

**RELATIONSHIP BETWEEN ANTHROPOMETRIC, METABOLIC PARAMETERS AND FASTING GLUCOSE IN RURAL POPULATION OF ANDHRA PRADESH**Ch. Srinivas<sup>1</sup>, N. Lakshmana Kumar<sup>2</sup>, K. V. N. Mallikarjuna Rao<sup>3</sup>, K. Kishore<sup>4</sup>, M. Kiran Deedi<sup>5</sup>, N. Surya Kumari<sup>6</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: OBJECTIVE AND AIM:** Prevalence of diabetes in adults worldwide has risen with a rapid pace in the past decade. W.H.O projects that by 2030 Diabetes will be the 7<sup>th</sup> leading cause of death in the world. India has the distinction of having the largest number of diabetics in the world. Lipid profile and body fat are the important predictors for metabolic disturbances, including Hyperinsulinaemia, Diabetes, Dyslipidaemia, Hypertension and Cardiovascular diseases. Objective of the present research was to study anthropometric measures and their relation to the metabolic disturbances in the population of the East Godavari district of coastal Andhra Pradesh. **MATERIAL AND METHODS:** This study was conducted on 335 subjects. BMI, waist circumference, Blood pressure, Hemoglobin, Fasting blood glucose and total cholesterol were measured by standard methods. Based on the Obtained data subjects were divided into diabetic and non-diabetic groups. **STATISTICAL ANALYSIS:** The data were analyzed and expressed as mean and standard deviation. The statistical software SAS 9.2, SPSS 15.0 was used for analysis of the collected data. **RESULTS:** The diabetic group (n-30) showed a significant increase in the BMI, waist circumference, fasting blood sugar, and total cholesterol levels when compared to non-diabetic group (n-305). **CONCLUSION:** Subjects with hyperglycemia showed alteration in their waist circumference, BMI and total cholesterol levels.

**KEYWORDS:** Diabetes mellitus, Hyperglycemia, Obesity, BMI and Total cholesterol.

**INTRODUCTION:** Prevalence of diabetes and its associated complications have increased worldwide. According to World Health Organization (WHO) 347 million people around the world are having diabetes. In the year 2004 alone 3.4 million people died of complications arising from diabetes. W.H.O projects that by 2030 Diabetes will be the 7<sup>th</sup> leading cause of death in the world. W.H.O also mentions that more than 80% of the diabetes deaths are occurring in low and middle income countries. <sup>1</sup>

Lipid profile and body fat are the important predictors for metabolic disturbances, including hyperinsulinaemia, diabetes, dyslipidaemia, hypertension and cardiovascular diseases.<sup>2</sup> The risk of diabetes increases if waist circumference is more than 80cm in females and 90cm in males.<sup>3</sup> When it comes to cholesterol level and its relation to diabetes and obesity, it was concluded by some authors that diabetes modulate cholesterol metabolism more than obesity alone.<sup>4</sup>

Anemia is a common concern in Diabetes and it can occur in 25% of diabetic cases.<sup>5</sup> uncontrolled diabetes with anemia increases risk of developing, retinopathy and cardiovascular diseases. The mortality rate is high in anemic diabetic patients who are having co-existing heart failure and/ or kidney disease.<sup>6</sup> Objective of the present research was to study anthropometric

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measures and their relation to the metabolic disturbances in the rural population of East Godavari district of coastal Andhra Pradesh.

**MATERIAL AND METHODS:** Present study was conducted at Peddapuram, rural area of East Godavari district of Andhra Pradesh. The study included 335 subjects, chosen by systematic random sampling. Informed written consent was taken from all the participants and the study was approved by the institutional ethics committee. The subjects included in the present study were aged between 25 to 70 years. Subjects who are known to have diabetes, hypertension and any other chronic or major disease were excluded from the study.

All the subjects were advised to come in the morning after 12 hours of fasting and anthropometric measurements were taken. Height was measured without shoes in meters nearest to 0.1centimeters with wall mounted height measuring scale (ws708) and weight was measured nearest to 0.1kilograms with the help of standard weighing machine with minimal clothing. The body mass index was calculated by dividing the weight in kilograms by the square of the height in meters ( $\text{kg}/\text{m}^2$ ).

The waist circumference was measured with a measuring tape in standing position and blood pressure with a sphygmomanometer in sitting position. Fasting venous samples of blood were collected. Total cholesterol was measured by enzymatic method and fasting plasma glucose levels were estimated by glucose oxidase and peroxidase method by semiautomatic analyzer. Hemoglobin values are also estimated by the cyanmethhemoglobin method in all the subjects.

**RESULTS:** The data obtained from the participants was analyzed and expressed as mean and standard deviation. The statistical software used for analysis of data was SAS 9.2, SPSS 15.0. Microsoft word and excel sheet were used to generate graphs, tables etc.

When the analyzed results were observed, we found that out of 335 subjects 30 subjects were diabetics. Based on the above findings, we have divided the subjects into two groups' Normal individual, group (n- 305) and Diabetic individual, group (n-30) and the results were compared between these two groups. There is no significant change in the systolic and diastolic blood pressures ( $p < 0.06$  and  $< 0.5$  respectively) between the two groups.

But there is a significant increase in the mean BMI value in the diabetic people ( $27.700 \text{ Kg}/\text{m}^2$ ) when compared to the non-diabetic normal subjects with a p- value of  $< 0.009$ . Similarly, even the waist circumference found to be more in the diabetic individual (mean 92.10cms) when compared to the normal subjects (mean 83.40cms) with statistically significant p-value of  $< 0.0001$ . The hemoglobin values did not show any significant change, but fasting plasma glucose values were elevated significantly in the diabetic group (Table 1, graphs 1 & 2)."

**DISCUSSION:** BMI and waist circumference independently contribute to the prediction of abdominal, visceral and subcutaneous fat.<sup>7</sup> There is clear association between the body fat and the lipid profile and both these are important predictors for metabolic disturbances including dyslipidaemia, hypertension, diabetes, cardiovascular disease, hyperinsulinaemia.<sup>6, 8</sup> In our present study we found that there is significant increase in the mean values of BMI and the waist circumference in the diabetic individuals when compared to the non-diabetic subjects.

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Our findings are consistent with observations of other researchers.<sup>3,6</sup> In this present study, we also observed that the statistically significant ( $p < 0.02$ ) rise in the mean total cholesterol values in the diabetic group whose BMI and waist circumference, mean values are more when compare to the non-diabetic group and these findings are in agreement with other researchers.<sup>2,9</sup>

Kidney function usually declines in diabetes; because of damage to the kidneys less erythropoietin is produced. As the erythropoietin is the hormone responsible for the production of Red blood cells its deficiency produces decreased erythropoiesis and eventually leads to Anemia. In this study haemoglobin values are found to be similar to the non-diabetic group of individuals and this finding is not in agreement with the study of Cawood TJ.<sup>10,11</sup>

This may be due to the duration of the diabetes and complications such as nephropathy might have not started in this group of patients.

It is also opined by some authors that anemia is also seen in people suffering from chronic obesity.<sup>12</sup> In our present study, we found that the hemoglobin levels were not significantly ( $p$ - value of  $< 0.67$ ) decreased in the diabetic group whose BMI is more when compared to the non-diabetic group. This finding is similar to the study of Karlee J.<sup>13</sup>

Hypertension is more commonly seen in patients with type 2 diabetes mellitus than in the non-diabetic population. Chronic hyperglycemia may exacerbate the vascular disease associated with diabetes mellitus and hypertension. Elevated glucose levels have a direct, toxic effect on vascular endothelial cells and these effects may lead to decreased endothelium-mediated vascular relaxation, increased vasoconstriction, promotion of VSMC hyperplasia, vascular remodeling, and atherosclerotic events.<sup>14</sup>

We found in the current study the blood pressure is not significantly elevated in the diabetic group when compared to non-diabetic group whose mean BMI is 24.923. This finding is not similar to the common observation of various researchers.<sup>14,15</sup>

There were certain limitations to our present study, as this study was a cross sectional study and we have taken waist circumference and BMI as parameters to measure obesity, more advanced methods such as bioelectrical impedance analysis (BIA) were available to measure body fat percentage and regional distribution of fat.

This BIA technique can give a measurement of the visceral fat percentage which is more prone to produce complications related to obesity. The duration of diabetes and Hb A1C values should also be considered to give a proper explanation for the normal blood pressure and haemoglobin values in the diabetic group, which are in contrast to common findings of many researches.

**CONCLUSION:** There is a clear positive association between hyperglycemia and increased waist circumference, BMI and total cholesterol levels.

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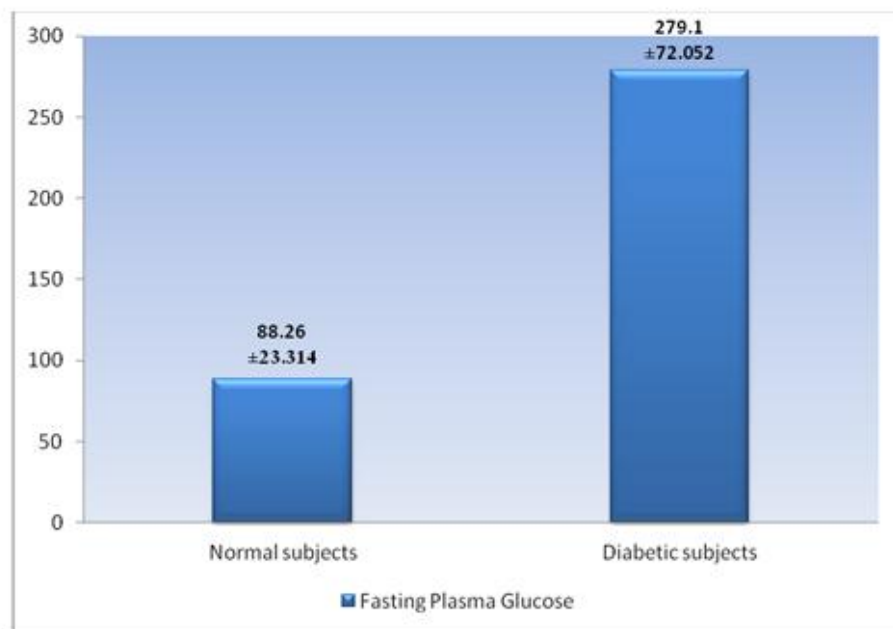
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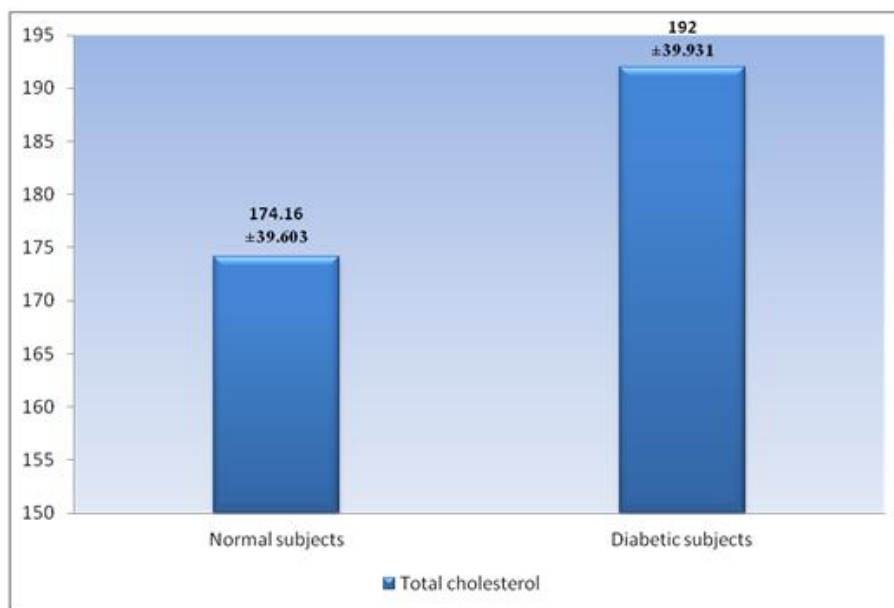
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**Figure 1: Comparison of fasting plasma glucose between normal and diabetic subjects.**



**Fig. 1**

**Figure 2: Comparison of Total cholesterol between normal and diabetic subjects.**



**Fig. 2**

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		Normal Subjects n-305		Diabetic Subjects n- 30		t- Value	p- Value
		mean	Stdv	mean	Stdv		
Age (in years)		47.73	±15.262	51.53	±12.993	1.318	0.188
BMI		24.923	±5.4581	27.700	±6.2494	2.62	0.009
Waist circumference (in centimeters)		83.40	±12.923	92.10	±11.728	3.54	0.0001
Blood pressure mmHg	Systolic	128.13	±60.974	134.00	±18.308	0.524	0.06
	Diastolic	79.77	±12.259	81.33	±9.732	0.67	0.50
Haemoglobin gm%		10.83	±1.84	10.98	±1.57	0.429	0.67

**Table 1: Comparison of parameters - Statistical analysis**

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