RELATIONSHIP BETWEEN BODY MASS INDEX AND MEAN ARTERIAL PRESSURE IN OBESE ADOLESCENT FEMALES

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ABSTRACT: Background: Obesity is a state of excess adipose tissue mass. The World Health Organization (WHO) designated obesity as a 'Global Epidemic' and also one of today's most neglected Public Health Problems. Obesity is now a commonly encountered clinical diagnosis for adolescents. Adolescent obesity is increasingly being observed with the changing life style and cultural transition. Totally 5% of the Indian population has been affected by obesity. Many obese adolescents already manifest complication such as hypertension which often goes undiagnosed. Adolescent obesity predicts overweight in adulthood, in addition to weight-related medical complications during childhood and later in life.**Methods:** Body mass index(Kg/m^2) was calculated. Systolic blood pressure(mm Hg) and Diastolic blood pressures(mm Hg) were recorded by auscultatory method. Total of 100 subjects were taken, of which control group included 50 adolescent non-obese females and the study group included 50 adolescent obese females respectively. The subjects were between the age group of 15-17 years. BMI was classified according to WHO criteria. Statistical analysis was done using Unpaired 't' test. Correlation analysis was done to measure the relationship between different parameters. **Results :** Mean arterial blood pressure (MAP) is significantly associated with increased BMI.(P<0.001)**Conclusion:** There is an association between MAP and BMI in adolescence and so the person becomes hypertensive.

Keywords: Body mass index, Mean arterial pressure

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Introduction:

Adolescence is a period of transition that assumes critical position in the lifecycle of human beings.[1]It is an age of acceptance of adult roles in work, family, and community.[2] Obesity tracks from childhood to adulthood.[3]Adiposity is a growing public health challenge[4] that is related to health risks[5] and medical conditions. Totally 5% of the Indian population has been affected by obesity. In Karnataka, overall prevalence of obese is 5.2% among boys.[6]Obesity is a complex condition that has impact on morbidity and mortality. It contributes to 2.6 million deaths worldwide every year.[7]Presence of nutritional abundance and a sedentary lifestyle, increases adipose energy stores and produces adverse health consequences.[8]Obesity affects nearly every organ system that causes non communicable diseases including hypertension[9] and cardiovascular disease**.** This study was undertaken to access the effect blood pressure changes with obesity.

Material and Methods:

The study was conducted in the Department Of Physiology, J.J.M.Medical College, Davangere. Ethical clearance was obtained from the institutional ethical committee. Our study was carried out on 100 subjects aged 15-17years. 50 adolescent obese males and 50 adolescent non-obese males were selected randomly from the general population of Davangere city. Participants of the study were explained the procedure that they would be undergoing in their local language. A written informed consent was taken from parents or guardian of the subject.

Height was measured on barefoot to the nearest of 0.1cm using a wall fixed stadiometer. Weight was recorded to the nearest 0.1kg using a portable weighing machine with light clothing and no shoes. Body mass index (BMI) was calculated using Quetlet's Index as weight (Kg) over height (m^2). BMI was classified according to WHO criteria.[10](TABLE1)

TABLE 1. WHO classification of BMI[10]

Obesity class	BMI(Kg/m^2)
Underweight	<18.5
Normal weight	18.5-24.9
Over weight	25-29.9
Obese class I	30-34.9
Obese class II	35-39.9
Obese class III	>40

Blood pressure was recorded by auscultatory method using sphygmomanometer. After giving rest for 5 minutes, blood pressure was recorded in supine posture. Right arm was used for consistency. Blood pressure recordings were expressed to the nearest 2 mm Hg. All blood

TABLE 2. Height, weight and BMI of subjects

| Age (yrs)	Height(cm)		Weight(Kg)		BMI(Kg/m^2)	
	Non-obese	Obese	Non-obese	Obese	Non-obese	Obese
15	151±3	156.5±3.5	56±2	74±4	22.79±2.29	30.18±0.91
16	161±4	156±3	56.5±2.5	79.5±5.5	21.44±3.06	32.45±1.00
17	162.5±2.5	155±3	55.5±2.5	73.5±8.5	21±2	31.15±1.05

pressure recordings were recorded by the same person and by the same instrument. Mean arterial pressure(mm Hg) was calculated as DBP + 1/3 Pulse pressure.[11]Results were subjected to appropriate statistical analysis. Unpaired 't' test was used to compare between the cases and controls.

RESULTS

BMI values in obese and non obese males were 31.07±0.51 Kg/m^2 and 20.89±0.14 Kg/m^2. (TABLE2) SBP in BMI≥30 was 144±4 mm Hg and in non obese was 125±6 mmHg. DBP of normal weight (75±6 mmHg) was lower when compared to obese(94±4mmHg). The mean value of MAP among cases and controls was 109.6±1.19 and 91.95±2.31 mmHg respectively. (P<0.001) (FIGURE1)

Discussion:

Obesity is a stigmatized and costly disease[12] that poses potential challenges to adolescents' healthy emotional and physical development.[13]It occurs due to calorie imbalance as a result of excess intake of calories than that is consumed by the body.[14]Obesity has a stronger relationship with morbidity and disability than with mortality and so focusing on the first two is more relevant. It is related to reduction in life expectancy and increased number of unhealthy life-years.[15] Also, in the developing world, people are using their growing income to replace their traditional diets rich in fiber and grain with diets that include a greater proportion of fats and caloric sweeteners.[16]The health consequences associated with obesity have an adverse effect on the quality of life. The consequences of these co morbidities and conditions increase the likelihood of higher rates of disability in obese people.[17]

FIGURE1. Comparison of mean arterial pressure between obese and non obese subjects.
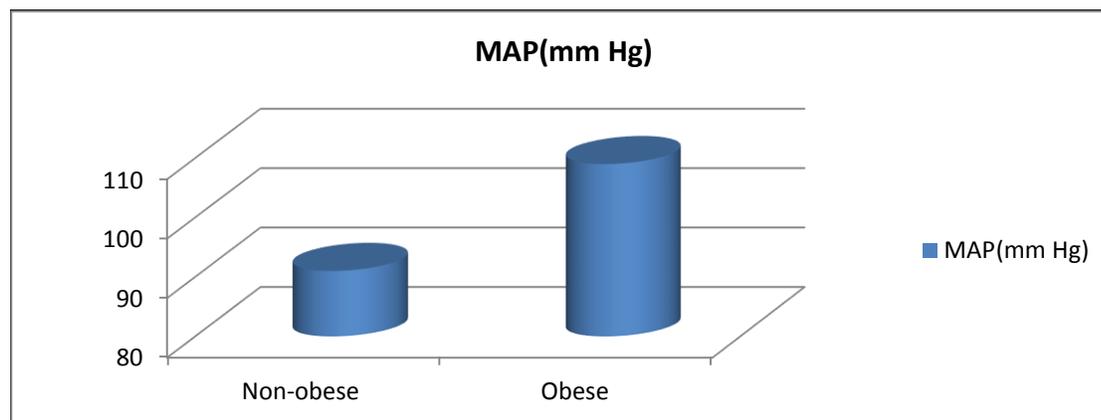
Obesity is associated with some of the major risk factors for cardiovascular diseases. Obesity is associated with increased blood flow and vasodilatation. Cardiac output, glomerular filtration rate and renal sodium retention also increase. Hyperfiltration in obesity causes progressive glomerular loss, loss of renal function and associated increase in arterial pressure that leads to hypertension.[18]In the present study, mean arterial pressure positively correlated with obesity.(P<0.001)

Nanaware et al stated that prevention of weight gain is the primary therapeutic target for reducing the problem of hypertension.[19]Approach to prevent obesity assesses and values health care uses for a specific disease or risk factor while another assesses the health care uses by groups of people with different BMIs. Habitual consumption of a high-fat diet may downregulate the appetite-control system, reducing satiety. Minor changes in food intake can have appreciable effects on body weight. High-fibre food enhances satiation through delayed gastric emptying and the attenuation of postprandial glucose responses. It also affects cholecystokinin involved in appetite regulation. Also, increase in intake of whole grains is associated with weight reduction.

In relation to weight control, physical activity and sedentary behavior are viewed from the perspective of asymmetry in appetite control that favours passive overconsumption of energy-dense diets. People of all ages must include a minimum of 30 minutes of physical activity of moderate intensity such as brisk walking and stair climbing or strenuous activities such as slow jogging and cycling on most, if not every day.[15]Thus, overweight in adolescents can identify those at increased risk of developing obesity in adulthood and its co-morbidities.

Conclusion:

Obesity is a predictor of morbidity and mortality of chronic diseases and poses future threat to public health. Obese adolescents become overweight adults if obesity persists in the teenage years. In our study, MAP values were higher among the obese males. Thus, lifestyle modification such as regular physical activity, limiting dietary fat intake and reducing portion sizes in each meal, have important implications for preventing obesity related hypertension.

REFERENCES

1. Shiny George, Jeffy Binu, Biju Baby Joseph. A study on the prevalence of overweight and obesity and its influencing factors in rural adolescent school going children in Kerala, India. Int J Cur Res Rev 2012 Dec; Vol 04 (24).
2. Henry M, Shlomo, Kenneth S, Reed P. William's Textbook of Endocrinology. 11thed. Philadelphia. Elsevier: 2008.
3. Freitas Júnior et al.: Resting heart rate as a predictor of metabolic dysfunctions in obese children and adolescents. BMC Pediatrics 2012 12:5.
4. T Kelly, W Yang, C-S Chen, K Reynolds, J He. Global burden of obesity in 2005 and projections to 2030. International Journal of Obesity.2008; 32: 1431–1437.
5. Laura J. Gray, Thomas Yates, Melanie J. Davies, Emer Brady, David R. Webb, Naveed Sattar et al. Defining Obesity Cut-Off Points for Migrant South Asians. PLoS ONE. October 2011; Volume 6: Issue 10.
6. Mohan Reddy N, Kalyana Kumar Ch, Jamil K (2012) New World Syndrome (Obesity) in South India. 1:567 doi:10.4172/scientificreports.567
7. Manu Raj, R. Krishna Kumar. Obesity in Children and Adolescents. Indian J Med Res 2010 November; 132(5):598–607.
8. Jeffrey S.Flier,Eleftheria Maratos-Flier. Biology of Obesity. Fauci.A.S, Braunwald.E, Kasper.D.L, Hauser.S.L, Longo.D.L, Jameson.J.L, Loscalzo. Harrison's Principles of Internal Medicine,17th Edition, New York,McGraw-Hill;2008:462-8
9. Krutarth R Brahmbhatt, Umesh N Oza. Obesity among adolescents of Ahmedabad city, Gujarat, India- a community based cross-sectional study. Int J Biol Med Res. 2012; 3(2):1554-1557.
10. K.Park.Epidemiology of Chronic Non-Communicable Diseases and Conditions:Obesity, Park's Textbook of Preventive and Social Medicine,21st Edition, Banarasidas Bhanot Publishers,2011 Feb:366-70
11. G K Pal,Parvati Pal. Textbook of practical physiology.3rd edition. Universities press.2013.P144
12. Ghosh A. Explaining overweight and obesity in children and adolescents of Asian Indian origin: the Calcutta childhood obesity study.Indian J Public Health 2014; 58:125-8.
13. Susan Wile Schwarz, Jason Peterson. Adolescent Obesity in the United States. National Centre for Children in Poverty November 2010.
14. Kumar,Abbas,Fausto,Mitchell.Robbins Basic Pathology. 8th edition.Elsevier.
15. Francesco Branca, Haik Nikogosian, Tim Lobstein. The challenge of obesity in the WHO European Region and the strategies for response. World Health Organization.
16. Jugesh Chhatwal, Manorama Verma, Sandeep Kaur Riar. Obesity among pre-adolescent and adolescents of a developing country (India). Asia Pac J Clin Nutr 2004;13 (3):231-235.
17. Colin Wilborn, Jacqueline Beckham, Bill Campbell, Travis Harvey, Melyn Galbreath, Paul La Bounty et al. Obesity: Prevalence, Theories, Medical Consequences, Management, and Research Directions. Journal of the International Society of Sports Nutrition 2005; 2(2): 4-31.
18. Richard N. Re. Obesity-Related Hypertension.The Ochsner Journal 2009; 9:133–136.
19. N. L. Nanaware, A. M. Gavkare, A. D. Surdi. Study of Correlation of Body Mass Index (BMI) With Blood Pressure in School Going Children and Adolescents. International Journal of Recent Trends in Science And Technology 2011; Volume 1, Issue 1:20-26.