). Detailed methodology is published before (20), and here we present it in brief.

The present study included students ages 10-18 year olds.They were selected by multistage random cluster sampling from urban and rural areas of 27 provinces of Iran. Eligible schools were randomly selected from a list of schools that were stratified according to the information bank of the Ministry of Education. Students also were selected randomly from each school. Students with any chronic disease or who were taking medications were not included in this study. Study protocol was approved by ethical committees and other relevant national regulatory organizations(20), written consent was obtained from parents and oral assent from students, respectively. Students were selected by multistage random cluster sampling.

2-2. Measurement

A trained team of health care providers, nurses, and physicians conducted the interviews, physical examination, and blood sampling under standard protocols and by using calibrated equipment.

A Venous blood samples was collected in the morning after a 12 h of overnight fasting from all study participants and delivered to the laboratory on the same day. All biochemical analyses were performed in the central provincial laboratory which follows the standards of the National Reference laboratory, a WHO-collaborating center in Tehran using standard kits (Pars Azmoun, Iran).

The questionnaire of the World Health Organization- Global School students Health Survey (WHO-GSHS) was used in this study. The content validity was confirmed based on observations of an experts' panel and item analysis. Reliability measures were assessed in a pilot study. more detailed was reported elsewhere (20). Abdominal obesity was considered as waist circumference- to-height- ratio (WHtR) of more than 0.5(21). Systolic and diastolic blood pressure (SBP, DBP) were measured, and mean arterial pressure (MAP) was calculated using the following equation: MAP= [(SBP-DBP)/ 3] + DBP (24).

ST was considered as the sum of the time spent on watching TV and computer use during leisure time in weekdays and weekends. As in Iran, the weekend is one day, the weighted mean of time spent on watching TV and computer use in a week was calculated as the sum of [1/7 ×(time spent on computer usage + time spent on watching TV) on weekends] and [6/7 ×(time spent on computer usage + time spent on watching TV) on weekdays](23). The screen time in total and the time spent on watching TV or computer use was categorized to tertiles. The screen time in total and the time spent on watching TV or computer use was categorized to tertiles (24). As there is no universally accepted definition for MetS in the pediatric age group, we used the continuous MetS score (cMetS). It was calculated by standardizing fasting blood glucose (FBG), triglycerides (TG), high density lipoprotein- cholesterol (HDL-C), MAP, and waist circumference (WC) using regressions on age and gender. As HDL-C has a reverse relationship with the MetS risk, it was multiplied by a negative. The cMetS of each person was taken from the sum of the remainders of standard Z-scores. Higher cMetS scores represent undesirable metabolic conditions (24).

After calculating the cMetS by the Receiver operating characteristics (ROC) curve analysis an appropriate cutting point on the cMetS was specified for predicting MetS. A gold standard for MetS diagnosis was obtained based on the definition provided by the International Diabetes Federation (IDF) in a way that it included at least 3 of the following components:

TG$\geq$ 150mg/dL, HDL-C$\leq$ 40 mg/dL, WHtR greater than 0.5, FBG $\geq$ 100 mg/dL, and SBP or DBP$\geq$ 90th percentile for age, gender and height (25). The best cutting point for the MetS was obtained based on the lowest score (26), which included the maximum sum of sensitivity and specificity. Participants were categorized into two groups with or without MetS.

2-3. Statistical Analysis

In order to describe and initial analysis quantitative, qualitative and ordinal variables based on MetS, independent t-test, Chi-square and Man-Withney-U test were used, respectively. The quantitative variables are reported as mean and standard deviation (SD) and the qualitative variables as frequency and percentage. Variables as age, gender, living area, parental education and occupation, type of school (public/private), having a personal computer, number of children in the family, birth weight, birth order, duration of breastfeeding, body image, trying to lose weight, sleep duration, number of close friends, time spent with friends after school, daily physical activity, type of bread mostly consumed, type of fat used for home foods, adding salt on the food table, type of milk and dairy products, and frequency of breakfast consumption were used as independent variables. Propensity scores in both case and control groups were categorized from lowest to highest based on the nearest propensity score. Each individual in the group with MetS was matched to a counterpart in the group without MetS. People who could not be matched in the above mentioned way were excluded from the analysis.

In order to analyze the relationship between ST in total, and time spent on watching TV or computer use with each component of MetS based on the IDF criterion, again matching was used and the

MetS components were added to the model as independent variables. In the analysis of the relationships of times spent on watching TV with MetS and its components, in addition to the above mentioned covariates, the time spent on computer use was also considered as an independent variable and was controlled in the model. Likewise, in the analysis of the relationship of MetS with the time spent on computer use, the time spent on watching TV was controlled. Finally, we applied conditional logistic regression.

SPSS version 18 (PASW Statistics for Windows, Chicago: SPSS Inc.) and STATA- 10 (StataCorp, College Station, Texas, USA) were also used to analyze the data set. The P- value less than 0.05 were considered as significant.

3- RESULTS

The mean (SD) age of the participants was 14.7(2.4) years. The mean (SD) time spent on watching TV, time spent on computer use and ST was reported as 2.52 (1.08), 0.92 (1.09) and 3.1 (44.65) hours a day, respectively. The cut of points of them were considered as lower limit of the last tertiles. Hence the cut of points of the time spent on watching TV, computer use, and ST was reported 3.14, 1, and 4 hours a day, respectively.

Based on the IDF definition, 7.2% of participants had MetS, this frequency was significantly higher in girls than in boys (8.4% vs. 6%, respectively, P=0.008). Moreover, 34.2 % of participants did not have any component of MetS, 39.5% had one component, 19.1% two components, 5.7 % three components, 1.4 % four components and 0.1 % had five components of MetS.

Based on the ROC curve of the c-MetS and regarding sensitivity and specificity, the best cutting point was defined as 2.3043 with a sensitivity of 91.1% and specificity of 89.6% for diagnosing individuals with MetS. The area under curve (AUC) was 0.96 and the confidence interval (CI) was 0.95-0.97, which indicates a high level of accuracy of this score in diagnosing MetS. The prevalence of MetS based on the same cutting point was found as 16.1%.

The propensity score was calculated using the covariates in a logistic model. The two groups (with or without MetS) were matched 1:1 without any replacement. The distribution of the variables of the two groups before and after their matching is presented in (Table.1). Those variables that had no significant difference before and after matching were excluded from this Table. The estimated propensity scores before and after matching for 288 subjects in the each group is illustrated in (Table.2). After matching, the standard error of mean was reduced from 12.7% to 2.8% and this shows the quality of the matching ensures that the distribution of the variables was similar in the two groups studied (Figure.1). After matching the odds ratio (OR) of the data was calculated. The OR (95%CI) of the relationship between MetS and ST of more than 4 hours was 1.44 (0.98-2.12) and a near significant P-value (0.052). In order to analyse each component of the MetS in relation to ST, watching TV and using computer, matching was performed and the other components of the syndrome were entered in the model as independent variables. After matching, the ORs of the data were also calculated. More details are illustrated in (Table.3).

Those adolescents who watched TV for more than 3.14 hours a day, were at higher risk of elevated TG compared who spent less time on TV watching (OR=1.83 , 95% CI :1.003-3.46, P=0.035). However no significant relationship was found between the time spent on watching TV and MetS (OR=1.24, 95% CI: 0.83-1.9; P=0.28). Significant positive relationship was documented between more than one hour of computer use and MetS (OR=1.45, 95% CI: 1-2.13; P=0.04) as well as between the time spent on using computer and obesity (OR=1.48, 95% CI: 1-2.2; P=0.04).

4- DISCUSSION

The current study showed that prolonged ST could increase the risk of MetS and some of its components in adolescents. Our findings are in line with some previous studies conducted in the pediatric populations of different communities. For instance, studies in American (17) and Korean teenagers (8) showed higher ST was associated with higher risk of MetS (8). Likewise, studies in prepubescent children in Finland (27) and in the US (23) confirmed positive relationship of ST with MetS and some of its components. A longitudinal study showed that ST in teenagers resulted in increase in MetS and its components including elevated TG and WC (19). Moreover, some studies have proposed an association between ST and increased risk of insulin resistance (28,29). A study in Australia found that boys who spent more than two hours on ST tended to be twice as much at the risk of increased plasma insulin and insulin resistance. However, the corresponding figure was not significant for girls (28). A study on 7-13 year old children in Norway showed a significant independent relationship between ST and insulin resistance (29). Meanwhile this study did not reveal any relationship between ST and an increase in the risk of MetS and its components. Some studies evaluated the separate role of the leisure time spent on TV watching and on computer use. Cross-sectional studies in Finland (27), the US (30), and Portugal (31) showed that watching TV was associated with an increase in the cardio metabolic risk, whereas this association was not found for the leisure computer use in children and adolescents. Similarly, a prospective cohort study found that watching TV in adolescence was positively related to obesity, elevated TG, and MetS, whereas the corresponding figure was not significant for the leisure time computer use (19).

Contrary to the abovementioned findings, some other studies did not confirm significant relationship between the time spent on watching TV and the increased risk of MetS and its components. Studies on American (32) and European (33) children and adolescents did not document significant association between the time spent on TV watching with MetS and its components as elevated BP and FBG and reduced HDL-C (32). Similar findings are reported from young Dutch children 2014 study on 5-6 years old Dutch children (34).

Our current finding on the association of the time spent on watching TV with elevated TG levels in adolescents is consistent with some previous cross-sectional (35) and cohort studies (19). This finding might be explained by the fact that more time children spend on watching TV, the more high-fat foods they consume (36), and their tendency to advertised foods (37). However, some other studies did not document significant association between time spent on watching TV and elevated TG (32-34, 38).

Many studies have shown the association of prolonged TV watching with increased risk of obesity (16, 19, 27, 32, 39, 40). In the current study, the time spent on leisure time computer use was associated with excess weight, but we did not document such association for TV watching. This might be explained in part by under-reporting of the time spent on TV watching by obese students (41). Another plausible reason could be that the weekend duration in Iran is only one day and this could have led to the underestimation of the TV watching time and the current findings. Many studies have been conducted with the aim of assessing the relationship between the duration of time spent on watching TV, videos and working with computer with MetS and its components in different pediatric populations. Controversies in their findings might be because of lack of universal definition for pediatric MetS, as well as using different methods to assess lifestyle factors, application of diverse statistical methods, and small sample size in some studies. The current survey was conducted on a large sample size by using the WHO-GSHS questionnaire and a validated continuous score for MetS, moreover an advanced statistical method was applied.

4-1. Study limitations and strengths

The main limitation of this study is the cross-sectional nature of the data, moreover, self-reported data are used.

One of the strengths of this study is that the matching method based on propensity score was used as the method for controlling a large number of underlying and probably confounding variables. Other strong points of this study are its novelty in the Middle Eastern pediatric population, its large nationally representative sample size and using a validated questionnaire. Determining the MetS by using a cut-off point of the c-MetS, which is defined by the golden IDF standard with a relatively high sensitivity and specificity proportions, is another strength.

5- CONCLUSION

The current findings serve as confirmatory evidence on the adverse health effects of prolonged ST, including the association of leisure time computer use with increase in the risk of MetS and excess weight, as well as the relationship of the time spent on watching TV with serum TG levels. Reducing sedentary leisure time activities, notably ST, should be considered as a health priority for the pediatric age group.

6-SOURCE OF FUNDING

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7-CONFLICT OF INTEREST: None.

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9-REFERENCES

1. Ford ES. Risks for all-cause mortality, cardiovascular disease, and diabetes associated with the metabolic syndrome a summary of the evidence. Diabetes care 2005; 28(7):1769-78.

2. Lutsey PL, Steffen LM, Stevens J. Dietary Intake and the Development ofthe Metabolic Syndrome The Atherosclerosis Risk in Communities Study. Circulation 2008;117(6):754-61.

3. Kelishadi R, Ardalan G, Gheiratmand R, Majdzadeh R, Hosseini M, Gouya M, et al. Thinness, overweight and obesity in a national sample of Iranian children and adolescents: CASPIAN Study. Child Care Health Dev 2008; 34(1):44-54.

4. Kohen-Avramoglu R, Theriault A, Adeli K. Emergence of the metabolic syndrome in childhood: an epidemiological overview and mechanistic link to dyslipidemia. Clin Biochem 2003;36(6):413-20.

5. Lorenzo C, Williams K, Stern MP, Haffner SM. The metabolic syndrome as predictor of type 2 diabetes the San Antonio heart study. Diabetes Care 2003;26(11):3153-59.

6. Cook S, Auinger P, Li C, Ford ES. Metabolic syndrome rates in united states adolescents, from the national health and nutrition examination survey, 1999–2002. J Pediatr 2008;152(2):165-70. e2.

7. 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):461-70.

8. Kang HT, Lee HR, Shim JY, Shin YH, Park BJ, Lee YJ. Association between screen time and metabolic syndrome in children and adolescents in Korea: the 2005 Korean National Health and Nutrition Examination Survey. Diabetes Res Clin Pract 2010; 89(1):72-8.

9. Bhat R, Parray I, Ahmad Z. Prevalence of the Metabolic Syndrome among North Indian Adolescents Using Adult Treatment Panel III and Pediatric International Diabetic Federation Definitions. J Diabetes Metab 2014; 5(352):2.

10. Alberti G, Zimmet P, Shaw J, Bloomgarden Z, Kaufman F, Silink M. Type 2 Diabetes in the Young: The Evolving Epidemic The International Diabetes Federation Consensus Workshop. Diabetes Care 2004;27(7):1798-811.

11. Bhowmik B, Afsana F, My Diep L, Binte Munir S, Wright E, Mahmood S, et al. Increasing prevalence of type 2 diabetes in a rural Bangladeshi population: a population based study for 10years. Diabetes Metab J 2013; 37(1):46-53.

12. Lind PM, Riserus U, Salihovic S, Bavel B, Lind L. An environmental wide association study (EWAS) approach to the metabolic syndrome. Environ Int 2013; 55:1-8.

13. American Academy of Pediatrics: Children, adolescents, and television. Pediatrics 2001;107(2):423.

14. Jari M, Qorbani M, Motlagh ME, Heshmat R, Ardalan G, Kelishadi R. A Nationwide Survey on the Daily Screen Time of Iranian Children and Adolescents: The CASPIAN-IVStudy. Int J Prev Med 2014; 5(2):224.

15. Katzmarzyk PT, Ardern C. Physical activity levels of Canadian children and youth: current issues and recommendations. Can J Diabetes. 2004;28:67-78.

16. Tremblay MS, LeBlanc AG, KhoME, Saunders TJ, Larouche R, Colley RC, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. Int J Behav Nutr Phys Act 2011; 8(1):98.

17. Mark AE, Janssen I. Relationship between screen time and metabolic syndrome in adolescents. J Public Health (Oxf) 2008; 30(2):153-60.

18. Saunders TJ, Tremblay MS, Mathieu ME, Henderson M, O'Loughlin J, Tremblay A, et al. Associations of sedentary behavior, sedentary bouts and breaks in sedentary time with cardiometabolic risk in children with a family history of obesity. PLoS One 2013; 8(11):e79143.

19. Grøntved A, Ried-Larsen M, Møller NC, Kristensen PL, Wedderkopp N, Froberg K, et al. Youth screen-time behaviour is associated with cardiovascular risk in young adulthood: the European Youth Heart Study. Eur J Prev Cardiol 2014; 21(1):49-56.

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. Knowles K, Paiva L, Sanchez S, Revilla L, Lopez T, Yasuda M, et al. Waist circumference, body mass index, and other measures of adiposity in predicting cardiovascular disease risk factors among Peruvian adults. Int J Hypertens 2011; 2011.

22. McNamara JR, Schaefer EJ. Automated enzymatic standardized lipid analyses for plasma and lipoprotein fractions. Clin Chim Acta 1987;166(1):1-8.

23. Martinez-Gomez D, Tucker J, Heelan KA, Welk GJ, Eisenmann JC. Associations between sedentary behavior and blood pressure in young children. Arch Pediatr Adolesc Med 2009;163(8):724-30.

24. Eisenmann JC. Aerobic fitness, fatness and the metabolic syndrome in children and adolescents. Acta Paediatr 2007; 96(12):1723-9.

25. Zimmet P, Alberti G, Kaufman F, Tajima N, Silink M, Arslanian S, et al. The metabolic syndrome in children and adolescents. The Lancet 2007; 369(9579):2059-61.

26. Perkins NJ, Schisterman EF. The inconsistency of “optimal” cutpoints obtained using two criteria based on the receiver operating characteristic curve. Am J Epidemiol 2006;163(7):670-5.

27. Väistö J, Eloranta A-M, Viitasalo A, Tompuri T, Lintu N, Karjalainen P, et al. Physical activity and sedentary behaviour in relation to cardiometabolic risk in children: cross-sectional findings from the Physical Activity and Nutrition in Children (PANIC) Study. Int J Behav Nutr Phys Act 2014;11(1):55.

28. Hardy LL, Denney-Wilson E, Thrift AP, Okely AD, Baur LA. Screen time and metabolic risk factors among adolescents. Arch Pediatr Adolesc Med 2010; 164:643–49.

29. Danielsen Y, Juliusson P, Nordhus I, Kleiven M, Meltzer H, Olsson S, et al. The relationship between life-style and cardio-metabolic risk indicators in children: the importance of screen time. Acta Paediatr 2011;100(2):253-59.

30. Carson V, Janssen I. Volume, patterns, and types of sedentary behavior and cardio-metabolic health in children and adolescents: a cross-sectional study. BMC Public health 2011;11(1):274.

31. Stamatakis E, Coombs N, Jago R, Gama A, Mourão I, NogueiraH, et al. Type-specific screen time associations with cardiovascular risk markers in children. Am J Prev Med 2013; 44(5):481-88.

32. Staiano AE, Harrington DM, Broyles ST, Gupta AK, Katzmarzyk PT. Television, adiposity, and cardiometabolic risk in children and adolescents. Am J Prev Med 2013; 44(1):40-7.

33. Ekelund U, Brage S, Froberg K, Harro M, Anderssen SA, Sardinha LB, et al. TV viewing and physical activity are independently associated with metabolic risk in children: the European Youth Heart Study. PLoS Med 2006; 3(12):e488.

34. Chinapaw MJ, Altenburg TM, van Eijsden M, Gemke RJ, Vrijkotte TG. Screen time and cardiometabolic function in Dutch 5-6 year olds: cross-sectional analysis of the ABCD-study. BMC Public health 2014;14(1):933.

35. Altenburg TM, de Kroon ML, Renders CM, Hirasing R, Chinapaw MJ. TV time but not computer time is associated with cardiometabolic risk in Dutch young adults. PLoS One 2013; 8(2):e57749.

36. Robinson RN. Television viewing and childhood obesity. Pediatr Clin North Am 2001; 48:1017 – 25

37. Vandewater EA, Shim M-s, Caplovitz AG. Linking obesity and activity level with children's televisionand video game use. J Adolesc 2004; 27(1):71-85.

38. Martinez-Gomez D, Rey-LópezJP, Chillón P, Gómez-Martínez S, Vicente-Rodríguez G, Martín-Matillas M, et al. Excessive TV viewing and cardiovascular disease risk factors in adolescents. The AVENA cross-sectional study. BMC Public health 2010;10(1):274.

39. Byun W, Dowda M, Pate RR. Associations between screen-based sedentary behavior and cardiovascular disease risk factors in Korean youth. J Korean Med Sci 2012; 27(4):388-94.

40. LeBlanc AG, Spence JC, Carson V, Connor Gorber S, Dillman C, Janssen I, et al. Systematic review of sedentary behaviour and health indicators in the early years (aged 0–4 years). Appl Physiol Nutr Metab 2012; 37(4):753-72.

41. Sirard JR, Pate RR. Physical activity assessment in children and adolescents. Sports medicine 2001; 31(6):439-54

Table 1: Characteristics of adolescents with and without metabolic syndrome before and after matching

Variables		Before Propensity Score- Matched			After Propensity Score- Matched		
		Metabolic syndrome group(n=542) NO.(%)	Control group (n=2824) NO.(%)	P-value	Metabolic syndrome group(n=288) NO.(%)	Control group (n=288) NO.(%)	P-value
Age(years)	Mean(SD)	14.73(2.2)	14.67(2.4)	0.63‡	14.76(0.14)	14.74(0.14)	0.92‡
Gender	Boy	270(49.8)	1459(51.7)	0.43	156(54.2)	170(59)	0.24
	Girl	272(50.2)	1365(48.3)		132(45.8)	118(41)	
Living area	Urban	402(76.4)	1892(69.1)	0.001	216(75)	217(75.35)	0.92
	Rural	124(23.6)	845(30.9)		72(25)	71(24.65)	
Father's occupation	Unemployed	27(5.3)	187(6.8)	<0.001	13(4.5)	9(3.13)	
	Workman/labor	89(17.4)	608(22.2)		17.7(51)	49(17)	0.66
	Employed/office work	137(26.8)	656(24)		80(27.8)	79(27.4)	
	Agriculturist	38(7.4)	320(11.7)		20(6.9)	29(10.1)	
	Self-employed	221(43.2)	967(35.3)		124(43.06)	122(42.4)	
Father's education(years)	<6	156(29.9)	1088(39.3)	<0.001*	87(30.2)	82(28.5)	
	6-9	128(24.6)	703(25.4)		64(22.2)	78(27.1)	0.98*
	9–12	175(33.6)	709(25.6)		99(34.4)	84(29.2)	
	>12	62(11.9)	270(9.7)		38(13.2)	44(15.3)	
Mother's education(years)	<6	205(38.6)	1436(51.4)	<0.001*	109(37.9)	105(36.5)	
	6-9	131(24.7)	624(22.3)		69(24)	64(22.2)	0.7*
	9–12	159(29.9)	585(20.9)		84(29.2)	97(33.7)	
	>12	36(6.8)	150(5.4)		26(9)	22(7.6)	
Possessing personal computer	Yes	260(49.1)	1168(42)	0.003	147(51)	144(50)	0.8
	No	270(50.9)	1615(58)		141(49)	144(50)	
School type	Public	479(91.8)	2605(94.4)	0.021	262(91)	259(89.9)	0.67
	Private	43(8.2)	155(5.6)		26(9)	29(10.1)	
Number of children in the family	<2	42(8)	136(4.9)	<0.001*	25(8.7)	27(9/4)	
	2–4	392(75.1)	1947(70.6)		211(73.3)	207(71.9)	0.99*
	>4	88(16.9)	675(24.5)		52(18.1)	54(18.7)	
Birth order	First	207(39.4)	928(33.6)	<0.001*	118(41)	115(39.9)	
	Second	148(28.1)	716(25.9)		71(24.7)	78(27.1)	0.96*
	Third	73(13.9)	418(15.1)		45(15.6)	44(15.3)	
	Fourth or more	98(18.6)	703(25.4)		54(18.8)	51(17.7)	
Body image	Very thin	31(5.8)	282(10)	<0.001*	12(4.2)	9(3.13)	

	Slightly thin	226(41.9)	418(14.8)		126(43.7)	130(45.1)	0.65*
	Normal	43(8)	656(23.3)		16(5.6)	16(5.6)	
	Slightly obese	53(9.8)	40(1.4)		31(10.8)	19(6.6)	
	Very obese	186(34.5)	1421(50.4)		103(35.8)	114(39.6)	
Following specific diet for weight loss	No, but I must have high weight	44(8.3)	565(20.2)	<0.001	13(4.5)	29(10.1)	0.01
	Not good	172(32.3)	1526(54.7)		92(31.9)	111(38.5)	
	No, but I must have to lose weight	235(44.2)	495(17.7)		130(45.1)	95(33)	
	yes	81(15.2)	205(7.3)		53(18.4)	53(18.4)	
Sleep duration (h)	<6	39(7.8)	178(6.7)	0.02*	10(3.5)	19(6.6)	
	6–8	162(32.2)	738(27.8)		92(31.9)	86(29.9)	0.6*
	>8	302(60)	1742(65.5)		186(64.6)	183(63.5)	
Type of fat used in the family food	Solid fats	184(39.7)	1177(46.7)	0.006	108(37.5)	108(37.5)	
	Liquid oil	121(26.1)	697(27.7)		78(27.1)	83(28.8)	0.51
	Ghee	13(2.8)	49(1.9)		8(2.8)	5(1.7)	
	Frying oil	140(30.2)	566(22.5)		92(31.9)	86(29.9)	
	Suet	5(1.1)	21(0.8)		2(0.7)	3(1.04)	
	Butter	1(0.2)	8(0.3)		0	3(1.04)	
Type of milk and dairy products consumed	Ordinary pasteurized	263(51)	1379(51)	0.025	146(50.1)	148(51.4)	0.82
	Pasteurized high fat	35(6.8)	225(8.3)		23(8)	26(9.03)	
	Pasteurized Low fat	132(25.6)	544(20.1)		65(22.6)	61(21.2)	
	Unpasteurized Ordinary	57(11)	349(12.9)		38(13.2)	32(11.1)	
	Unpasteurized full fat	29(5.6)	208(7.7)		16(5.6)	21(7.3)	

* According to the Mann-Whitney test, ‡ According to the t-test, other p-values are based on chi-square test

Table 2.Results of the estimated propensity score

	Groups	Number	Mean(SD)	Minimum	Maximum
Before Propensity Score- Matched	Control	1680	0.13(0.11)	0.0063	0.7225
	Metabolic syndrome	292	0.27(0.18)	0.0137	0.8076
After Propensity Score- Matched	Control	288	0.25(0.15)	0.0137	0.7041
	Metabolic syndrome	288	0.26(0.17)	0.0137	0.7036

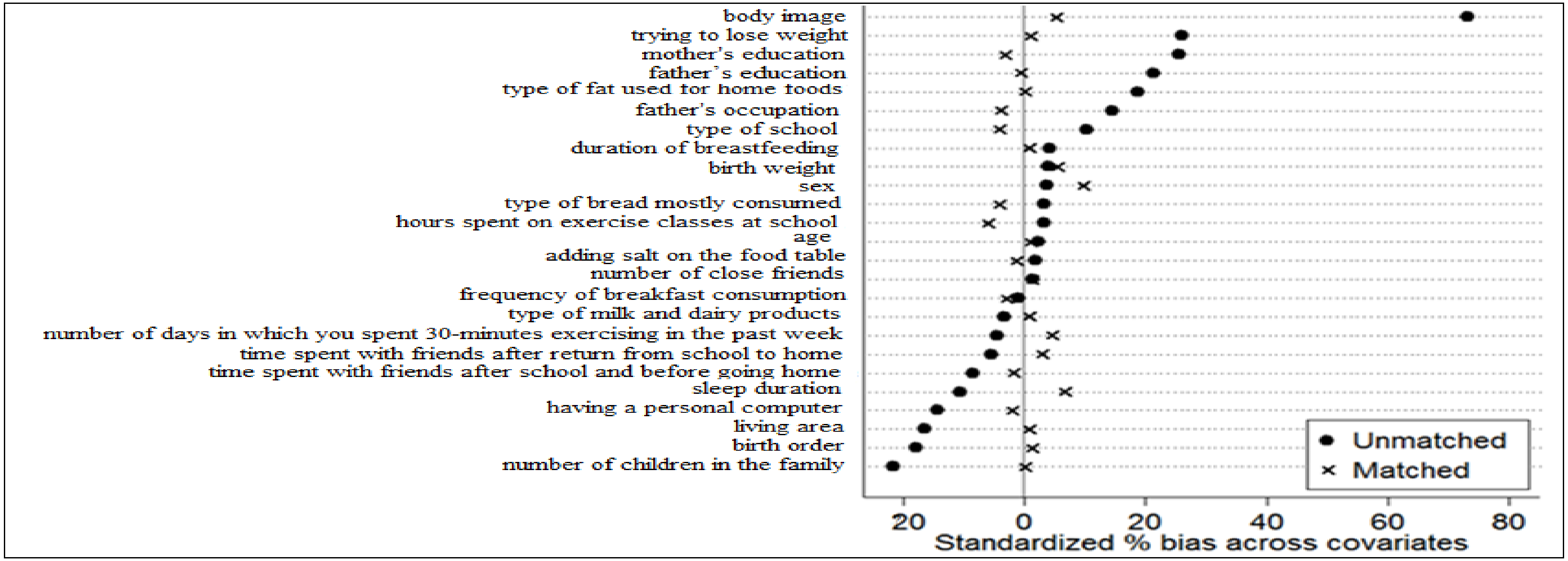

Fig. 1: Standardized differences for baseline covariates in the original and the matched sample (for examining the relationship between screen time and metabolic syndrome).

Table 3: The results of the Conditional logistic of watching TV, leisure time computer use, and screen time relationship with the metabolic syndrome and its components

Variables	Dependent variable	Number of matching	Standard error of mean %	OR(95%CI)	P-value
	Metabolic Syndrome	288	2.9	1.44(0.98-2.12)	0.052
	HDL	733	1.8	0.92(0.72-1.2)	0.45
	BP	501	2.2	1.1(0.81-1.4)	0.65
	WHR	272	4.2	1.31(0.91-1.91)	0.13
	FBG	251	4.4	0.72(0.48-1.1)	0.09
	TG	131	7.5	0.9(0.51-1.6)	0.7
Screen time	HDL and BP	209	5	1/2(0/8-1/9)	0.36
	BPand WHR	125	7.7	0.97(0.6-1.7)	0.9
	HDLand WHR	113	5.4	1.1(0.7-1.8)	0.7
	FBG and BP	73	9.7	0.58(0.28-1.2)	0.1
	HDLand FBG	71	7.3	1(0.48-2.1)	1
	HDL and TG	60	6.6	1.5(0.6-3.5)	0.3
	WHR and TG	51	8.6	2(0.7-6.5)	0.16
	BP and TG	49	9	0.54(0.2-1.45)	0.2
	Metabolic Syndrome	288	4.3	1.24(0.83-1.9)	0.28
	HDL	733	1.9	0.85(0.7-1.1)	0.17
	BP	503	2.3	1(0.74-1.32)	0.94
TV-watching	WHR	272	4.2	1.04(0.7-1.6)	0.84
	FBG	252	4.5	0.75(0.47-1.2)	0.2
	TG	131	5.2	1.83(1.003-3.5)	0.035
	HDL and BP	209	4.2	0.97(0.6-1.6)	0.9
	BPand WHR	125	7	0.8(0.4-1.5)	0.5
	HDLand WHR	113	6.4	0.9(0.5-1.6)	0.7
	FBG and BP	73	7.3	0.37(0.13-0.92)	0.02

	HDLand FBG	71	9.2	0.73(0.25-2)	0.5
	HDL and TG	60	7.4	0.75(0.3-1.7)	0.45
	WHR and HDL and BP	52	9.2	0.91(0.35-2.4)	0.8
	WHR and TG	51	8.7	1.3(0.5-3.3)	0.53
	BP and TG	49	9.3	1.6(0.6-4.5)	0.3
Leisure time computer use	Metabolic Syndrome	289	4.8	1.45(1-2.13)	0.04
	HDL	732	2	1.03(0.83-1.3)	0.8
	BP	501	4	0.98(0.75-1.3)	0.84
	WHR	271	4.9	1.48(1.002-2.2)	0.04
	FBG	250	4.6	1.12(0.8-1.63)	0.53
	TG	131	4.5	0.92(0.55-1.5)	0.71
	HDL and BP	209	5.3	1.2(0.8-1.8)	0.5
	BP and WHR	126	5.4	084(0.5-1.5)	0.5
	HDLand WHR	112	7.5	1.2(0.6-2.1)	0.6
	FBG and BP	73	8.6	0.84(0.4-1.7)	0.6
	HDLand FBG	71	10.2	1.6(0.7-3.9)	0.24
	HDL and TG	60	9.3	1.2(0.6-2.8)	0.6
	BP and TG	49	10.8	0.9(0.3-2.5)	0.8
	WHRand TG and BP	24	9.8	0.5(0.08-2.3)	0.3

Note: Boldface indicates significance.

To assess each of the components of metabolic syndrome, the covariates and the other components of the syndrome was controlled.

Criterion for diagnosing Components of the metabolic syndrome was obtained based on the IDF (international diabetes federation): TG$\geq$ 150 mg/dL, HDL-C$\leq$ 40 mg/dL, WHR greater than 0.5, FBG $\geq$ 100 mg/dL, and SBP or DBP$\geq$ 90th percentile for age, gender and height.

Abbreviations: WHR: waist to height ratio; HDL: high-density lipoprotein (mg/dL); TG: triglyceride (mg/dL); FBG: fasting blood glucose (mg/dL); BP: blood pressure (mmHg).