Epidemiological profile of obesity in mid school children

Vikas Narayan Solunke[1], Yogita Gaikwad[2], Shivprasad Mundada[3*], Kiran Bhaisare[4], Shital Bhattad[5], Satyakala Garad[6]

{[1,2,4]Associate Professor, [3]Professor And Head, [5]Assistant Professor, Department of Pediatrics} {[6]Medical officer, Department of Ophthalmology} Government Medical College, Latur, Maharashtra, INDIA.
Email: drvikassolunke@gmail.com

Abstract

Background: Epidemiology of obesity in early adolescent is multi factorial and involves diverse interactions between genetic, metabolic, neuroendocrine, psychological, environmental and socio-cultural factors. **Objectives:** To see epidemiological profile of obesity in early adolescent children. **Material and Methods:** This cross-sectional study was planned to assess the prevalence of overweight, obesity in school children in early and mid adolescence in different schools in a city in Maharashtra, India and was carried out during August 2015 to July 2017. Five schools in a district of Maharashtra were selected with sample size of 2496. Descriptive statistics were expressed in Mean+SD, frequencies and percentages, correlation was studied using Pearson's product moment correlation for data with normal distribution. **Results:** Among the students, 37.9% were of 13 years, 34.6% were of 12 years. Among the students, 57.8% were males while 42.2% were females. As per CDC classification, about 9.2% students were overweight while obesity was present in 4.4% students. A very strong agreement (κ=0.814) was found between the two classifications for overweight or obesity. No association was found between the presence of overweight or obesity and socioeconomic status, statistical significant association was found between the presence of overweight or obesity and type of diet consumed, junk food, salt intake and oil consumed. **Conclusions:** obesity and overweight was significantly associated with upper socioeconomic status, type of diet, junk food intake, salt consumption and oily food.
Key Word: Obesity, BMI, Adolescents

***Address for Correspondence:**
Dr. Shivprasad Mundada, Associate Professor, Department of Pediatrics, Government Medical College, Latur, Maharashtra, INDIA.
Email: drvikassolunke@gmail.com

Access this article online	
Quick Response Code:	**Website:** www.medpulse.in
	Accessed Date: 21 May 2019

INTRODUCTION

In recent decades, there has been an unprecedented increase in the prevalence of overweight, obesity and hypertension among adolescents, in most of the countries, in both developed and developing alike.[1–3] Owing to this increased occurrence, the health problems associated with these disorders in adults are also being frequently observed in adolescents.[1,4] Body mass index (BMI) reflects the weight of an individual with reference to height. Many obese adolescents face psychosocial problems at schools and among friends, such as bullying, being laughed at, stigmatization, etc.[1,3,5] During the initial years of adolescence, puberty hits, and, the adolescent undergoes many physiological changes owing to change in the hormonal levels. Coping up with these changes is quite stressful for them. Presence of obesity further complicates this scenario. Body dissatisfaction and weight concerns have been found to be more common in obese adolescents than those with normal weight.[6–9] This perception of being obese, may result in psychological problems and affect the development of dietary behaviors, rather the actual weight of the individual.[10–15] This can be overcome by prevention and treatment of increased weight among adolescents. Development of obesity among adolescents has several adverse physical consequences, such as increase in the cardiovascular risk

factors like hypertension, dyslipidemia, hyper insulinemia, and impaired glucose tolerance. These may not present with any symptoms or signs in adolescence, but have been found to predict increase in mortality and morbidity in adulthood due to cardiovascular causes.[16,17] Obese adolescents are predisposed to an increased risk of various systemic disorders of the pulmonary, neurological, gynecological, gastroenterological, orthopedic, hormonal disorders, etc.[1,18,19] The present study was planned with an aim to observe the prevalence of overweight, obesity in the early adolescence in a district place in Maharashtra, India, to study the various associated factors.

MATERIAL AND METHODS

The present cross-sectional study was planned to assess the prevalence of overweight, obesity in school children in early and mid adolescence in different schools in a city in Maharashtra, India was carried out during August 2015 to July 2017. Fiveschools in a district in Maharashtra were selected randomly. In a study by Bharati et al[20] in Wardha city in Maharashtra, the prevalence of overweight and obesity in school going children was 4.3% (p). Using formula, sample size = 4pq/l2, where, p =prevalence, q = 100-p, l = precision = 1 for type 1 error of 5%.Sample size = 4 x 4.3 x (100 − 4.3)/ (1)2= 4 x 4.3 x 95.7 = 1646. Thus, for the study, we need at least data on 1646 adolescents. Since, it is an epidemiological study, it was decided to include maximum number of adolescents from the 5 selected schools in 7th, 8th and 9th standard. At the end of data collection, the final sample size was 2496. Students of either sex in the 7th, 8th and 9th standards in school, aged >11 years but < 15 years and those students who gave informed assent, and whose parents or teachers gave informed consent were included and all those with any systemic diseases were excluded from the study. Teachers, students and their parents were informed about the study, in a language which could be easily understood by them. Informed consent from the teachers and parents, and from students. Height, weight and BMI was calculated using predefined and standard procedures. BMI was classified as Normal: BMI< 85th percentile Overweight: 85-95th percentile Obese: > 95th percentile. The data was analyzed using SPSS version 21 software. Descriptive statistics were expressed in Mean+SD, frequencies and percentages, correlation was studied using Pearson's product moment correlation for data with normal distribution. The level of significance in the study was 0.05 ($p<0.05$).
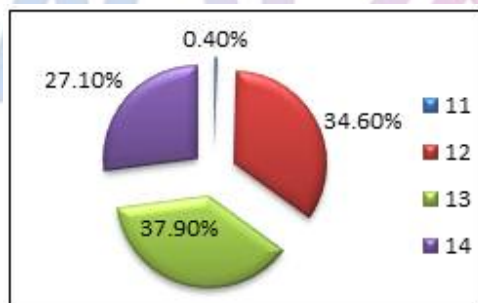
RESULTS

Figure 1: Distribution as per age

Among the students, 37.9% were of 13 years, 34.6% were of 12 years, 27.1% were of 14 years, while 0.4% were of 11 years. Among the students, 57.8% were males while 42.2% were females.

Table 1: Distribution of BMI as per CDC classification

BMI as per CDC classification	Frequency	Percentage
Underweight	647	25.9
Normal	1510	60.5
Overweight	230	9.2
Obese	109	4.4
Total	2496	100

As per CDC classification, about 9.2% students were overweight while obesity was present in 4.4% students.

Table 2: Agreement between CDC and IOTF BMI classification-

		Count as per CDC	Count as per IOTF
Normal	N	2157	2033
	%	86.4	81.45
Overweight or obese	N	339	463
	%	13.6	18.55
Total	N	**2496**	**2496**
	%	**100**	**100**

A Cohen's kappa was run to assess the agreement between the classification of overweight or obesity as per CDC classification and IOTF classification. A very strong agreement (κ=0.814) was found between the two classifications for overweight or obesity.

Table 3: Association with socioeconomic status and BMI

		Count	Socioeconomic status				Total
			Upper	Upper middle	Lower middle	Upper lower	
	Normal	N	22	794	1330	11	**2157**
		%	88	87.2	86	84.6	**86.4**
CDC classification	Overweight or obese	N	3	117	217	2	**339**
		%	12	12.8	14	15.4	**13.6**
	Total	N	**25**	**911**	**1547**	**13**	**2496**
		%	**100**	**100**	**100**	**100**	**100**

Chi square = 3.774, df=3, p=0.856. On comparing the presence of overweight or obesity in students from different socioeconomic status using Chi square test, no association was found between the presence of overweight or obesity and socioeconomic status of students [$\chi 2$ (3) = 3.774, p=0.856].

Table 4: Association with consumption of type of diet

		Count	Type of diet			Total
			Vegetarian	Non-vegetarian $\leq$ 1 /week	Non-vegetarian > 1 /week	
	Normal	N	1675	180	302	**2157**
		%	87.2	78.9	87	**86.4**
CDC classification	Overweight or obese	N	246	48	45	**339**
		%	12.8	21.1	13	**13.6**
	Total	N	**1921**	**228**	**347**	**2496**
		%	**100**	**100**	**100**	**100**

On comparing the presence of overweight or obesity with type of diet in students using Chi square test, a statistical significant association was found between the presence of overweight or obesity and type of diet consumed by students [$\chi 2$ (2) = 11.939, p=0.003].

Table 5: Association with intake of junk food

		Count	Frequency of intake of junk food				Total
			Daily	Occasionally > 1/week	Occasionally $\leq$ 1/week	Never	
	Normal	N	321	561	752	523	**2157**
		%	82.7	87.8	85.6	88.5	**86.4**
CDC classification	Overweight or obese	N	67	78	126	68	**339**
		%	17.3	12.2	14.4	11.5	**13.6**
	Total	N	**388**	**639**	**878**	**591**	**2496**
		%	**100**	**100**	**100**	**100**	**100**

On comparing the presence of overweight or obesity with intake of junk food in students using Chi square test, a statistical significant association was found between the presence of overweight or obesity and intake of junk food by students [$\chi 2$ (3) = 8.134, p=0.043].

Table 6: Association with salt intake

	Count		Frequency of salt intake			Total
			Low	Medium	High	
CDC classification	Normal	N	143	1783	231	**2157**
		%	883	87.7	76.5	**86.4**
	Overweight or obese	N	19	249	71	**339**
		%	11.7	12.3	23.5	**13.6**
	Total	N	**162**	**2032**	**302**	**2496**
		%	**100**	**100**	**100**	**100**

Table 7: Association with oilintake

	Count		Frequency of oil intake			Total
			Low	Medium	High	
CDC classification	Normal	N	81	1926	150	**2157**
		%	97.6	90.7	51.9	**86.4**
	Overweight or obese	N	2	198	139	**339**
		%	2.4	9.3	48.1	**13.6**
	Total	N	**83**	**2124**	**289**	**2496**
		%	**100**	**100**	**100**	**100**

Table 8: Association with physical/sports activity

	Count	Frequency of physical/sports activity					Total
		Daily > 1 hour	Daily ≤ 1 hour	Occasion ally > 1/week	Occasional ly ≤ 1/week	Never	
CDC classification	Normal — N	574	887	122	394	180	**2157**
	%	90.7	89.7	81.3	80.7	76.3	**86.4**
	Overwei ght or obese — N	59	102	28	94	56	**339**
	%	9.3	10.3	18.7	19.3	23.7	**13.6**
	Total — N	**633**	**989**	**150**	**488**	**236**	**2496**
	%	**100**	**100**	**100**	**100**	**100**	**100**

On comparing the presence of overweight or obesity with physical/sports activity in students using Chi square test, a statistical significant association was found between the presence of overweight or obesity and physical/sports activity by students [$\chi 2$ (4) = 56.217, p<0.001].

DISCUSSION

Adolescent obesity is associated with increased risk of persistence in adulthood. In India, there is a lack of studies which demonstrate the correlation between the adolescent overweight or obesity. Hence, this study was planned with the objectives to evaluate the factors associated with prevalence of overweight or obesity in adolescents, and to assess, if any, association between various factors leading to obesity. The present study was conducted in a city in Maharashtra, India in early adolescents from 6 schools. Prevalence of overweight in early adolescents was 9.2% (as per CDC classification)/ 11.2% (as per IOTF classification). Prevalence of obesity was 4.4% (as per CDC classification)/ 7.4% (as per IOTF classification). Common factors associated with presence of overweight or obesity were consumption of vegetables, salt, oil, physical/sports activities, duration of daily sleep, mode of delivery, parental history of hypertension, and waist circumference. Additional factors associated

particularly with presence of overweight or obesity were consumption of type of diet – vegetarian/nonvegetarian, junk food, and daily duration of sleep. Lang *et al*[21] studied the BMI of the early adolescents in the age group of 12-17 years according to the CDC and IOTF criteria. As per CDC, reported prevalence of overweight or obesity in England was 24.4% and in US was 32.2%, while as per IOTF, it was 25.6% and 33.6%, respectively. This is much higher compared to that observed in the present study. This might be due to the type of diet consumed by the population in the respective countries. A higher prevalence was also noted in an Iranian study by Hajjan-Tilaki*et al*[22], who reported it to be 25.5% in boys and 21.4% in girls as per CDC, and 26% in boys and 20.9% in girls as per IOTF. They found a strong agreement between the CDC and IOTF classification of 0.86 and 0.73 in boys and girls, respectively. In the present study, an overall strong agreement (κ=0.814) was found between the CDC and IOTF classification for

determining overweight and obesity. Thus, either of CDC or IOTF can be used for assessing overweight or obesity in early adolescents. However, it should be noted and kept in mind that the reported prevalence by IOTF is slightly more than CDC. As per CDC, the prevalence of overweight and obesity in present study was 9.2% and 4.4%, respectively. In a systematic review by Bibiloni *et al*[23], regarding prevalence of overweight in different regions in adolescents aged 10-19 years, it was 4.4-15.7% and 0.7-8.7% in Asia. The findings of the current study match the prevalence of overweight and obesity in the range of Asian countries stated by Bibiloni *et al*[23], Vieno *et al*[24] and Biro *et al*[25]. Among Indian studies, Maiti *et al*[26] in West Bengal, reported prevalence of overweight and obesity to be 7.64% and 7.49% as per CDC and IOTF, respectively, and of only obesity, it was 1.74% and 1.31%, respectively in children aged 10-14 years. Kowsalya *et al*[27] reported prevalence of overweight and obesity of 12.11%. Chandrakala *et al*[28] reported CDC prevalence of overweight and obesity to be 7% and 4.2%, respectively. Thus, findings of the present study further adds to the variation, but lies in the range of prevalence in different studies in India. As observed in the lifestyle habits in the present study, intake of non- vegetarian diet was associated with high prevalence of overweight or obesity compared to the vegetarian diet. Further, those with less vegetable intake, more junk food intake, high salt intake, and high oil intake showed a higher prevalence of the overweight or obesity. This demonstrates the importance of dietary habits in the role of overweight and obesity. Also, increased physical activity or participation in sports was associated with decreased prevalence of overweight or obesity. Those sleeping daily in the range of 6-8 hours, which we consider as an optimal duration of sleep, had lower prevalence. While those sleeping in less than 6 hours and more than 8 hours had higher prevalence of overweight and obesity. Thus, less sleep and excess sleep both are associated with the weight abnormalities. Association of physical and sedentary activity with presence of overweight or obesity was observed by Vieno *et al.*[24] Macieira *et al*[29] found significant association of prevalence of obesity with food habits, exercise, family history, age and sedentary lifestyle with childhood obesity.

CONCLUSION
The prevalence of overweight was 9.2% as per CDC classification and 11.2% as per IOTF classification. The prevalence of obesity was 4.4% as per CDC classification and 7.4% as per IOTF classification. There was a strong agreement in measuring the prevalence of overweight and obesity by CDC and IOTF classification. Associated

factors with increased prevalence of overweight or obesity were intake of non-vegetarian diet, less vegetable intake, more junk food intake, high salt and oil intake, reduced physical or sports activity, excess or inadequate daily sleep duration and increased waist circumference.

REFERENCES
1. Lobstein T, Baur L, Uauy R, IASO International Obesity TaskForce.Obesity in children and young people: a crisis in public health. Obes Rev. 2004; 5(s1):4-85. doi:10.1111/j.1467-789X.2004.00133.x.
2. Kautiainen S. Trends in adolescent overweight and obesity in the Nordic countries. Scand J Nutr. 2005;49(1):4-14. doi:10.1080/11026480510011352.
3. WHO Consultation on Obesity. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. World Heal Organ Tech Rep Ser. 2000; 894(i–xii):1-253.
4. Pinhas-Hamiel O, Zeitler P. "Who Is the Wise Man?—The One Who Foresees Consequences:" Childhood Obesity, New Associated Comorbidity and Prevention. Prev Med (Baltim). 2000; 31(6):702-705. doi:10.1006/pmed.2000.0752.
5. Latner JD, Stunkard AJ. Getting Worse: The Stigmatization of Obese Children. Obes Res. 2003; 11(3):452-456. doi:10.1038/oby.2003.61.
6. Neumark-Sztainer D, Paxton SJ, Hannan PJ, Haines J, Story M. Does Body Satisfaction Matter? Five-year Longitudinal Associations between Body Satisfaction and Health Behaviors in Adolescent Females and Males. J Adolesc Heal. 2006; 39(2):244-251. doi:10.1016/j.jadohealth.2005.12.001.
7. Stice E, Shaw HE. Role of body dissatisfaction in the onset and maintenance of eating pathology: a synthesis of research findings. JPsychosom Res. 2002; 53(5):985-993. http://www.ncbi.nlm.nih.gov/pubmed/12445588. Accessed May 19, 2017.
8. Brener ND, Eaton DK, Lowry R, McManus T. The Association between Weight Perception and BMI among High School Students. Obes Res. 2004;12(11):1866-1874. doi:10.1038/oby.2004.232.
9. Wardle J, Cooke L. The impact of obesity on psychological well-being.Best Pract Res ClinEndocrinolMetab. 2005; 19(3):421-440. doi:10.1016/j.beem.2005.04.006.
10. Eaton DK, Lowry R, Brener ND, Galuska DA, Crosby AE. Associations of Body Mass Index and Perceived Weight With Suicide Ideation and Suicide Attempts Among US High School Students. Arch PediatrAdolesc Med. 2005; 159(6):513. doi:10.1001/archpedi.159.6.513.
11. Emmons L. Predisposing factors differentiating adolescent dieters and nondieters. J Am Diet Assoc. 1994; 94(7):725-728, 731-30. http://www.ncbi.nlm.nih.gov/pubmed/8021412. Accessed May 19, 2017.
12. Strauss RS. Self-reported Weight Status and Dieting in a Cross- sectional Sample of Young Adolescents. Arch PediatrAdolesc Med. 1999; 153(7):741. doi:10.1001/archpedi.153.7.741.
13. Jansen W, van de Looij-Jansen PM, de Wilde EJ, Brug J. Feeling Fat Rather than Being Fat May Be Associated

with Psychological Well- Being in Young Dutch Adolescents. J Adolesc Heal. 2008; 42(2):128- 136. doi:10.1016/j.jadohealth.2007.07.015.

14. Koskelainen M, Sourander A, Helenius H. Dieting and weight concerns among Finnish adolescents. Nord J Psychiatry. 2001; 55(6):427-431. doi:10.1080/08039480152693336.

15. Ojala K, Vereecken C, Välimaa R, Currie C, Villberg J, Tynjälä J, et al.Attempts to lose weight among overweight and non-overweight adolescents: a cross-national survey. Int J BehavNutrPhys Act. 2007; 4(1):50. doi:10.1186/1479-5868-4-50.

16. Baker JL, Olsen LW, Sørensen TIA. Childhood Body-Mass Index and the Risk of Coronary Heart Disease in Adulthood. N Engl J Med. 2007; 357(23):2329-2337. doi:10.1056/NEJMoa072515.

17. Bjorge T, Engeland A, Tverdal A, Smith GD. Body Mass Index in Adolescence in Relation to Cause-specific Mortality: A Follow-up of 230,000 Norwegian Adolescents. Am J Epidemiol. 2008; 168(1):30-37. doi:10.1093/aje/kwn096.

18. Reilly JJ, Methven E, Mcdowell ZC, Hacking B, Alexander D, Stewart L, et al. Health consequences of obesity. Arch Dis Child. 2003; 88: 748-752. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1719633/pdf/v088p0074 8.pdf. Accessed May 19, 2017.

19. Speiser PW, Rudolf MCJ, Anhalt H, Camacho-Hubner C, Chiarelli F, Eliakim A, et al. Childhood Obesity. J ClinEndocrinolMetab. 2005; 90(3):1871-1887. doi:10.1210/jc.2004-1389.

20. Bharati DR, Deshmukh PR, Garg BS. Correlates of overweight andamp; obesity among school going children of Wardha city, Central India. Indian J Med Res. 2008; 127(6):539-543. http://www.ncbi.nlm.nih.gov/pubmed/18765871. Accessed May 26, 2017.

21. Lang IA, Kipping RR, Jago R, Lawlor DA. Variation in childhood and adolescent obesity prevalence defined by international and country- specific criteria in England and the United States. Eur J ClinNutr. 2010; 65(2):143-150. doi:10.1038/ejcn.2010.260.

22. Hajjan-Tilaki K, Heidari B. A comparison between International Obesity Task Force and Center for Disease Control References in assessment of overweight and obesity among adolescents in Babol, Northern Iran. Int J Prev Med. 2013;4(2):226-332.

23. Bibiloni MDM, Pons A, Tur JA. Prevalence of overweight and obesity in adolescents: a systematic review. ISRN Obes. 2013; 2013: 392747. doi:10.1155/2013/392747.

24. Vieno A, Santinello M, Martini MC. Epidemiology of overweight and obesity among Italian early adolescents: relation with physical activity and sedentary behaviour. EpidemiolPsichiatr Soc. 2005; 14(2):100-107. doi:10.1017/S1121189X00006308.

25. Biro S, Barber D, Williamson T, Morkem R, Khan S, Janssen I. Prevalence of toddler, child and adolescent overweight and obesity derived from primary care electronic medical records: an observational study. C open. 2016; 4(3):E538-E544. doi:10.9778/cmajo.20150108.

26. Maiti S, De D, Ali KM, Bera TK, Ghosh D, Paul S. Overweight and obesity among early adolescent school girls in urban area of West Bengal, India: Prevalence assessment using different reference standards. Int J Prev Med. 2013; 4(9):1070-1074.

27. Kowsalya T, Parimalavalli R. Prevalence of Overweight / Obesity among Adolescents in Urban and Rural Areas of Salem, India. J ObesMetab Res. 2014;1(3):3-6. doi:10.4103/2347-9906.141142.

28. Chandrakala P, Soumya A. A study of prevalence of overweight and obesity in adolescents. Int J ContempPediatr. 2016; 3(3):960-964.

29. de MoraisMacieira LM, Tavares Lopes de Andrade Saraiva JM, da Conceição Santos L. Overweight and obesity and their associated factors among early adolescence school children in urban and rural Portugal. BMC Nutr. 2017; 3(1):17. doi:10.1186/s40795-017-0134-6.