Original Research Article

**Prevalence of Diabetes mellitus in obese subjects in South Kerala**

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**Abstract**

Background: Obesity is an independent risk factor for Type2 Diabetes and is rising in prevalence throughout the developed and developing countries. This study aims to find the prevalence of Diabetes Mellitus in Obese Patients compared to non-obese patients who attended Medicine and Diabetology departments of various hospitals in South Kerala during the period June 2010 to May 2013.

Materials and methods: The participant population comprised of 426 patients in the age group 30 to 65 years. All participants underwent routine physical examinations that included measurement of Body mass Index and waist circumference. Fasting plasma glucose concentration was measured by the hexokinase method. Among the study group 186 patients were obese (90 males and 96 females).

Results: The mean FBS was higher in obese (131.2 mg/dl) compared to non-obese (102 mg/dl), and there was a higher proportion of people with hyperglycemia among the obese. This difference was found to be statistically significant.

Conclusions: Although not all overweight or obese individuals are metabolically unhealthy, the majority are insulin resistant. The combination of obesity, physical inactivity, and consumption of an atherogenic diet is believed to lead to insulin resistance and thus to Type 2 Diabetes Mellitus.

**Keywords:** Diabetes, obesity, fasting blood sugar

**Introduction**

Chronic non-communicable diseases are assuming increasing importance among the adult population in both developed and developing countries. The impact of chronic diseases on the lives of people is serious when measured in terms of loss of life, disablement and economic loss to the country. Life-style diseases are preventable, and can be lowered with changes in diet, lifestyle, and environment.

Obesity is an independent risk factor for Type 2 Diabetes and Coronary artery disease and is rising in prevalence throughout the developed and developing countries. It has been proposed that hyperinsulinaemia stimulates 11β-hydroxysteroid dehydrogenate in mental adipose tissue,
generating cortisol and promoting a cushingoid fat distribution. Adipose tissue is now recognized to be a source of a number of inflammatory cytokines (interleukin IL-6), tumor necrosis factor-α (TNF-α), growth factors (heparin binding epidermal growth factor HB-EGF) and hormone-like substances (leptin, adiponectin, resistin). Weight reduction is associated with an improvement in a number of coronary risk factors including BP and fasting blood glucose. Rapid weight gain in childhood (between 2 and 11 years) appears to predict diabetes and coronary disease in adulthood. Both diabetes mellitus and impaired glucose tolerance are important risk factors for CAD. In patients with diabetes, a high HbA1c is associated with an increased risk of CAD.

Metabolic syndrome is a cluster of metabolically related cardiovascular risk factors, the core components of which comprise of central obesity, insulin resistance, dyslipidemia, and hypertension. The presence of metabolic syndrome predicts the risk of cardiovascular disease in non-diabetic subjects as well as in those with diabetes. Body Mass Index is promulgated by the World Health Organization (WHO) as the most useful epidemiological measure of obesity. A BMI between 25 and 30 kg/m² is defined as overweight and above 30 kg/m² is defined as obesity. Persons with normal weight have a BMI of 18.5-24.9. It is nevertheless a crude index that does not take into account the distribution of body fat, resulting in variability in different individuals and populations. An increase in visceral fat reflects central obesity and increases health risks. The Waist Circumference (WC) is used to assess the amount of visceral obesity. Waist-hip circumference ratio (WHR), Waist-height ratio (WHR) and Waist Circumference (WC) are commonly used to predict the risk of obesity related morbidity and mortality as they account for regional abdominal obesity. The term metabolic syndrome is applied to a constellation of obesity, poor glucose tolerance and an atherogenic lipid profile. It is also known as Insulin resistance syndrome. Insulin resistance or reduced glucose tolerance and abdominal obesity are hallmarks.

Epidemiological studies have shown that Asian Indians are more insulin resistant and it is considered to be a major reason for the higher prevalence of type 2 diabetes and cardiovascular disease. Insulin resistance and hyperinsulinemia have been demonstrated as a characteristic feature in Asian Indians. A main factor contributing to insulin resistance is obesity. From the field of obesity and diabetes, insulin resistance has spread to adjacent areas (Eg: Hypertension, dyslipidemia, ischemic heart disease), from which new angles have emerged.

Materials and methods
The study was conducted on patients who attended Medicine and Diabetology departments of various hospitals in South Kerala during the period June 2010 to May 2013.

The participant population comprised of 426 patients in the age group 30 to 65 years. Self-answered questionnaires were used for collecting participants' information including age, occupation, medical history, the use of ant diabetic, antihypertensive or lipid lowering medications, smoking status and alcohol consumption habits.

All participants underwent routine physical examinations that included measurement of waist circumference and resting blood pressure. Waist circumference was measured midway between the inferior margin of last rib and the iliac crest at the end of expiration with a heavy duty inelastic plastic fiber measuring tape to the nearest 0.5 cm while the subject stood balanced on both feet. BMI was calculated in all patients. Systolic and diastolic blood pressure was measured using sphygmomanometer after the subjects had been in a rested seating
position for at least five minutes. Central obesity was measured by waist circumference. The cut points were greater than or equal to 40 inches for men and greater than or equal to 35 inches for women.

Diabetes mellitus is defined by fasting plasma glucose concentration (FPG) greater than equal to 126 mg/dl, two hour plasma glucose greater than or equal to 200 mg/dl during an OGTT, or by classic symptoms of hyperglycemia or hyperglycemic crisis with a random plasma glucose greater than or equal to 200 mg/dl. Impaired fasting plasma glucose (IFG) is defined as FPG 100 mg/dl to 125 mg/dl. Family history of diabetes mellitus is defined as the positive history of diabetes in first degree relations such as patients or siblings. Fasting is defined as no calorie intake for at least eight hours. About 5 ml of blood sample was collected from anterior cubital vein under aseptic conditions after an overnight fast from all participants. It was collected in a plain dry tube and was allowed to clot. After retraction of the clot, serum was separated by centrifugation at 3000 rpm for 5 minutes. Fasting plasma glucose concentration was measured by the hexokinase method (enzymatic reference method). All these estimations were carried on Roche Cobas Integra 400 plus fully automated clinical chemistry analyzer.

**Results**

The present study included 426 patients in the age group of 30 to 65 years who attended medicine and Diabetology OPD in various hospitals in South Kerala after informed consent. Among the study group 186 patients were obese (90 males and 96 female). As seen in Table-1, 66% of no obese patients had normoglycemia, while 68% obese patients had FBS above 110 mg/dl.

<table>
<thead>
<tr>
<th>Fasting blood sugar</th>
<th>Obese</th>
<th>Non-obese</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100 mg/dl</td>
<td>59 (32%)</td>
<td>158 (66%)</td>
<td>217</td>
</tr>
<tr>
<td>≥100 mg/dl</td>
<td>127 (68%)</td>
<td>81 (34%)</td>
<td>208</td>
</tr>
<tr>
<td>Total</td>
<td>186</td>
<td>239</td>
<td>425</td>
</tr>
</tbody>
</table>

**Chart 1: Fasting Blood Sugar In The Study Groups**

The Mean FBS in Obese Group was found to be 131.2 mg/dl and in no obese Group it was 102 mg/dl.

**Chart 3: Blood glucose: comparison of mean**

Chart 3 shows the comparison.
Discussion
In the present study, 426 subjects were included. They were grouped into obese and non-obese based on their Body Mass Index (BMI). BMI above 30 was taken as obese and BMI < 25 was as normal weight subjects. BMI between 25 and 30 was taken as overweight. 186 subjects were obese. The increase in the prevalence of obesity in the recent decades is a likely cause of the rising incidence of insulin resistance and Type 2 Diabetes mellitus. Although not all overweight or obese individuals are metabolically unhealthy, the majority are insulin resistant. The combination of obesity, physical inactivity, and consumption of an atherogenic diet is believed to lead to insulin resistance and thus to Type 2 Diabetes Mellitus. Hence a community-based education in this regards is of utmost important.

Fasting blood glucose was estimated in all subjects and the results summarized. From the graph it is seen that the mean FBS was higher in obese compared to non-obese, and there is a higher proportion of people with hyperglycemia among the obese. This difference was found to be statistically significant. (A chi-square test showed $\chi^2 (1, N=425) = 7.824, P<0.005$). Similar findings observed in Aviva et al and Michael Criqui Type 2 DM showed a strong increase in prevalence with increasing overweight class among both younger and older subjects. Accompanying the increase in obesity there will be increase in insulin resistance which include pre-diabetes and diabetes.

Conclusion
By analyzing the results of the study conducted among 425 patients it was found that the prevalence of hyperglycemia was significant in the obese patients compared to non-obese individuals. From the above findings it has been concluded that there is an increased risk of Type 2 Diabetes among obese compared to non-obese people. Although not all overweight or obese individuals are metabolically unhealthy, the majority are insulin resistant. The combination of obesity, physical inactivity, and consumption of an atherogenic diet is believed to lead to insulin resistance and thus to Type 2 Diabetes Mellitus. Hence a community-based education in this regards is of utmost important.

References