

## Original Research Article

# Comparative study of visceral adiposity index and lipid profile with Body Mass Index in adolescent and young adults

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### ABSTRACT

**Background:** Obesity is associated with increased rate of mortality and morbidity if untreated. Obesity is a health hazard it required attention towards adolescent and adult age group. Generally, body fat is distributed into two main compartments that are subcutaneous adipose tissue and visceral adipose tissue. Waist Hip Ratio measures the subcutaneous adipose tissue, determination of visceral adiposity will further helpful for determination of cardiovascular disease.

**Methods:** The study comprised of 120 subjects, of these adolescents comprised of 60 healthy adolescent childrens. The adults comprised of 60 healthy individuals. In all the subjects, Height was estimated in centimetres and Weight was measured in kilogram measured and BMI was calculated. The waist hip ratio and visceral adiposity index was calculated. In all the subjects, venous blood was collected from all the subjects for lipid profile estimation.

**Results:** In present study BMI more than 25 have soon increased waist hip ratio and visceral adiposity index value than BMI less than 25 and it's statically significant in both adolescent and adult group. It is also reported that BMI more than 25 have increased level of mean serum triglycerides, serum total cholesterol, LDL cholesterol and VLDL the increase was statistically significant. The mean serum HDL cholesterol was significantly decreased in BMI>25 group when compared with BMI<25.

**Conclusions:** It was concluded that different age groups of adolescent and adult, appropriate methods should be planned specifically for adolescent and adult age group. Regular educational sessions are needed to make changes adolescent and adults toward obesity.

**Keywords:** Lipid profile, Obesity, Visceral adiposity index, Waist hip ratio

### INTRODUCTION

In the worldwide Obesity is the one of the major health problems. During the last three decades, there was continuously increase in prevalence of obesity in both developed and developing countries.

In both adolescent and adults, the obesity is more common especially high economic countries and its prevalence is also growing rapidly in developing countries.<sup>1</sup>

Increased obesity leads to increased obesity related cardiovascular diseases. Obesity is associated with increased rate of mortality and morbidity if untreated. Obesity is a health hazard it required attention towards adolescent and adult age group.<sup>2</sup> Previous studies also shown that the presence of overweight, dyslipidemia and hypertension in young adults was associated with same risk factors in adolescent.<sup>3</sup>

Generally, body fat is distributed into two main compartments that are subcutaneous adipose tissue and

visceral adipose tissue. Visceral adipose tissue will differ from the subcutaneous adipose tissue based on adipocytes, lipolytic activity and response to insulin. Visceral adipose tissue is more vascular than subcutaneous adipose tissue.<sup>4</sup> Visceral adipose venous drainage directly connected to the portal vein. In metabolic syndrome visceral obesity is a main component and it causes prognosis of the obesity.<sup>5</sup> The triglycerides synthesized and consumed based on requirement excess will be deposited in adipose tissue.<sup>6</sup> Based on age, sex, Physical activity and genetic factor the distribution of the adipose tissue will varies.<sup>7</sup>

Obesity is an independent risk factor for cardiovascular and cerebrovascular diseases, but all the obese people will not show this condition. Normal body mass index with increased Waist Hip Ratio (WHR) also serves as risk factor for cardiovascular diseases. Waist Hip Ratio measures the subcutaneous adipose tissue, determination of visceral adiposity will further helpful for determination of cardiovascular disease. Visceral adiposity is measured by using visceral adiposity index.<sup>8</sup>

Obesity individual shows abnormal lipid profile especially increased triglycerides and hypercholesterolemia especially those having high Body mass index and increase the risk for cardiovascular disease. There is a positive correlation between serum cholesterol level and mortality due to cardiovascular disease.<sup>9</sup> According to Framingham study increased serum cholesterol will be lead to increased myocardial infarction in adults.<sup>10</sup> The present study was undertaken to study the waist hip ratio, visceral adiposity index and lipid profile in adolescent and adults.

## METHODS

Type of study was cross sectional study. Study population was study population are patients and attendants who attend the Department of Pediatrics and Department of Medicine. Study period was 8 months period that is from January 2018 to August 2018. Sample size was 120 in which 60 are normal adolescent age group and 60 are adult age group.

### Inclusion criteria

- The patients attending the Department of Paediatrics and Department of Medicine.

### Exclusion criteria

- Known Subjects with history of smoking, alcoholism and medicines which influence serum lipid profile levels are excluded. Individuals with any debilitating illness also excluded from this study.

### Study design

The study consists of 60 adolescent age group and divided into 3 groups based on BMI and 60 adult age group and divided into 3 groups based on BMI. Informed consent will

be taken from the both the groups. Demographic data was collected followed current health status, history of medication, alcoholism and Active smoking. A questionnaire was given to all individuals and detailed clinical examination was performed.

In all the subjects, Height was estimated in centimeters and Weight was measured in kilogram on standard clinical weighing machine. BMI was calculated as Weight in kilogram divided by Height in meters squared. Waist Circumference (WC) taken against the skin at the point of maximal narrowing of the waist. Hip circumference taken at the point of maximal gluteal protuberance over undergarments. The Waist Hip Ratio (WHR) was calculated.

Visceral Adiposity Index (VAI) was calculated 11 in male by using for formulae Males:  $VAI = (WC/39.68 + (1.88 \times BMI)) \times (TG/1.03) \times (1.31/HDL)$ , in Females by  $VAI = (WC/36.58 + (1.89 \times BMI)) \times (TG/0.81) \times (1.52/HDL)$ ,

### Sample analysis

About 5 ml of venous blood was collected from all the subjects for biochemical analysis. Serum Total cholesterol and HDL Cholesterol are estimated by cholesterol oxidase method.<sup>12,13</sup> Serum Triglycerides was estimated by glycerol kinase method.<sup>14</sup> The VLDL and LDL were calculated.

### Statistical analysis

Data was expressed in mean and standard deviation (mean±SD). Z test was used for comparison of means between controls and cases. The statistical significance was determined at 5% (p<0.05) level.

## RESULTS

The present study was conducted at Maharajah's Institute of medical sciences, Vizianagaram, Andhra Pradesh, India. A total of 120 subjects were included. They are further divided into 60 adolescent and 60 adults.

Mean age of the adolescent was 14.27y±2.09 years and the mean age of the adult group was 23.37±1.98 years. the majority of subjects were male in adolescent 65% and adult 67% (Table 1).

**Table 1: Demographic Profile of adolescent and adult group.**

	Adolescent	Adult
Number	60	60
Age (mean±SD) years	14.27±2.09	23.37±1.98
Sex (Males %)	65	67
(Females%)	35	33

Most of the subjects both adolescent (46%) and adult (48%) group had normal BMI followed by overweight

BMI in adolescent (43.5%) and adult (45%). The number of subjects in both groups in lower and higher spectrum of BMI was much less (Table 2).

In adolescent group mean serum triglycerides was significantly higher in BMI >25 group (207.18mg/dL±31.23) when compared with BMI <25 (112.81mg/dL±16.23). The mean Cholesterol was significantly higher in BMI >25 group (190.62mg/dL±21.22) compared with BMI <25 (152.16mg/dL±12.27). This increase was statistically significant (p<0.001). The serum HDL was significantly decreased in BMI >25 group (34.22mg/dL±4.99) when compared with BMI <25 (46.72mg/dL±4.71). The mean LDL and VLDL were significantly higher in BMI >25 group when compared with BMI <25 (Table 3).

**Table 2: Distribution of adolescent and adult group according to BMI.**

BMI	Adolescent (n=60)	Adult (n=60)
Under weight (<18.4)	02(3.5%)	02(3.5%)
Normal (18.5-24.9)	28(46%)	29(48%)
Overweight (25-29.9)	26(43.5%)	27(45%)
Obese (>30)	4(7%)	2(3.5%)

**Table 3: Comparative study of lipid profile in adolescent group based on BMI.**

Parameter	BMI <25 (n=30)	BMI >25 (n=30)
Serum triglycerides (mg/dl)	112.81±16.23	207.18±31.23**
Serum total cholesterol (mg/dl)	152.16±12.27	190.62±21.22**
Serum HDL-C (mg/dl)	46.72±4.71	34.22±4.99**
Serum LDL-C (mg/dl)	82.88±13.65	114.97±26.15**
Serum VLDL (mg/dl)	22.56±3.56	41.43±6.48**

\*\* p<0.001

Adolescent group mean WHR was significantly higher in BMI >25 group (0.84±0.03) when compared with BMI <25 (0.71±0.02). The mean VAI was significantly higher in BMI >25 group (3.04±0.36) compared with BMI <25 (2.09±0.22). This increase was statistically significant (p<0.001) (Table 4).

**Table 4: Comparison of WHR and VAI in adolescent group based on BMI.**

	BMI <25 (n=30)	BMI >25 (n=30)	p value
WHR	0.71 ±0.02	0.84±0.03	<0.001
VAI	2.09 ±0.22	3.04±0.36	<0.001

Adult group mean Serum Triglycerides was significantly higher in BMI >25 group (219.80mg/dL±30.99) when compared with BMI <25 (123.72mg/dL±18.23). The mean Cholesterol was significantly higher in BMI >25 group

(198.36mg/dL±21.02) compared with BMI<25 (167.16 mg/dL±15.12). This increase was statistically significant (p<0.001). The serum HDL was significantly decreased in BMI >25 group (36.18mg/dL±5.23) when compared with BMI <25 (46.22mg/dL±3.98). The mean LDL and VLDL were significantly higher in BMI >25 group when compared with BMI <25 (Table 5).

**Table 5: Comparative study of lipid profile in adult group based on BMI.**

Parameter	BMI <25 (n=31)	BMI >25 (n=29)
Serum triglycerides (mg/dl)	123.72±18.23	219.80±30.99**
Serum total cholesterol (mg/dl)	167.16±15.12	198.36±21.02**
Serum HDL-C (mg/dl)	46.22±3.98	36.18±5.23**
Serum LDL-C (mg/dl)	95.95±12.22	118.22±21.54**
Serum VLDL (mg/dl)	24.75±4.21	43.96±5.68**

Adult group mean WHR was significantly higher in BMI >25 group (0.91±0.05) when compared with BMI <25 (0.78±0.03). The mean VAI was significantly higher in BMI >25 group (3.22±0.46) compared with BMI <25 (2.12±0.24). This increase was statistically significant (p<0.001) (Table 6).

**Table 6: Comparison of WHR and VAI in adult group based on BMI.**

	BMI <25 (n=31)	BMI >25 (n=29)	p value
WHR	0.78 ±0.03	0.91±0.05	<0.001
VAI	2.12 ±0.24	3.22±0.46	<0.001

**DISCUSSION**

In the present study, author evaluated Lipid profile, WHR and VAI between BMI >25 and BMI <25. Body Mass Index (BMI) is a commonly used index of weight-for-height and used to classify underweight, normal weight, overweight and obesity.<sup>15</sup> It is usually used as an indicator of general obesity but cannot define central obesity. Most of the subjects both adolescent and adult group had normal BMI and overweight BMI. The number of subjects in both groups in lower and higher spectrum of BMI was much less.

Lipid profile was also performed on the fasting blood sample. The blood lipid variables investigated were Triglyceride (TG), Total Cholesterol (TC), High-Density Lipoprotein (HDL) cholesterol concentrations, Low-Density Lipoproteins (LDL) cholesterol and VLDL. In obese group where the BMI is more than 25 have soon increased level of mean serum triglycerides, serum total cholesterol, LDL cholesterol and VLDL the increase was statistically significant (p<0.001). The mean serum HDL cholesterol was significantly decreased in BMI >25 group (p<0.001). The Obese adolescent and adult have more risk

of dyslipidemia like hypertriglyceridemia and hypercholesterolemia which will leads to more cardiovascular risk.<sup>16</sup>

Waist Hip Ratio (WHR) is measures the central obesity. The WHO states abdominal obesity is defined as WHR above 0.90 in males and in females above 0.85.<sup>17</sup> In this study shows that WHR higher in BMI more than 25 in both adolescent and adult groups.

Visceral Adiposity Index (VAI) will be influenced by anthropometric and serum triglycerides. VAI level is influenced by anthropometric measurements and biochemical tests. The raise in VAI value is due to raised level of Waist Circumference (WC) or serum triglycerides (TG) or both.<sup>18</sup> The decreased level of serum HDLc also increases the VAI. The raised VAI indicates visceral tissue dysfunction is due to central obesity and altered lipid profile.<sup>19</sup> In this study shows that WHR higher in BMI more than 25 in both adolescent and adult groups.

Today, Modern lifestyle and altered nutritional diet put adolescents and adult at risk of cardiovascular disease in many countries including India.<sup>20</sup> Since our results in different age groups of adolescent and adult, appropriate methods should be planned specifically for adolescent and adult age group. Regular educational sessions are needed to make changes adolescent and adults toward obesity. Therefore, physicians and health experts will play important role in improving lipid disorders of overweight adolescents and adult which will helpful to preventing CVD.

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