Original Article Open Access

## Changes of Overweight and Obesity Prevalence Among School Children in North West of Iran After 3 Years Follow-up (2009–2011): A Longitudinal Study

Sakineh Nouri Saeidlou, Fatemeh Rezaiegoyjeloo<sup>1</sup>, Parvin Ayremlou, Fariba Babaie<sup>1</sup>

Food and Beverages Safety Research Center, Urmia University of Medical Sciences, Urmia, Iran, 1 Health Department, Urmia University of Medical Sciences, Urmia, Iran

#### Correspondence to:

Parvin Ayremlou, Food and Beverages Safety Research Center, Urmia University of Medical Sciences, Urmia, Iran. E-mail: p.ayremlou@gmail.com

How to cite this article: Nouri Saeidlou S, Rezaiegoyjeloo F, Ayremlou P, Babaie F. Changes of overweight and obesity prevalence among school children in North West of Iran after 3 years follow-up (2009-2011): A longitudinal study. Int J Prev Med 2016;7:79.

#### **ABSTRACT**

**Background:** Obesity and overweight among children is a major public health problem in developed and developing countries and has important health and economic implications. This longitudinal study aimed to assessing the prevalence trend of overweight and obesity in West Azerbaijan in North West of Iran.

**Methods:** This study was a longitudinal follow-up study and was conducted in school children at 2009–2011 year. The subjects were all school children (12 years of age) that were recruited from rural and urban schools in West Azerbaijan. Overall, 22,820 girls and 28,763 boys were enrolled in 2009 and were followed for 3 years. A body mass index (BMI) 85<sup>th</sup>–95<sup>th</sup> percentile was classified as overweight and a BMI >95<sup>th</sup> percentile was classified as obese. All statistical analyses were performed using the Excel Software. Descriptive statistics were used to characterize the sample in different time periods. The prevalence was calculated as the ratio of number of present cases to a given population number in a given subgroup at a given time.

**Results:** In urban schools, the prevalence of overweight among girls and boys was 118.26 and 103.9 per 1000 persons in 2009 year, respectively, and this trend was increased in both girls (152.90 per 1000 persons) and boys (125.72 per 1000 persons) in 2011. The obesity trend was increased among both girls and boys (22.26 and 26.52 among girls and boys in 2009 to 24.66 and 28.65 per 1000 persons in 2011), respectively. In rural schools, the prevalence of overweight among girls was increased from 84.5 in 2009 to 108.89 per 1000 persons in 2011, but this trend was decreased among boys (from 95.49 in 2009 to 43.9 per 1000 persons in 2011), and the prevalence of obesity among boys was increased at the end of follow-up, but this trend was decreased among girls.

**Conclusions:** Overweight and obesity in children has increased. Further studies are necessary to evaluate the relationship between obesity and overweight and risk factors such as dietary pattern and physical inactivity.

Keywords: Longitudinal study, obesity, overweight, prevalence, school children

# Access this article online Quick Response Code: Website: www.ijpvmjournal.net/www.ijpm.ir DOI: 10.4103/2008-7802.183651

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

#### **INTRODUCTION**

Obesity and overweight among children is a major public health problem in developed and developing countries. [1-4] Obesity in children is associated with a wide range of serious health complications, including diabetes, hypertension, hypercholesterolemia, musculoskeletal disorders, and heart disease. [5-9] Without intervention, obese infants and young children will likely continue to be obese during childhood, adolescence, and adulthood. [10-13]

Several studies show that in Iranian children the prevalence of overweight and obesity has increased<sup>[14-16]</sup> but in children and adolescents, only a few longitudinal follow-up studies have been performed. Assessment of the trend of overweight and obesity using longitudinal studies compared with cross-sectional studies have found stronger evidences. The results of longitudinal studies are very important for planning appropriate interventions.

According to a single study, the prevalence of overweight was 5.1%, 4.5%, and 3.7% in Northwestern, Central, and Southern regions of Iran, respectively. Moreover, the prevalence of obesity in these three regions was 1.3%, 0.7%, and 0.1%, respectively. [17,18] A study conducted in West Azerbaijan shows that the trend of overweight and obesity among school children has increased. [19] This longitudinal study aimed to assessing the prevalence trend of overweight and obesity in West Azerbaijan in North West of Iran among 12 years of age children.

#### **METHODS**

The study was planned as a longitudinal follow-up study and was conducted in school children at 2009 year. Subjects were all school children (12 years of age) that were recruited from rural and urban schools in West Azerbaijan. Participants were all healthy children that recruited from public and private schools and according to the medical records of children who had the diseases which influence on overweight and obesity were excluded from the study (children with physical disability, diabetic, and children who use drugs). In Iran, the academic year runs for 10 months from September to June. The current data were from the annual survey in Iranian school children that was conducted in October month each year. Overall, 22,820 girls and 28,763 boys were enrolled in 2009. We used the data of a longitudinal study to evaluate the changes in overweight and obesity among children. Sample of children followed to 15 years of age in 2011 year. The total eligible sample enrolled after the 3-year included 18,846 girls and 28,282 boys. Nearly 4500 children were not assessed during follow-up period because they did not register in this region's schools. All data were collected by interviews and anthropometric measurements. For each district the team of data collection selected and after training, gathering of data started in the whole of districts at the same time (8 to 12 o'clock every morning). Fixed health experts visited for anthropometric measurements at each school. Height and weight were measured with the highest accuracy. The body mass index (BMI) is defined as the body mass divided by the square of the body height (weight [kg])/(height [m])2. Using Centers for Disease Control and Prevention cut-off points, a BMI 85th-95th percentile was classified as overweight and a BMI >95th percentile was classified as obese. The subjects were adjusted by age, sex, and region (urban and rural). All statistical analyses were performed using the Excel software. Descriptive statistics were used to characterize the sample in different time periods. The prevalence was calculated as the ratio of number of present cases to a given population number in a given subgroup at a given time per 1000 persons.

#### **RESULTS**

In the current study, totally, 22,820 girls and 28,763 boys at 12 years of age in urban and rural schools were recruited. In urban schools, a total 17,386 and 20,364 girls and boys were studied in the 2009 survey. Our finding showed that the prevalence of overweight among girls and boys was 118.26 and 103.9 per 1000 persons in 2009 survey, respectively, and this trend was increased in both girls (152.90 per 1000 persons) and boys (125.72 per 1000 persons) in 2011. Our findings showed that in urban schools, the highest prevalence of obesity observed among boys in both 2009 and 2011 years and the obesity trend was increased among both girls and boys as this trend was increased from 22.26 and 26.52 among girls and boy in 2009 to 24.66 and 28.65 per 1000 persons in 2011, respectively. In rural schools, a total 5434 and 8399 girls and boys were studied in the 2009 survey. Results showed that the prevalence of overweight among girls was increased from 84.5 in 2009 to 108.89 per 1000 persons in 2011, but this trend was decreased among boys (from 95.49 in 2009 to 43.9 per 1000 persons in 2011). The prevalence of obesity among boys in 2011 was increased compared to 2009 (from 13.22 to 24.79 per persons), but this trend was decreased among girls (from 37.73 to 20.9 per 1000 persons) [Table 1]. Totally, the prevalence of overweight was increased among both girls and boys at 15 ages of years compared at 12 age of years and also, the same trend was observed in obesity prevalence among boys but a few decreases were observed among girls [Figures 1 and 2].

#### **DISCUSSION**

Children who are obese are likely to be obese as adolescents and adults, and childhood obesity has both immediate and long-term effects on health and well-being.<sup>[20]</sup> Evaluation overweight and obesity

during children is useful for the prevention of obesity and severe consequences later in adolescence and adulthood therefore, the aim of the current study was to evaluate longitudinal changes in prevalence trend of overweight and obesity in children. In this study during the follow-up, the drop-out rate was slow with 17.4% of girls and 1.6% of boys not reevaluated after 3 years. Loss to follow-up occurred in most longitudinal studies. In this study, missing is low compared to other studies. In this study, missing is low compared to other studies. In this study, missing is low compared to other studies. In this study, missing is low compared to other studies to follow-up has between 80% and 90%. Typically, some have suggested that <5% loss leads to little

Table 1: The prevalence of overweight and obesity among girls and boys in West Azerbaijan Province

Region	Cases (n)			
	12 years of age (2009)		15 years of age (2011)	
	Girls	Boys	Girls	Boys
Urban schools				
Overweight	2056	2116	2567	2962
Obesity	387	540	414	675
Population	17,386	20,364	16,789	23,561
Prevalence*				
Overweight	118.26	103.9	152.90	125.72
Obesity	22.26	26.52	24.66	28.65
Rural schools				
Overweight	459	802	224	207
Obesity	205	111	43	117
Population	5434	8399	2057	4721
Prevalence				
Overweight	84.5	95.49	108.89	43.9
Obesity	37.73	13.22	20.9	24.79
Total schools				
Overweight	2515	2918	2791	3169
Obesity	592	651	457	792
Population	22,820	28,763	18,845	28,282
Prevalence				
Overweight	110.21	101.45	148.09	112.05
Obesity	25.94	22.63	24.51	28

<sup>\*</sup>Prevalence per 1000 persons

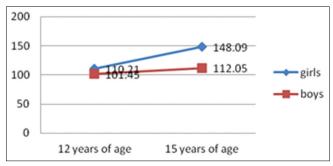


Figure 1: The overweight trends per 1000 persons among total school children in West Azerbaijan province

bias, while >20% poses serious threats to validity. Indeed, a cut-off of 80% is used. [25,26] In the current study, the loss to follow-up is missing at random and children characteristics who drop-out is more likely to of children that following. The higher of drop-out in girls due to lake of enough high schools in rural regions they did not continue education but the boys feel free to continue their education in urban schools. Loss over time is unavoidable, even in the best studies. The potential effects of missing data should be considered in the analysis.

In the current study, the prevalence trend of overweight was increased among girls and boys from 110.21 and 101.45 per 1000 persons in 2009 to 148.09 and 112.05 per 1000 persons in 2011, respectively, that our findings consistent with other studies. [16,27] Our results showed that overweight increased with age. Many factors such as lifestyle, nutrition, and maturation contribute in these differences. The current study showed that the prevalence of obesity among boys was increased at 15 years of age comparing 12 years of age, but this trend in girls was decreased slightly. The prevalence of overweight and obesity in urban children higher than rural children, this difference may be due to rural regions are known to have fewer food and lowest socioeconomic status that affect the nutrition status. [28,29]

In summary, these results showed that the overweight and obesity has increased among school children at 15 years of age comparing 12 years of age in West Azerbaijan Province. The increasing of overweight and obesity due to unhealthy behaviors such as lack of physical activity, overconsumption of process and fast foods, and long sedentary games computers among school-aged children. [30-33] Parents and children should be educated for cooking and healthy eating.

The main strengths of this study are follow-up design, large sample size, and low rate of lost to follow-up, with a quite long follow-up time and generalizability. A further strength of the current study is the use of

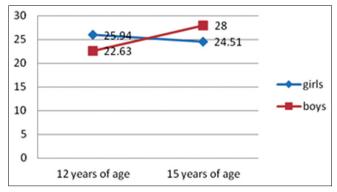


Figure 2:The obesity trends per 1000 persons among total school children in West Azerbaijan province

population-based methods. The limitations including the relationship between overweight and obesity with risk factors such an unhealthy dietary pattern and physical inactivity have not been evaluated. We recommend further studies to assess the risk factors that influence on overweight and obesity in school-aged children. Despite these limitations, the current study offers an analysis of large sample children in a longitudinal follow-up study to determine the overweight and obesity pattern in school-aged children.

#### **CONCLUSIONS**

The prevalence of overweight and obesity in children has increased. Research on prevalence trend of overweight and obesity by longitudinal follow-up studies in children is poorly reported in Iran. Our findings also confirmed that further studies are needed to assess the relationship of overweight and obesity with unhealthy dietary pattern and physical inactivity that are important risk factors in children

### Financial support and sponsorship Nil.

#### **Conflicts of interest**

There are no conflicts of interest.

Received: 03 Aug 15 Accepted: 08 Mar 16 Published: 08 Jun 16

#### **REFERENCES**

- Dégi AA, Kis E, Kerti A, Cseprekál O, Szabó AJ, Reusz GS. Prevalence of obesity and metabolic changes after kidney transplantation: Hungarian pediatric cohort study. Transplant Proc 2014;46:2160-3.
- Cunningham SA, Kramer MR, Narayan KM. Incidence of childhood obesity in the United States. N Engl J Med 2014;370:403-11.
- Júlíusson PB, Eide GE, Roelants M, Waaler PE, Hauspie R, Bjerknes R. Overweight and obesity in Norwegian children: Prevalence and sociodemographic risk factors. Acta Paediatr 2010;99:900-5.
- Maggio AB, Saunders Gasser C, Gal-Duding C, Beghetti M, Martin XE, Farpour-Lambert NJ, et al. BMI changes in children and adolescents attending a specialized childhood obesity center: A cohort study. BMC Pediatr 2013:13:716
- Bechard LJ, Rothpletz-Puglia P, Touger-Decker R, Duggan C, Mehta NM. Influence of obesity on clinical outcomes in hospitalized children: A systematic review. JAMA Pediatr 2013;167:476-82.
- Han DY, Murphy R, Morgan AR, Lam WJ, Thompson JM, Wall CR, et al. Reduced genetic influence on childhood obesity in small for gestational age children. BMC Med Genet 2013;14:10.
- Caleyachetty R, Rudnicka AR, Echouffo-Tcheugui JB, Siegel KR, Richards N, Whincup PH. Prevalence of overweight, obesity and thinness in 9-10 year old children in Mauritius. Global Health 2012;8:28.
- Lang JE. Obesity and asthma in children: Current and future therapeutic options. Paediatr Drugs 2014;16:179-88.
- Taheri F, Kazemi T, Fesharakinia A. Alarming increase in the prevalence of childhood dyslipidemia in elementary schoolchildren in east of Iran. J Res Med Sci 2014;19:383-4.
- Cavazzotto TG, Brasil MR, Oliveira VM, da Silva SR, Ronque ER, Queiroga MR, et al. Nutritional status of children and adolescents based on body mass index: Agreement between World Health Organization and International Obesity Task Force. Rev Paul Pediatr 2014;32:44-9.

- Hickie M, Douglas K, Ciszek K. The prevalence of overweight and obesity in Indigenous kindergarten children – A cross sectional population based study. Aust Fam Physician 2013;42:497-500.
- Lin SL, Leung GM, Lam TH, Schooling CM. Timing of solid food introduction and obesity: Hong Kong's "children of 1997" birth cohort. Pediatrics 2013;131:e1459-67.
- Jari M, Qorbani M, Motlagh ME, Heshmat R, Ardalan G, Kelishadi R. Association of overweight and obesity with mental distress in Iranian adolescents: The CASPIAN-III study. Int J Prev Med 2014;5:256-61.
- 14. Baygi F, Qorbani M, Dorosty AR, Kelishadi R, Asayesh H, Rezapour A, et al. Dietary predictors of childhood obesity in a representative sample of children in north east of Iran. Zhongguo Dang Dai Er Ke Za Zhi 2013;15:501-8.
- Taheri F, Kazemi T, Chahkandi T, Namakin K, Zardast M, Bijari B. Prevalence of overweight, obesity and central obesity among elementary school children in Birjand, east of Iran, 2012. J Res Health Sci 2013;13:157-61.
- Kelishadi R, Haghdoost AA, Sadeghirad B, Khajehkazemi R. Trend in the prevalence of obesity and overweight among Iranian children and adolescents: A systematic review and meta-analysis. Nutrition 2014;30:393-400.
- Nouri Saeidlou S, Babaei F, Ayremlou P. Children malnutrition in northwestern, central and southern regions of Iran: Does geographic location matter? Glob J Health Sci 2014;6:36-41.
- Nouri Saeidlou S, Babaei F, Ayremlou P. Malnutrition, overweight, and obesity among urban and rural children in north of west Azerbijan, Iran. J Obes 2014;2014;541213.
- Nouri Saeidlou S, Rezaiegoyjeloo F, Ayremlou P, Babaei F. Trend of overweight and obesity, based on population study among school children in north west of Iran: Implications for when to intervene. Maedica 2015;10:214-20.
- Ahuja B, Klassen AF, Satz R, Malhotra N, Tsangaris E, Ventresca M, et al. A review of patient-reported outcomes for children and adolescents with obesity. Qual Life Res 2014;23:759-70.
- Nohr EA, Frydenberg M, Henriksen TB, Olsen J. Does low participation in cohort studies induce bias? Epidemiology 2006;17:413-8.
- de Groot S, Haisma JA, Post MW, van Asbeck FW, van der Woude LH. Investigation of bias due to loss of participants in a Dutch multicentre prospective spinal cord injury cohort study. J Rehabil Med 2009;41:382-9.
- Littman AJ, Boyko EJ, Jacobson IG, Horton J, Gackstetter GD, Smith B, et al. Assessing nonresponse bias at follow-up in a large prospective cohort of relatively young and mobile military service members. BMC Med Res Methodol 2010;10:99.
- Galea S, Tracy M. Participation rates in epidemiologic studies. Ann Epidemiol 2007;17:643-53.
- Kristman V, Manno M, Côté P. Loss to follow-up in cohort studies: How much is too much? Eur J Epidemiol 2004;19:751-60.
- Fewtrell MS, Kennedy K, Singhal A, Martin RM, Ness A, Hadders-Algra M, et al. How much loss to follow-up is acceptable in long-term randomised trials and prospective studies? Arch Dis Child 2008;93:458-61.
- Ayatollahi SM, Bagheri Z, Heydari ST. Agreement analysis among measures of thinness and obesity assessment in Iranian school children and adolescents. Asian J Sports Med 2013;4:272-80.
- Yu Z, Han S, Chu J, Xu Z, Zhu C, Guo X. Trends in overweight and obesity among children and adolescents in China from 1981 to 2010: A meta-analysis. PLoS One 2012;7:e51949.
- Muhihi AJ, Mpembeni RN, Njelekela MA, Anaeli A, Chillo O, Kubhoja S, et al. Prevalence and determinants of obesity among primary school children in Dar es Salaam, Tanzania. Arch Public Health 2013;71:26.
- Andegiorgish AK, Wang J, Zhang X, Liu X, Zhu H. Prevalence of overweight, obesity, and associated risk factors among school children and adolescents in Tianjin, China. Eur J Pediatr 2012;171:697-703.
- Al Junaibi A, Abdulle A, Sabri S, Hag-Ali M, Nagelkerke N. The prevalence and potential determinants of obesity among school children and adolescents in Abu Dhabi, United Arab Emirates. Int J Obes (Lond) 2013;37:68-74.
- Muthuri SK, Wachira LJ, Leblanc AG, Francis CE, Sampson M, Onywera VO, et al. Temporal trends and correlates of physical activity, sedentary behaviour, and physical fitness among school-aged children in Sub-Saharan Africa: A systematic review. Int J Environ Res Public Health 2014;11:3327-59.
- Hajian-Tilaki K, Heidari B. Prevalences of overweight and obesity and their association with physical activity pattern among Iranian adolescents aged 12-17 years. Public Health Nutr 2012;15:2246-52.