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The Prevalence of Overweight and Obese School-Going Adolescents in Ulaanbaatar and Its Lack of Associated Risk Factors.

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Objectives: The high prevalence of overweight and obese adolescents has severe consequences for economic and social development in Mongolia. This study aims to describe the prevalence of obesity and its associated factors among adolescents. **Methods:** Using the published results of the 2013 Global School-based Student Health Survey (GSHS), we determined the prevalence of overweight and obese youth as well as some aspects of their physical activity, alcohol consumption, tobacco usage, and dietary behavior. A total of 5393 students from grade 7-12 students who were normal weight, overweight or obese were studied. **Results:** Approximately 15% of adolescents were overweight or obese with significant differences in BMI when comparing students in grades 7 to 9 to students in grades 10 to 12 (p= .004). More of the students from grades 7 - 9 were overweight than obese (13.3% vs. 10.7%), while more in grades 10 - 12 were obese (2.1% vs. 1.1%). None of the risk factors available in the GSHS data set were related to being overweight or obese. **Conclusion:** Using the potential risk factors available in the GSHS data set, none were associated with being overweight or obese. There is a need for better understanding of the social, economic, and physical determinants of the high prevalence of overweight and obese adolescents in Mongolia.

Keywords: Adolescents, Mongolia, Overweight, Risk Factor, Prevalence

Introduction

In the twenty-first century, one of the most pressing public health concerns is childhood and adolescent obesity[1]. Until recently, obesity was associated with the developed world and affluence[2]. However, over time obesity in low- and middle-income countries (LMICs) has significantly increased[3-5]. In 2009, the World Health Organization (WHO) estimated 155 million or one in ten school-

age children 5 – 17 years old worldwide are either overweight or obese. In Africa, the estimated prevalence of children being classified as being overweight increased from 4% in 1990 to 7% in 2011, while in high-income countries 15% were obese[2,6]. Of the Association of Southeast Asian Nations (ASEAN) member countries, among 13-15 years old students, the prevalence of being overweight or obese was highest in Brunei Darussalam (36.1%), followed by Malaysia (23.7%), and the lowest in

Myanmar (3.4%) and Cambodia (3.7%)[7]. In comparison, Mongolia had a prevalence of being either overweight or obese of 16.7%, which is higher than the all African countries and a few of the ASEAN member countries[8].

Several organ systems such as musculoskeletal, cardiovascular and respiratory and their psychological health are adversely affected in obesity in youth[9]. Furthermore, long term obesity is associated with chronic noncommunicable diseases, in particular, adult obesity, hypertension, Type II diabetes, cardiovascular morbidity, resulting in premature mortality[10]. Studies have found that being overweight and obese are associated with sedentary behavior and over-nutrition[11-13]. Other factors, such as food insecurity, fast food, and soft drink consumption, decreased level of parental involvement, as well as less fruit and vegetable consumption, have been associated with weight gain in youth[14-20].

Compared to other research, which studied obesity and its association with cardiovascular diseases or life statisfaction, our study solely focuses on the risk factors leading to excess weight[21,22]. We focused separately on the overweight and obese youth because, the more weight a child gains while young, the more likely they are to have obesity-associated diseases later in life[10]. To our knowledge, the prevalence of Mongolian youth who are overweight or obese, and the risk factors associated with those conditions have not been described using the Global School-based Student Health Survey (GSHS) data. The objective of this paper is to synthesize, present and interpret these data for adolescents from school-based self-reported surveys who report being overweight or obesity, and the risk factors of physical inactivity, dietary habits, and alcohol and tobacco usage that may be associated with it.

Materials and Methods

Design and sample

Data were obtained from the GSHS, collected in Mongolia in 2013. The GSHS uses a standardized sampling strategy in all participating countries worldwide. The details for the procedures used to conduct the for GHSH in Mongolia were not provided. However, the survey questionnaire was administered to 5393 students, in the 7th to 12th grades. The school response rate was 98%, the student response rate was 89%, and the overall response rate was 88%. From the sample, students who were categorized as normal weight, overweight, and obese were selected for the study.

Measures
Body Mass Index
Height and body weight were self-reported as part of the GSHS. We calculated Body Mass Index (BMI) as weight/height^2 (kg/m^2). The international age- and gender-specific child BMI cut-points were used to define underweight, overweight, and obesity[23]. According to the WHO classification of BMI for youth, BMI < 25.0 kg/m^2 is normal, $\geq$25.0 - 29 kg/m^2 as overweight, and a BMI $\geq$30.0 kg/m^2 is classified as obese[24].

Demographics
Self-reported data for gender, age, and school grade were self-reported on the GSHS.

Health risk behaviors
Use of substances, such as tobacco and alcohol, was assessed by asking the students how many days they had drank alcohol or used tobacco in the 30 days before the survey. More than once was considered a risk factor. Dietary practices, such as daily fruit or fast food consumption, were evaluated. Eating fruit less than two times per day and eating fast food more than three times in the last week were considered risk behaviors. We selected a physical activity factor based on evidence-based global recommendations to prevent weight gain. For adolescents, being physically active at least 60 minutes per day is recommended[48]. Students who participated in PE less than three times per week PE and spent more than 3 hours a day sitting were considered to be at risk for gaining weight.

Data analysis
Data from the publicly available GSHS was used. All quantitative data of interest were tested for normality using the Kolmogorov-Smirnov test and were found to be normally distributed. Categorical data were represented as frequency distributions (percentages) and were analyzed using the chi-square test. Correlation analysis was done for the risk factors to determine their independence. Independent variables significantly correlated with the outcome variables in bivariate analysis and were less than moderately correlated (r<.3) with each other were included in the final multivariate model. Multiple

logistic regression was used to assess the impact of socio-demographic indicators and health risk behaviors on the odds of being categorized as overweight. The analysis was repeated for students who were obese. Both the reported 95% confidence intervals and the p-values were adjusted for the multi-stage stratified cluster sample design of the study. A p≤.05 was used to indicate statistical significance. The data analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 23.

Ethical statements

All questionnaires were completed anonymously. Approval to participate in the survey was obtained from students, and informed consent was obtained from the participating teachers and parents of students. Participants completed the questionnaires in private, away from their parents, classmates and school staff. Ethical approval for this study was not sought as the data used were accessible on the public domain.

Table 1. Socio-demographic characteristics of school-attending adolescents 12-18 years by BMI

Variable	Normal weight BMI N (%)	Over Weight BMI N (%)	Obese BMI N (%)	Total N	*p-value
Gender					
Male	1003 (84.6)	150 (12.6)	33 (2.8)	1186	.734
Female	1115 (85.3.9)	154 (11.8)	38 (2.9)	1307	
Age					
≤13	710 (84.7)	105 (12.5)	23 (2.7)	838	.919
≥14	1408 (85.1)	199 (12.0)	48 (2.9)	1655	
Class					
7-9	1203 (83.3)	192 (13.3)	51 (1.1)	1444	.004
10-12	915 (87.2)	112 (10.7)	22 (2.1)	1049	
Ate fruit >2 times per day past 30 days					
Yes	349 (84.7)	49 (11.9)	14 (3.4)	412	.73
No	1760 (85.0)	254 (12.3)	56 (2.7)	2070	
Ate fast >3 time per day past 7 days					
Yes	546(84.1)	85(13.1)	18(2.8)	649	.69
No	1553(85.4)	215(11.8)	50(2.8)	1818	
Smoked cigarettes >1 day of past 30 days					
Yes	194(86.6)	20(8.9)	10(4.5)	224	.11
No	1906(84.9)	279(12.4)	60(2.7)	2245	
Drank alcohol >1 day of past 30 days					
Yes	181(89.6)	17(8.4)	4(2.0)	202	.15
No	1895(84.5)	283(12.6)	65(2.9)	2243	
>3 days PE each week					
Yes	125(81.2)	22(14.3)	7(4.5)	154	.29
No	1971(85.2)	278(12.0)	64(2.8)	2313	
Active >60 mins/day for >5 of past 7 days					
Yes	775(85.9)	105(11.6)	22(2.4)	902	0.55
No	1323(84.4)	197(12.6)	47(3.0)	1567	
Sitting activities >3 hours/day of usual day					
Yes	887(85.6)	121(11.7)	28(2.7)	1036	0.75
No	1224(84.5)	181(12.5)	43(3.0)	1448	

*p-value calculated between BMI groups using chi-square test.

Results

Demographics
Gender, age, and grade
Among Mongolian schoolchildren in grades 7 to 12, 52.5% were male, and 47.5% were female (Table 1). Of those students, 33.6% were 12 to 13 years of age, while 66.4% were 14 to 18 years of age. Most of the students (57.9%) were in the younger grades, grades 7-9, with a smaller percentage (42.1%) in grades 10 – 12.

BMI stratification
We found that approximately 15% of adolescents were overweight or obese with significant differences in BMI when comparing students in grades 7 to 9 to students in grades 10 to 12 (p= .004). More of the students from 7th to 9th grades were overweight (13.3% vs. 10.7%,), while a higher percentage of the students from 10th to 12th grades were obese (2.1% vs. 1.1%). There were no differences in BMI based on gender or age (Table 1).

Prevalence of health behaviors
The results of correlation between all variables are shown in Table 2 and many of the risk factors assessed in the survey were weakly, albeit significantly correlated with each other (r<3, p≤.05). The results of multivariable logistic regression are presented in Tables 3 and 4, and none of the potential risk factors studied were found to be significantly related to being overweight or obese.

Discussion

In the present study, we have found a high prevalence of overweight and obesity in school-age adolescents in Mongolia. Overall, among the adolescents of 12.2% were overweight and 2.8% were obese. Compared with the GSHS questionnaire conducted in Mongolia 2010, where the overweight was at 8.3% and obese at 0.8%, the prevalence has significantly risen. The occurrence of obese boys (from 1.0% in 2010 to 1.3%) and girls (from 0.5 from 2010 to 1.5%) alike, have also risen[25]. This shows us the gravity of the public health problem in Mongolia, where the number of obese children has increased 3.5 times in just 3 years.

According to The Global Burden of Disease (GBD) Study 2013 in developed countries among adolescents, the prevalence of overweight has increased from 16.9 to 23.8% in males, and 16.2 to 22.6% in females, from 1980 to 2013. In developing countries, the prevalence has risen from 8.1% to 12.9% in males, and from 8.4 to 13.4% in females[26]. Our study has fewer overweight and obese youths, however, there is a sharper incline of them in Mongolia; wherein the GBD shows the difference between 20 years and our study of 3 years. Similar results were found in among African countries such as Benin and Malawi in 2009, with overweight adolescents being 11.2% and 10.0% respectively. However, more compared to Djibouti (18.8%), Egypt (31.4%), Mauritania (24.3%), and Morocco (16.6%) the prevalence was much less so in Mongolia[2].

Similar to other studies, we found no association between being overweight or obesity with alcohol consumption (p>.05)[27].

Table 2. The correlation between predictor variables.

	Ate fruit >2 times per day past 30 days	Ate fast food >3 days past 7 day	Active >60 mins/day for >5 of past 7 days	>3 days PE each week	Sitting activities >3 hours/ day of usual day	Smoked cigarettes >1 day of past 30 days	Drank alcohol >1 day of past 30 days
Ate fruit >2 times per day past 30 days	1						
Ate fast food >3 days past 7 day	.095**	1					
Active >60 mins/day for >5 of past 7 days	.047**	.055**	1				
>3 days PE each week	.055**	-.044**	.040**	1			
Sitting activities >3 hours/day of usual day	-.012	.144**	.036**	-.036**	1		
Smoked cigarettes >1 day of past 30 days	.009	.114**	.014	-.019	.113**	1	
Drank alcohol >1 day of past 30 days	.009	.093**	.012	-.003	.114**	.455**	1

**Correlation is significant at the .01 level (2-tailed); *Correlation is significant at the .05 level (2-tailed)

Table 3. Multiple logistic regression between health risk behaviors and being categorized as overweight in 12-18-year-old adolescents in Ulaanbaatar.

Factors	Overweight		
	Odds ratio	95% CI[a]	p-value
Ate fruit >2 times per day past 30 days			
Yes	1	1	.54
No	1.11	0.78- 1.57	
Ate fast food >3 days past 7 day			
No	1	1	.34
Yes	1.15	0.86- 1.54	
Smoked cigarettes >1 day of past 30 days			
No	1	1	.54
Yes	1.19	0.69-2.05	
Drank alcohol >1 day of past 30 days			
No	1	1	.39
Yes	1.59	0.87-2.87	
Active >60 mins/day for >5 of past 7 days			
Yes	1	1	.64
No	1.08	0.83-1.41	
>3 days PE each week			
Yes	1	1	.52
No	1.24	0.76- 2.03	

[a]Odds ratio from multiple logistic regression; 1 is the reference value for the healthy behavior; PE is physical education.

Table 4. Multiple logistic regression between poor health risk behaviors and being categorized as obese in adolescents 12-18-year-old adolescents in Ulaanbaatar.

Factors	Obese		
	Odds ratio	95% CI[a]	p-value
Ate fruit >2 times per day past 30 days			
Yes	1	1	.62
No	1.20	0.63- 2.29	
Ate fast food >3 days past 7 day			
No	1	1	.81
Yes	1.09	0.59- 1.97	
Smoked cigarettes >1 day of past 30 days			
No	1	1	.6
Yes	1.99	0.84- 4.73	
Drank alcohol >1 day of past 30 days			
No	1	1	.3
Yes	1.93	0.61- 6.09	
Active >60 mins/day for >5 of past 7 days			
Yes	1	1	.12
No	1.29	0.76- 2.22	
>3 days PE each week			
Yes	1	1	.09
No	2.01	0.89- 4.54	

[a]Odds ratio from multiple logistic regression; 1 is the reference value for the healthy behavior; PE is physical education.

However, several studies have identified it as a risk factor. Such studies that have found the correlation between BMI and obesity is related to the amount or intensity of drinking in one sitting, while the frequency of drinking is negatively correlated[28-30]. Other studies higher risk of obesity and large waist circumference with have found that binge drinking[31,32]. Other research has shown that when comparing heavy male and female drinkers with light drinkers, there was a higher risk of excess adiposity[33-36].

Ulaanbaatar is the most developed city in Mongolia; hence, the citizens are more likely to have a sedentary lifestyle with reduced physical activity due to private car ownership, and sedentary employment. Adolescents are more susceptible to having unhealthy dietary habits, including consumption of low cost of fast food, and carbonated drinks. Furthermore, they are more likely to spend time on technology-based entertainments, such as playing computer games and watching television, over physical activity-based ones. These changes of lifestyle and culture associated with urbanization could have attributed to the increasing obesity incidences[37].

Fruit and vegetable consumption of adolescents in Mongolia compared to Philippines, Thailand, and China were less by 3.1-4.2 times[25]. Many Mongolian youths fail to eat the recommended minimum amount of 400 g/d of fruit and vegetables as recommended in the 2002 Joint FAO/WHO Expert Consultation on 'Diet, Nutrition and the Prevention of Chronic Diseases.' Similarly, the majority of adolescents in eleven East Mediterranean Region countries also did not meet adequate fruit and vegetable consumption[38]. Perishable commodities require a different transportation and storage infrastructure than highly processed foods, and consequently, they may be lacking reliable supply chains[39]. Various factors contributing to the consumption of fruit and vegetables, such as their accessibility, affordability, and other interrelated aspects, need to be better understood[40].

The GSHS results across 34 countries revealed that only 23.8 % of boys and 15.4 % of girls were physically active for 60 minutes on at least five days of the week[41]. In comparison, 34.7% of all students in our study were physically active. In countries where surveys were more recently conducted, such as in 2011–2013, the prevalence of physical inactivity and sedentary behavior was significantly higher. For example, in Cambodia, Malaysia, Philippines and Vietnam (p<.001; analysis not shown) physical inactivity and sedentary behavior are higher recently than in studies conducted much earlier (2007–2008:

Indonesia, Myanmar, and Thailand)[42]. In the GSHS conducted in 2003, 2007, and 2011 in the Philippines, the prevalence of physical inactivity was 89.6%, 92.8%, and 86.7%, and sedentary behavior 31.6%, 32.7%, and 33.9%, respectively, showing no significant differences over the years[43]. One study found that male students coming from low income or lower-middle-income countries, such as Mongolia, Cambodia and the Philippines, had higher odds of physical inactivity, which agrees with a previous study among university students in 23 countries[44]. It is possible that adolescent boys from upper-middle-income countries had better access to sports or physical activity facilities resulting in higher physical activity levels than students from low or lower-middle-income countries[45].

We have studied only a limited number of risk factors and inequalities, such as socioeconomic status. Further research for a more comprehensive understanding of overweight and obese adolescents are needed, involving a more extensive range of risk and protective behaviors, such as the association of tobacco and obesity. Our study had shown no association, and there are few if any other GSHS studies describing their correlation. Importantly, to shape public policy, all risk behaviors contributing to the prevalence of obesity need to be understood and analyzed.

Limitations

This study had several limitations. The study was based entirely on the questions asked as part of the GSHS survey, and it is possible that self-reporting survey methodology in general or the GSHS questions, in particular, were not appropriate to identify the risk behaviors associated with adolescent obesity. For example, over reported physical activity, as has been found in other studies of adolescents[46]. The survey only included adolescents who are in a formal school, which is not representative of all adolescents in Mongolia as there may be differences health risk behaviors between adolescents who attend an official school and those who do not. Several other environmental factors[47] can be related to physical activity and were not assessed in this study, and should be assessed in future studies. Furthermore, since this study was based on data collected in a cross-sectional survey and no causal conclusions can be drawn.

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Conflict of Interest

The authors state no conflict of interest.

References

1. Gungor NK. Overweight and obesity in children and adolescents. J Clin Res Pediatr Endocrinol 2014; 6: 129–43. doi: 10.4274/Jcrpe.1471.

2. Manyanga T, El-Sayed H, Doku DT, Randall JR. The prevalence of underweight, overweight, obesity and associated risk factors among school-going adolescents in seven African countries. BMC Public Health 2014; 14: 887.

3. Florencio TM, Ferreira HS, de Franca AP, Cavalcante JC, Sawaya AL. Obesity and undernutrition in a very-low-income population in the city of Maceio, northeastern Brazil. Br J Nutr 2001; 86: 277–84.

4. Reddy SP, Resnicow K, James S, Kambaran N, Omardien R, Mbewu AD. Underweight, overweight and obesity among South African adolescents: results of the 2002 National Youth Risk Behaviour Survey. Public Health Nutr 2009; 12: 203–7.

5. Verstraeten R, Roberfroid D, Lachat C, Leroy JL, Holdsworth M, Maes L, et al. Effectiveness of preventive school-based obesity interventions in low- and middle-income countries: a systematic review. Am J Clin Nutr 2012; 96: 415–38.

6. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet 2013; 382: 427–51.

7. Pengpid S and Peltzer K. Overweight, Obesity and Associated Factors among 13-15 Years Old Students in the Association of Southeast Asian Nations Member Countries, 2007-2014. Southeast Asian J Trop Med Public Health 2014; 47: 250-62.

8. Mandakh U, Bolor K, Batmunkh A. Association between consumption of Sugar-sweetened Beverages and Childhood Obesity and Overweight. Cent Asian J Med Sci 2016; 187-193.

9. Kessaram T, MCkenzie J, Girin N, Edwin O, Pullar J, Roth A, et al. Overweight, obesity, physical activity and sugar-sweetened beverage consumption in adolescents of Pacific islands: results from the Global School-Based Student Health Survey and the Youth Risk Behavior Surveillance System. BMC Obes 2015; 2: 34.

10. te Velde SJ, van Nassau F, Uijtdewilligen L, van Stralen MM, Cardon G, De Craemer M, et al. Energy balance-related behaviours associated with overweight and obesity in preschool children: a systematic review of prospective studies. Obes Rev 2012; 13: 56–74.

11. Al-Haifi AR, Al-Fayez MA, Al-Athari BI, Al-Ajmi FA, Allafi AR, Al-Hazzaa HM, et al. Relative contribution of physical activity, sedentary behaviors, and dietary habits to the prevalence of obesity among Kuwaiti adolescents. Food Nutr Bull 2013; 34: 6–13.

12. 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: 266–84.

13. Ho TF, Yip WC, Tay JS, Rajan U. Social class distribution of obese Chinese children. J Singapore Paediatr Soc 1991; 33: 55–8.

14. Kimani-Murage EW. Exploring the paradox: double burden of malnutrition in rural South Africa. Global Health Action 2013, 6:19249.

15. Nasreddine L, Naja F, Akl C, Chamieh MC, Karam S, Sibai AM, et al. Dietary, lifestyle and socio-economic correlates of overweight, obesity and central adiposity in lebanese children and adolescents. Nutrients 2014; 6: 1038–62.

16. Williams SL, Mummery WK. Links between adolescent physical activity, body mass index, and adolescent and parent characteristics. Health Educ Behav 2011; 38: 510–20.

17. Berge JM, Wall M, Larson N, Forsyth A, Bauer KW, Neumark-Sztainer D. Youth dietary intake and weight status: healthful neighborhood food environments enhance the protective role of supportive family home environments. Health Place 2014; 26: 69–77

18. Shields M, Tremblay MS. Canadian childhood obesity estimates based on WHO, IOTF and CDC cut-points. Int J Pediatr Obes 2010; 5: 265–73.

19. Yu BN, Protudjer JL, Anderson K, Fieldhouse P. Weight status and determinants of health in Manitoba children and youth. Can J Diet Pract Res 2010; 71: 115–21.

20. Park MH, Falconer C, Viner RM, Kinra S. The impact of childhood obesity on morbidity and mortality in adulthood: a systematic review. Obes Rev 2012; 13: 985–1000.

21. Caleyachetty R, Echouffo-Tcheugui JB, Tait CA, Schilsky S, Forrester T, Kengne AP. Prevalence of behavioural risk factors for cardiovascular disease in adolescents in low-income and middle-income countries: an individual participant data meta-analysis. Lancet Diabetes Endocrinol 2015; 3: 535-44

22. Zahedi H, Kelishadi R, Heshmat R, Ranjbar SH, Motlagh ME, Ardalan G. Association of adolescents' weight status with life satisfaction: role of self, peers, family and school perception; the CASPIAN-IV study. Minerva Pediatr 2015.

23. de Onis M, Blossner M, Borghi E, Frongillo EA, Morris R. Estimates of global prevalence of childhood underweight in 1990 and 2015. JAMA 2004; 291: 2600–6.

24. World Health Organization. Body mass index – BMI [accessed on 24 February 2019]. Available at:http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi.

25. World Health Organization. Global School-based student Health Survey-Mongolia [accessed on 24 February. 2019]. Available at: https://www.who.int/ncds/surveillance/gshs/GSHS_Country_report_Mongolia2010.pdf.

26. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2014; 384: 766-81.

27. Sayon-Orea C, Martinez-Gonzalez MA, Bes-Rastrollo M. Alcohol consumption and body weight: a systematic review. Nutr Rev 2011; 69: 419–31.

28. Breslow RA, Smothers BA. Drinking patterns and body mass index in never smokers: National Health Interview Survey, 1997–2001. Am J Epidemiol 2005; 161: 3 68–76.

29. French MT, Norton EC, Fang H, Maclean JC. Alcohol consumption and body weight. Health Econ 2010; 19: 814–32.

30. Tolstrup JS, Heitmann BL, Tjønneland AM, Overvad K, Sørensen TI, Grønbaek MN. The relation between drinking pattern and body mass index, waist and hip circumference. Int J Obes 2005; 29: 490-7. doi: 10.1038/sj.ijo.0802874.

31. Arif AA, Rohrer JE. Patterns of alcohol drinking and its association with obesity: Data from the Third National Health and Nutrition Examination Survey, 1988–1994. BMC Public Health 2005; 5: 126.

32. Lee K. Gender-specific relationships between alcohol drinking patterns and metabolic syndrome: The Korea National Health and Nutrition Examination Survey 2008. Public Health Nutr 2012; 15: 1917–24. doi: 10.1017/S136898001100365X.

33. Croezen S, Visscher TL, Ter Bogt NC, Veling ML, Haveman-Nies A. Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: Results of the E-MOVO project. Eur J Clin Nutr 2009; 63: 405–12.

34. Duvigneaud N, Wijndaele K, Matton L, Deriemaeker P, Philippaerts R, Lefevre J, et al. Socio-economic and lifestyle factors associated with overweight in Flemish adult men and women. BMC Public Health 2007; 7: 23. doi:10.1186/1471-2458-7-23.

35. Lukasiewicz E, Mennen LI, Bertais S, Arnault N, Preziosi P, Galan P, et al. Alcohol intake in relation to body mass index and waist-to-hip ratio: the importance of type of alcoholic beverage. Public Health Nutr 2005; 8: 315–20.

36. Wakabayashi I. Cross-sectional relationship between alcohol consumption and prevalence of metabolic syndrome in Japanese men and women. J Atheroscler Thromb 2010; 17: 695–704.

37. Mehio Sibai A, Nasreddine L, Mokdad AH, Adra N, Tabet M, Hwalla N. Nutrition transition and cardiovascular disease risk factors in Middle East and North Africa countries: reviewing the evidence. Ann Nutr Metab 2010; 57: 193–203.

38. Al Ani, MF, Al Subhi LK, Bose S. "Consumption of fruits and vegetables among adolescents: a multi-national comparison of eleven countries in the Eastern Mediterranean Region." Br J Nutr 2016; 1-8.

39. The Economist Intelligence Unit (2014) Special report: food loss and its intersection with food security. A report from The Economist Intelligence Unit [accessed on 20 February 2019]. Available at: http://foodsecurityindex.eiu.com/.

40. Rahim HFA, Sibai A, Khader Y, Hwalla N, Fadhil I, Alsiyabi

H, et al. Non- communicable diseases in the Arab world. Lancet 2014; 383: 356–67.

41. Guthold R, Cowan MJ, Autenrieth CS, Kann L, Riley LM. Physical activity and sedentary behavior among schoolchildren: a 34-country comparison. J Paediatr 2010; 157: 43-9.

42. Peltzer K, Pengpid S. Leisure Time Physical Inactivity and Sedentary Behaviour and Lifestyle Correlates among Students Aged 13-15 in the Association of Southeast Asian Nations (ASEAN) Member States, 2007-2013. Int J Environ Res Public Health 2016; 13: 217.

43. Peltzer K, Pengpid S. Health risk behaviour among in-school adolescents in the Philippines: Trends between 2003, 2007 and 2011, across-sectional study. Int J Environ Res Public Health 2016; 13: 73.

44. Pengpid S, Peltzer K, Kassean HK, Tsala JP, Sychareun V, Müller-Riemenschneider F. Physical inactivity and associated factors among university students in 23 low-, middle- and high-income countries. Int J Public Health 2015; 60: 539–49.

45. Collins A.E, Pakiz B, Rock CL. Factors associated with obesity in Indonesian adolescents. Int J Pediatr Obes 2008; 3: 58–64.

46. Shiely F, MacDonncha C. Meeting the international adolescent physical activity guidelines: A comparison of objectively measured and self-reported physical activity levels. Ir Med J 2009; 102: 15–9.

47. Trang NH, Hong TK, Dibley MJ, Sibbritt DW. Factors associated with physical inactivity in adolescents in Ho Chi Minh City, Vietnam. Med Sci Sports Exerc 2009; 41: 1374–83.

48. Global Recommendations on Physical Activity for Health. Geneva: World Health Organization 2010 [accessed on 15 February 2019]. Available at: https://www.ncbi.nlm.nih.gov/books/NBK305057/.