Targeted Screening of Adolescents for Risk Factors of Cardiovascular Diseases

Dr. Sakshi Jain

Senior Resident, Dept of Pediatrics, Lady Hardinge Medical College, New Delhi, India

ABSTRACT **Background and aims:** Metabolic syndrome (MS) in adolescents is considered precursor of cardiovascular diseases and diabetes in adults. This study aimed to screen adolescents for obesity, lifestyle risk factors, and metabolic syndrome.
Methods: We enrolled 522 adolescents from 2 Delhi schools. We collected information about cardiovascular risk factors and body mass index . MS was defined by modified NCEP ATP III and IDF criteria. Percentages and odds ratio were calculated.
Results: Overweight and obesity were found in 18% and 4% adolescents respectively. Prevalence of MS was 11-18% in overweight and 40-47% in obese adolescents by different criteria. Prevalence of life style risk factors were higher in overweight and obese adolescents but was not statistically different from normal weight adolescents.
Conclusions: Adolescents with overweight and obesity should be screened for presence of metabolic syndrome.
Disclosure of Interest: None Declared.

INTRODUCTION

According to World Health Organization (WHO) estimates 2010, non-communicable diseases account for approximately 63% of all deaths in the world and 78% of deaths by non-communicable diseases occur in the developing countries[1].A potential emerging public health issue is the increasing incidence of adolescent obesity in developing countries[2]. Adolescent obesity is associated with a high prevalence of metabolic syndrome which itself is a clustering of cardiovascular risk factors i.e. hypertension, hyperinsulinemia and dyslipidemia[2,3].

Since the metabolic syndrome if present in adolescence tracks into adulthood,its early identification and management and also prevention by modifying lifestyle and maintaining normal BMI may alleviate the morbidity and mortality related to cardiovascular diseases[4,5,6]. This study aimed to screen the otherwise normal school going adolescents of Delhi for presence of lifestyle risk factors and overweight and obesity and to further target the overweight and obese adolescents for presence of metabolic syndrome.

METHODS

This is a cross-sectional observational descriptive study, subjects were enrolled from 2 schools (one government and one private school) in Delhi. The study was carried out from Nov. 2010 to March 2012. This study was approved by institutional ethical committee. The subjects of both sexes from 10 to 18 years were selected from class 7th to 12th proportionately using stratified random sampling.

The study was conducted in following 3 steps:
Step 1:This step consisted of a questionnaire which was divided into 2 parts .

Part 1 of the questionnaire (for the parents) was given to the students along with the consent forms .This consisted of questions on :

1)Socio-demographic variables
2)Medical history .

3)Family history
The students who got the consent forms signed and Part 1 of the questionnaire filled from their parents were enrolled for the further study.
The enrolled students were then given part 2 of the questionnaire. This consisted of questions on:-
1) dietary patterns (using food frequency questionnaire,
2) physical activity and sedentary behaviour
3) High risk activities like smoking and alcohol intake

Step 2 : In this step anthropometric measurements and clinical examination of all subjects were done to rule out any medical/surgical disease which comes in our exclusion criteria.

1) Weight : It was recorded in light clothing to the nearest 0.1kg on a SECA Model 813 digital weighing scale (SECA, Germany).

2) Height : It was measured without shoes to the nearest 0.1 cm using a SECA Stadiometer Model 214 (SECA, Germany).

3) Body mass index (BMI)- This was calculated using the formula; $BMI = weight (kg)/height (m)^2$

4) Waist circumference; (WC) was measured midway between the iliac crest and the lower-most margin of the ribs according to WHO guidelines for waist circumference measurement. Means of three readings were recorded to the nearest 0.1 cm; using a SECA Model 200 tape (SECA, Germany).

5) Blood pressure. Arterial blood pressure was measured manually using a mercury sphygmomanometer with a suitable cuff size for each participant

Step 3: – The data was analyzed for presence of the overweight and obesity i.e. BMI Z-score >1.

The parents of adolescent having BMI Z-score >1 were contacted and were informed about the presence of risk

factors in their children and then were asked to come in Adolescent Clinic in Kalawati Saran Children's Hospital, New Delhi for blood tests and further management. The subjects were asked to come after 12 hr fasting.

A venous blood sample (4ml) was collected using the standard venepuncture technique by a trained doctor for -

1.Total cholesterol

2.Triglycerides (TG),

3.High-Density Lipoprotein Cholesterol (HDL-C),,

4.Low –density Lipoprotein Cholesterol (LDL-C)

5.Fasting Blood Glucose (FBG).

DEFINITIONS
1. Overweight defined as BMI z score > 1-2 and obesity defined as BMI z score > 2 using WHO Anthroplus software[7].

2.High waist circumference - > 90th centile for age and gender .We have no nomograms for WC for Indian adolescents, therefore, percentiles were compared to estimated value for percentile regression for European-American children and adolescents, according to gender and age[8] .

3. High blood pressure - The centiles used were those given by NHLBI[9].

4.Metabolic syndrome is defined by IDF (International diabetic federation) considers presence of central obesity (defined as waist circumference> 90th centile) as the essential factor, and the presence of any two of the four additional factors viz.(1) raised TG level:≥150 mg/ dl, (2) reduced HDL-cholesterol: < 40 mg/dl in males and < 50 mg/ dl in females in children >=16 years and < 40 mg/dl in both males and females in children < 16 years, (3)raised blood pressure > 130 systolic or >85 mm Hg diastolic or both and (4) raised fasting plasma glucose (FPG>100 mg/dl)[10].

Metabolic syndrome according to modified NCEP ATP III (National Cholesterol Education Programme Adult Treatment Panel) is defined as presence of at least 3 of the following 5 risk factors i.e. (1)abdominal obesity (defined as waist circumference >=90 th centile for age and gender , (2)high TG >=110 mg/dl ,(3) low HDL<=40 mg/dl , (4)elevated BP (defined as systolic or diastolic or both BP >=90th percentile for age and gender) and (4)high fasting blood glucose >110 mg/dl [11,12] .

The data was collecred on pretested proforma and was first entered in a spreadsheet. Dats was checked for errors and was corrected. This data was transferred to the software STATA 8.2 for further analysis. Sociodemographic factors,prevalence of overweight ,obesity, metabolic syndrome and risk factors are described as percentages. Comparison of proportions was done using t-test taking p-values of<0.05 as significant statistically.

RESULTS
In our study 569 adoelscents were screened for inclusion. After excluding 45 children who did not brought consent form and one child with hypothyroidism and one child with post polio paralysis, 522 children were included in the study. 117 students were found to be overweight and obese and parents were contacted and counselled for blood tests of which 70 children turned up to the hospital for the same .

Table No.1 : Demographic variables, overweight ,obesity and metabolic syndrome in study population

	Number of subjects	
Age group		
10-13 year (Early adolescence)	148(28%)	
14-16 year (Mid adolescence)	215(41%)	
16-18 year (Late adolescence)	159(30%)	
Sex distribution		
Male	293(56%)	
Female	229(44%)	
Socioeconomic status		
Lower	139(26%)	
Middle	273(52%)	
Upper	110(21%)	
Prevalence of overweight		
Males (n=293)	42(14%)	
Females (n= 229)	52(23%)	
Total (n=522)	94(18%)	
Prevalence of obesity		
Males (n-=293)	15(5%)	
Females(n=229)	7(3%)	
Total (n=522)	22(4%)	
Prevalence of metabolic syndrome	IDF criteria	NCEP ATP III criteria
Overweight adolescents	6(11%)	10(18%)
Obese adolescents	6(40%)	7(47%)

Table no.2 : Prevalence of lifestyle risk factors

Risk factors	Obese n=22	Over-weightn=94	Others	P value
Family history of cardiovascular disease	13(59%)	25(27%)	27(7%)	>0.05
Junk food intake in last 1 week	10(45%)	43(46%)	167(41%)	>0.05
Went for a meal outside home in last 1 week	16(73%)	58(62%)	253(62%)	>0.05
Low Physical activity in last 1 week	6(27%)	34(37%)	113(28%)	>0.05
Daily TV viewing for at least 1 hour in last 1week	18(82%)	60(65%)	246(62%)	>0.05
TV viewing >2 hours/day usually	12(55%)	56(60%)	229(58%)	>0.05
Computer surfing at least once in last 1 week	17(77%)	52(55%)	228(56%)	>0.05
Daily computer surfing in last 1week	2(12%)	15(29%)	78(34%)	>0.05
Prevalence of smoking ever	2(9%)	3(20%)	7(2%)	>0.05
Alcohol intake ever	1(5%)	4(10%)	10(2%)	>0.05

Low physical activity was defined as physically active for <3 days in a week for at least 60 minutes in games and sports with moderate physical activity).The prevalence of lifestyle risk factors was overall higher in overweight and obese adolescents than the non-overweight adolescents although it was not statistically significant.

DISCUSSION

In our study we studied the prevalence of overweight and obesity in adolescents. The results were comparable to various studies conducted in India in last decade which report a prevalence of overweight in adolescents to be 4.6% to 18.5% and prevalence of obesity as 0.79% to 5.3% [13-18].

High BMI status predispose an individual for metabolic syndrome . The prevalence studies of metabolic syndrome in adolescents show a prevalence range of 2-4% in general population whereas it is much higher in the high risk group i.e. overweight and obese adolescents as in our study.

Table No.3:Prevalence studies of metabolic syndrome in adolescents

Country	Criteria used	Prevalence of metabolic syndrome		
		Obese	Overweight	Overall
India,Chandigarh[19]	NCEP ATP III	36.6%	11.5%	
India,J& K[20]	NCEP ATP III	33% in centrally obese		3%
China[21]	IDF	35.2%	23.4%	3.7%
Kuala Lumpur[22]	IDF	5.3% in overweight and obese		
Turkey[23]	NCEP ATP III	24%		
Tehran[24]	IDF	42% in overweight and obese		10%
Egypt[25]	IDF	20%		
Jordan[26]	IDF	15.1%	3%	0.3%
Mexico[27]	NCEP ATP III	62%		
Korea[28]	IDF	24.7%	3.2%	1.9%

Using a questionnaire based on WHO STEPS approach[29] we also studied the prevalence of high risk behavioural and lifestyle factors in adolescents . We noticed that the overall prevalence of these risk factors was higher in overweight and obese adolescents although it was not statistically significant which may due to our small sample size..

LIMITATIONS OF STUDY :

We could not study the prevalence of metabolic syndrome in non-overweight non-obese adolescent population as the ethical committe did not give approval for sampling of these normal adolescents. This could have been an important comparative tool to assess the utility for targeted screening. The information about high risk behaviours was taken only from adolescents and the results were not statistically significant. Parents should also be asked about these behaviours present in their wards and providing adequate privacy and ensuring confidentiality in clinical setting may help in extracting correct information. The sample size of our study was also small as it is used to study the approach and not mainly as a cross-sectional observational study.

SUMMARY:

We found high prevalence of metabolic syndrome in overweight and obese adolescents even when their high risk behaviours were not much different from adolescents having normal weight. For identifying metabolic syndrome objective features like overweight and obesity are reliable indicators.

RECOMMENDATIONS:

Adolescents should be examined for having high BMI status i.e.overweight and obesity. All adolescents having overweight and obesity should be screened for presence of metabolic syndrome. Targeted screening of life style,physical and metabolic risk factors in adolescents can be used as a tool for primardial prevention of cardiovascular disease in adult life.

REFERENCES

1. Global status report on non-communicable disease 2010L:World Health Organization 2011 .www.who.int/ ISBN 978 92 4 156422 9

2. Srinivasan ST, Bao W, Wattigney WA, Berenson GS. Adolescent overweight is associated with adult overweight and related multiple cardiovascular risk factors: the Bogalusa Heart Study. Metabolism 1996;45:235-40.

3. Swati Bhardwaj, Anoop Misra, Lokesh Khurana, Seema Gulati, et al Childhood obesity in Asian Indians: a burgeoning cause of insulin resistance, diabetes and sub-clinical inflammation. Asia Pac J Clin Nutr 2008;17 (S1):172-175

4. Froberg K, Andersen LB. Mini review: physical activity and fitness and its relations to cardiovascular disease risk factorsin children. Int J Obes (Lond) 2005;29(suppl 2):S34–9.

5. Berenson GS, Srinivasan SR, Bao W, et al..Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults.. The Bogalusa Heart Study; N Engl J Med 1998, 338:1650–1656.

6. Tzou WS, Douglas PS, Srinivasan SR, et al. Increased subclinical atherosclerosis in young adults with metabolic syndrome: the Bogalusa Heart Study. J Am Coll Cardiol 2005;46:457– 63.

7. The WHO Child Growth Standards:www.who.int/childgrowth/accessed on 20.12.12

8. Fernández JR, Redden DT, Pietrobelli A, Allison DB. Waist Circumference Percentiles in Nationally Representative Samples of African-American, European-American, and Mexican-American Children and Adolescents. J Pediatr2004;145:439-44.

9. The Fourth Report on the Diagnosis, Evaluation, and Treatment of Hypertension in Children. - NHLBI – NIH. www.nhlbi.nih.gov/health/prof/ heart/hbp/ .accessed on 2.8.2010

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

11. Executive summary of the Third Report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III): JAMA 2001;285:2486 –97.

12. de Ferranti SD, Gauvreau K, Ludwig DS, Neufeld EJ, Newburger JW, et al Prevalence of the metabolic syndrome in American adolescents: findings from the Third National Health and Nutrition Examination Survey: Circulation 2004;110:2494 –7.

13. Sood A, Sundararaj P, Sharma S, Kurpad AV, Muthayya S.BMI and body fat percent: affluent adolescent girls in Bangalore City: Indian Pediatr. 2007 Aug;44(8):587-91.

14. Samiran Bisail, Romendro Khongsdier, Kaushik Bose, et al .Prevalence Of Overweight And Obesity Among Bengalee Adolescents In Midnapore Town, West Bengal, India: International Journal of Current Research Vol. 10, pp.074-083, November, 2010

15. Misra A, Shah P, Goel K, Hazra DK, Gupta R, Seth P, Tallikoti P, et al . The high burden of obesity and abdominal obesity in urban Indian school children: a multicentric study of 38,296 children: Ann Nutr Metab. 2011;58(3):203-11. Epub 2011 Jul 14.

16. Nagendra Kumar, Jagdish Goyal, Indira Parmar, Vijay Shah. Prevalence of Overweight and Obesity in Affluent Adolescent Girls in Surat City, Western India. Int J Med Sci Public Health. 2012; 1(1): 2-4

17. Gupta DK, Shah P, Misra A, Bharadwaj S, Gulati S, Gupta N, et al. Secular trends in prevalence of overweight and obesity from 2006 to 2009 in

urban asian Indian adolescents aged 14-17 years. PLoS One. 2011 Feb 23;6(2):e17221

18. Bishwalata Rajkumari, Singh Akoijam Brogen, Singh Akoijam Joy, et al. Overweight and obesity among school children in Manipur, India. National Medical Journal of India. 2010 Sept-Oct; 23(5): 263-266

19. Singh R, Bhansali A, Sialy R, Aggarwal A. Prevalence of metabolic syndrome from North India: Diabet Med -2007; 24(2): 195-1999

20. Narinder Singh, Ravi Kumar Parihar, Ghanshyam Saini et al .Prevalence of metabolic syndrome in adolescents aged 10-18 years in J&K. Indian J Endocrinol Metab 2013 Jan;17(1):133-7

21. Y. Li1,, X. Yang, F. Zhai1, F. J. Kok, W. Zhao, J. Piao, J. et al. Prevalence of the metabolic syndrome in Chinese adolescents: British Journal of Nutrition (2008), 99, 565–570

22. Bee S Wee, Bee K Poh, Awang Bulgiba, Mohd N Ismail, et al. Risk of metabolic syndrome among children living in metropolitan Kuala Lumpur. A case control study: BMC Public Health 2011, 11:333

23. Filiz M. Çizmecio lu, ükrü Hatun, Sibel Kalaça. Metabolic syndrome in obese Turkish children and adolescents: comparison of two diagnostic models: The Turkish Journal of Pediatrics 2008; 50: 359-365

24. Esmaillzadeh, Ahmad, Parvin Mirmiran, et al: High prevalence of the metabolic syndrome in Iranian adolescents. Obesity. 2006;14: 377–382.

25. Moushira Erfan Zaki , Hala T. El-Bassyouni, Mona El-Gammal et al Indicators of the metabolic syndrome in obese adolescents. Arch Med Sci 2015; 11, 1: 92–98

26. Yousef Khader, Anwar Batieha, et al .Metabolic Syndrome and Its Individual Components among Jordanian Children and Adolescents .International Journal of Pediatric Endocrinology Volume 2010, Article ID 316170, 7 pages doi:10.1155/2010/316170

27. Maria Lola Evia-Viscarra, Edel Rafael Rodea-Montero, et al .Metabolic syndrome and its components among obese Mexican adolescents:http://www.endocrineconnections.org DOI: 10.1530/EC-13-005733

28. Hyunjung Lim, Hong Xue , et al. Association between obesity and metabolic co-morbidities among children and adolescents in South Korea based on national data:BMC Public Health 2014, 14:279

29. WHO STEPwise approach to surveillance (STEPS): www.who.int/chp/steps