

# Evaluation of Cardiovascular and Lipid Profile Abnormalities in Obese Children and Adolescents

M. Horri, R. Vakili<sup>1</sup>

## Abstract

**Background:** The prevalence of childhood obesity has risen dramatically in past several decades. Hormonal and genetic factor are rarely the cause of childhood obesity. Because obese children may suffer life long physical and emotional consequences, this imperative to discuss prevention with parents during well- child examinations. The obesity-related cardiovascular and lipid profiles are determined in obese children and adolescents living in Mashahd, Northeast of Iran.

**Methods:** Fifty two obese individuals, with mean age  $10.46 \pm 1.25$  yrs-old and associated body mass index (BMI) over 95 percentile for their age and sex and twenty healthy none obese individuals as control group with mean age  $10.68 \pm 1.33$  yrs-old with normal BMI for that age and sex participated in the study. Left ventricular (LV) mass, using Two-D and M-mode echocardiography, blood pressure and lipid profiles (total cholesterol, HDL-LDL and triglycerides) of all participants were obtained.

**Results:** In obese group the mean value of LV-mass was  $53.78 \pm 9.68$ g, body mass index was  $28 \pm 3.7$  g/m<sup>2</sup>, total cholesterol was  $203.38 \pm 30.20$  mg/dl, HDL was  $49.35 \pm 8.9$ mg/dl, LDL was  $127.9 \pm 24.32$ mg/dl and triglycerides was  $138 \pm 66$  mg/dl. In control subjects the mean LV-mass was  $25.5 \pm 4.8$  g and Lipid profiles were in their normal limits.

**Conclusion:** Both the mean of LV-mass and the frequency of dyslipidemia are increased in obese children and adolescents. Therefore, in obese children and adolescents, their evaluation should be considered as a routine approach for the prediction of middle-age-cardiovascular diseases.

**Iran J Med Sci 2006; 31(2): 87-90.**

**Keywords** • Obesity • LV-mass • lipid profiles • children • cardiovascular disease

## Introduction

**C**hildhood and adolescent obesity is the most frequent nutritional dysfunction in developed countries and at the present time is one of the greatest social problems.<sup>1,2</sup> In 95 percent of obese children, there are no known, metabolic disorders or disease such as Prader-Willi syndrome, thyroid dysfunction, and etiology is not yet well known.<sup>3,4</sup> Obesity is a risk factor for chronic diseases such as diabetes mellitus,

Divisions of Pediatric Cardiology and Pediatric Endocrinology,<sup>1</sup> Department of Pediatrics, Emam Raza Hospital, Mashhad University of Medical Sciences, Mashahd, Iran.

## Correspondence:

Rahim Vakili MD,  
Department of Pediatrics,  
Emam Raza Hospital,  
Mashhad University of Medical sciences,  
Mashhad, Iran.  
**Tell:** +98 511 8543031  
**Fax:** +98 511 8593038  
**E-mail:** r-vakili@mums.ac.ir

hypertension, cardiovascular diseases, hyperlipidemia, sleep apnea, some type of cancer and articular pathologies.<sup>5-7</sup>

Recent studies have indicated that the life expectancy of adults with severe obesity might be 15 to 20 yrs lower than normal individuals.<sup>3</sup> A significant proportion of morbidity and mortality in obese adults are due to sudden cardiac arrest and congestive heart failure related to obesity.<sup>3,8-10</sup> The purpose of this study, therefore, was to identify the prevalence of cardiovascular and metabolic complications of obesity in childhood and adolescents.

## Subjects and Methods

Fifty two obese children and adolescents (28 female and 24 males) who were evaluated in Pediatric Endocrinology and Metabolism Clinic of Emam Raza Hospital, Mashhad University of Medical Sciences as obese children or adolescents participated in the study. They or their parents were instructed about the study and an informed consent was obtained. Their age range was 8 to 12-yrs-old with body mass index (BMI) above 95<sup>th</sup> percentile for that age (moderate to severe obesity) in 50 cases, and from 85–95<sup>th</sup> percentile in two cases for their age (mild to moderate obesity); according to National Center for Health Statistics standards.

**Table 1:** Mean±SD of age, weight, height, LV-mass and serum Lipid Profiles of control and obese groups.

	Control (n=20)	Case (n=52)
Age (Yr)	10.68±1.33	10.46±1.25
Weight (kg)	29.42±4.38	59.36±13.06
Height (m)	1.33±0.03	1.44±0.084*
BMI (kg/m <sup>2</sup> )	15.68±4.29	28.04±3.371
LV-mass (g)	25.47±4.84	53.78±9.68*
Male	--	48.89±15.58*
Female	--	42.77±15.10*
<b>Cholesterol (mg/dl)</b>		
Male	160±25	203.38±30.20*
Female	163±24	186.70±39.50*
<b>LDL (mg/dl)</b>		
Male	97.30±23.19	127.90±24.32*
Female	94.42 ±25.9	107.72±26.61*
<b>HDL (mg/dl)</b>		
Male	55.30±8.04	46.35±7.47*
Female	52.25±7.04	46.60±8.40*
<b>TG (mg/dl)</b>		
Male	63.11±18.06	145.51±67.48*
Female	74.13±19.06	132.28±65.84*

\*significantly different from control subjects (P<0.05)

They did not have any known organic causes of obesity and were not receiving any hormonal medications such as corticosteroids. Twenty non-obese children and adolescents (11 female and nine males) matched for age; gender and pubertal stages were also served as control group. Early morning blood samples were collected in all children after a minimum of

12-hr fasting and with the routine procedure serum total cholesterol, triglycerides (TG) and HDL-cholesterol were measured using an automated instrument. LDL-cholesterol levels were calculated for samples containing TG more than 400 mg/dl by the equation:

$$\text{LDL} = \text{Total cholesterol} - (\text{HDL} + \text{TG}/5)$$

Echocardiography was performed in all participants by a pediatric cardiologist and left ventricular (LV) mass was calculated in two-dimensional-guide M-mode echocardiography using the formula mentioned by Kimball et al.<sup>11</sup> LV hypertrophy was diagnosed on the basis of the measurement LV-mass with echocardiography and the coefficient variations of the ventricular mass by BMI. We also compared coefficient ratios of both normal and obese subjects, and their variances were used to detect the impact of gender and obesity on the indices of LV-mass.

## Statistical analyses

Data are presented as mean±SD. Student t-test is used to compare LV-mass and lipids profiles of the groups of obese and control subjects. Pearson's correlation test is used to find the correlation between LV-mass, mean BMI and lipid profiles and P<0.05 are considered as statistically significant.

## Results

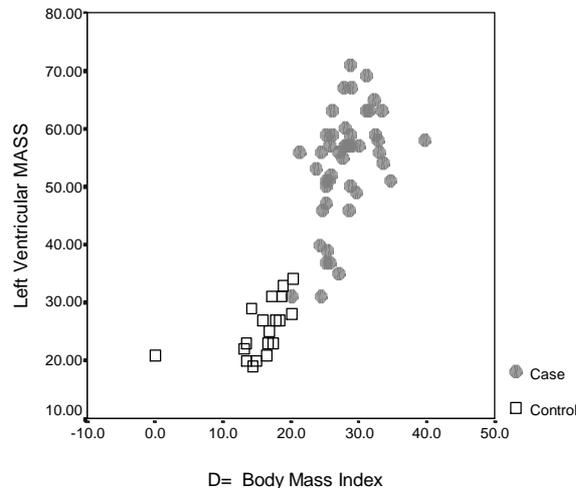
Age, weight, height, BMI, LV-mass and serum lipids of the obese and control children and adolescents, are summarized in Table 1. BMI were 28.07±3.71 (kg/m<sup>2</sup>) and 15.68 ±4.29 for obese and control group respectively. There were significant and positive correlations between: BMI percentile and serum cholesterol, BMI percentile and LDL-cholesterol, as well as between BMI percentile and TG. No significant correlation was found between BMI percentiles and serum HDL.

A significant correlation was also found between LV-mass and BMI in non obese, mildly obese and moderately obese children.

HDL-cholesterol levels were found to be lower in the obese subjects (55.30±8.04 mg/dl and 46.35±7.47 mg/dl) for control and obese males respectively (P<0.001), 52.2±7.0 mg/dl and 46.6±8.4 mg/dl for control and obese females respectively (P<0.004).

Among the obese subjects 58% had serum LDL-cholesterol levels around 110 mg/dl, and 36% had LDL-cholesterol levels well above 130mg/dl.

Fig 1 shows the relation between LV-mass and BMI.



**Fig 1:** The relation of left ventricular mass to body mass index in two groups. (solid circle, obese subjects; halo squares, none obese subjects).

## Discussion

Childhood obesity is considered a problem in many countries, and it is considered a risk factor in adulthood for chronic diseases such as diabetes mellitus, arterial hypertension, other cardiovascular disease, sleep apnea, some types of cancer, articular pathologies and psychological alterations.<sup>3</sup> Although not considered illness in itself, except in extreme situations, obesity has important repercussions for health in childhood and adolescence and particularly during adult life.<sup>4,5</sup> Childhood obesity represents a high risk of morbidity and mortality, and its perpetuation into adulthood strongly increases the risk of cardiovascular disease.<sup>4-6</sup> LV-mass has been established as an independent risk factor for cardiovascular morbidity and mortality.<sup>12,13</sup> Since LV-mass is affected by body size a variety of factors have been proposed for indexing LV-mass.<sup>12</sup>

The relations between the growths of a body part the body (body-weight, body-height and body-mass) and the organs such as the heart are generally curvilinear or logarithmic.<sup>1</sup> The mean LV-mass in female obese subjects was  $42.8 \pm 15.1$ g, in male subjects was  $48.9 \pm 15.6$ g and in control subjects was  $25.47 \pm 4.84$ g respectively. There was a significant correlation between BMI and LV-mass in obese subjects, whereas, in two genders LV-mass was not significantly different from each other, nor they had a correlation with lipid profiles.

Serum TG and cholesterol levels were significantly higher in obese children and adolescents, 50% of them had serum cholesterol levels well above the 90<sup>th</sup> percentile (190 mg/dl). However, in the present study the rate of hypercholesterolemia was relatively lower than

the reports of Glassan and colleagues.<sup>10</sup> On the other hand, the level of LDL-cholesterol in this study was relatively higher than what was reported previously.<sup>12</sup>

The present study found a significant positive association between adiposity estimated by BMI percentiles and serum TG, total and LDL-cholesterol. As demonstrated in several studies, high values of lipoproteins are important factors in risk of coronary diseases, in addition to the existence or other associated factors.<sup>14,15</sup>

It is commonly accepted that the development of childhood obesity is the cause lipid abnormalities. However, it is interesting to mention that in some cross-sectional studies performed in a group four to 10-yrs-old hypercholesterolemia children indicated that the lipid abnormality preceded the development or increased body fat, and doubts have raised about which comes first.<sup>15-17</sup>

The results of this study are indicating that the level of HDL-cholesterol is significantly lower in the obese children than control subjects of both sexes. Freedman and colleagues also showed that obesity is associated with lower levels of HDL-cholesterol in childhood and adolescence was.<sup>18</sup>

## Conclusion

Unfavorable lipid levels and increased LV-mass were relatively common among obese children and adolescents. This is suggesting that obesity should be considered as a risk factor for hypercholesterolemia and increased left ventricular mass in adult life.

## Acknowledgements

*This study was supported by grant no 83012 provided by Vice Chancellor for Research of Mashhad University of Medical Science. The authors are grateful to all children and their families participated in the study.*

## References

- 1 de Simone G, Daniels SR, Devereux RB, et al. Left ventricular mass and body size in normotensive children and adults: assessment of allometric relations and impact of overweight. *J Am Coll Cardiol* 1992; 20: 1251-60.
- 2 Friedland O, Nemet D, Gorodnitsky N, et al. Obesity and lipid profiles in children and adolescents. *J Pediatr Endocrinol Metab* 2002; 15: 1011-6.
- 3 Gidding SS, Nehgme R, Heise C, et al. Severe obesity associated with cardiovascular

- deconditioning, high prevalence of cardiovascular risk factors, diabetes mellitus /hyperinsulinemia, and respiratory compromise. *J Pediatr* 2004; 144: 766-9.
- 4 Kavey RE, Daniels SR, Lauer RM, et al. American Heart Association. American Heart Association guidelines for primary prevention of atherosclerotic cardiovascular disease beginning in childhood. *J Pediatr* 2003; 142: 368-72.
  - 5 Moran R. Evaluation and treatment of childhood obesity. *Am Fam Physician* 1999; 59: 861-8.
  - 6 Gunczler P, Lanes R, Lopez E, et al. Cardiac mass and function, carotid artery intima-media thickness and lipoprotein (a) levels in children and adolescents with type 1 diabetes mellitus of short duration. *J Pediatr Endocrinol Metab* 2002; 15: 181-6.
  - 7 Cabrinety N, Pisonero MJ, Ajram J, et al. Lipoprotein (a) in obese children with a family history of cardiovascular disease. *J Pediatr Endocrinol Metab* 2002; 15: 77-80.
  - 8 Daniels SR, Meyer RM, Lang Y, Bove K. Echocardiographically determined left ventricular mass in normal children, adolescents and young adults. *J Am Coll Cardiol* 1988; 12: 703-8.
  - 9 Shub C, Klein AL, Zachariah PK, et al. Determination of left ventricular mass by echocardiography in a normal population: effect of age and sex in addition to body size. *Mayo Clin Proc* 1994; 69: 205-11.
  - 10 Glassman MS, Schwarz SM. Cholesterol screening in children: should obesity be a risk factor? *J Am Coll Nutr* 1993; 12: 270-3.
  - 11 Kimball TR, Meyer RA. Echocardiography in: Hugh DA, Gutgesell HP, Clark EB (ed): Moss and Adams` Heart Disease in Infant, Children, and Adolescents; 6<sup>th</sup> ed by Williams & Wilkins Philadelphia, USA; 2001. p. 225.
  - 12 Gutgesell HP, Paquet M, Duff DF, McNamara DG. Evaluation of left ventricular size and function by echocardiography. Results in normal children. *Circulation* 1977; 56: 457-62.
  - 13 Rosengren A, Wilhelmsen L, Eriksson E, et al. Lipoprotein (a) and coronary heart disease: a prospective case-control study in a general population sample of middle aged men. *BMJ* 1990; 301:1248-51.
  - 14 Gidding SS. Preventive pediatric cardiology. Tobacco, cholesterol, obesity, and physical activity. *Pediatr Clin North Am* 1999; 46: 253-62.
  - 15 Tershakovec AM, Kuppler KM, Zemel BS, et al. Body composition and metabolic factors in obese children and adolescents. *Int J Obes Relat Metab Disord* 2003; 27:19-24.
  - 16 Tershakovec AM, Jawad AF, Stouffer NO, et al. Persistent hypercholesterolemia is associated with the development of obesity among girls: the Bogalusa Heart Study. *Am J Clin Nutr* 2002; 76: 730-5.
  - 17 Tershakovec AM, Kuppler KM, Zemel B, Stallings VA. Age, sex, ethnicity, body composition, and resting energy expenditure of obese African American and white children and adolescents. *Am J Clin Nutr* 2002; 75: 867-71.
  - 18 Freedman DS, Burke GL, Harsha DW, et al. Relationship of changes in obesity to serum lipid and lipoprotein changes in childhood and adolescence. *JAMA* 1985; 254: 515-20.