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Effect of obesity on the incidence of type 2 diabetes mellitus varies with age among Indian women

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ABSTRACT

Diabetes is a condition in which a person has a high blood sugar (glucose) level as a result of the body either not producing enough insulin, or because body cells do not properly respond to the insulin that is produced. Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems. The present study sought to investigate whether the effect of obesity on the incidence of type 2 diabetes varies with age among Indian women's. The study is an independent cohort study at different parts of Karnataka for one year; the combined effect of body mass index (BMI) and age on the incidence of type 2 Diabetes was evaluated by regression analysis. A total of 2564 subjects were enrolled in the cohorts and the follow up rate was 75%. In our study ratio for incidence of type 2 diabetes was significantly higher in obese subjects ($25.0 \text{ kg/m}^2 \leq \text{BMI}$) in normal weight subjects ($18.5 \text{ kg/m}^2 \leq \text{BMI}$) across all age groups, With the highest hazard ratio observed in the youngest group aged 40-59 year. Analysis for the interaction between age groups and obese subjects versus normal weight subjects revealed significant weakening of the effect of obesity in women in both subjects aged 60-69 and 70-79 years compared to younger subjects aged 40-59 years. Based on data from the study group; the effect of obesity on the incidence of type 2 diabetes was found to decline with age in Indian women but not in men.

Key words: Obesity, Type 2 Diabetes mellitus, Body mass index, Insulin

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INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems [1, 2]. Body mass index (BMI), a measurement which compares weight and height, defines people as overweight (pre-obese) when their BMI is between 25 kg/m^2 and 30 kg/m^2 , and obese when it is greater than 30 kg/m^2 . Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, breathing difficulties during sleep, certain types of cancer, and osteoarthritis [2]. Obesity is most commonly caused by a combination of excessive dietary calories, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications or psychiatric illness. Evidence to support the view that some obese people eat little yet gain weight due to a slow metabolism is limited; on average obese people have a greater energy expenditure than their thin counterparts due to the energy required to maintain an increased body mass [4,5]. Obesity is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century [8]. Obesity is stigmatized in the modern Western world, though it has been perceived as a symbol of wealth and fertility at other times in history, and still is in many parts of Africa [2].

Diabetes is a condition in which a person has a high blood sugar (glucose) level as a result of the body either not producing enough insulin, or because body cells do not properly respond to the insulin that is produced. Insulin is a hormone produced in the pancreas which enables body cells to absorb glucose, to turn into energy. If the body cells do not absorb the glucose, the glucose accumulates in the blood (hyperglycemia), leading to vascular, nerve, and other complications [2, 3].

METHODS

By independent cohort study at different parts of Karnataka for one year; Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health. It is defined by body mass index (BMI) and further evaluated in terms of fat distribution via the waist-hip ratio and total cardiovascular risk factors. BMI is closely related to both percentage body fat and total body fat. BMI is calculated by dividing the subject's mass by the square of his or her height i.e.; $\text{BMI} = \text{kilograms} / \text{meters}^2$. In this study, the combined effect of body mass index (BMI) and age on the independence of type 2 diabetes was evaluated by regression analysis. A total of 2564 subjects were enrolled in the cohorts and the follow up rate was 75%.

Statistical analysis

The combined effect of body mass index (BMI) and age on the incidence of type 2 diabetes was evaluated by regression analysis. $P < 0.05$ was considered the level of significance.



RESULTS

In our study, the ratio of incidence of type 2 diabetes was significantly higher ($p < 0.0001$) in obese subjects ($25.0 \text{ kg/m}^2 \leq \text{BMI}$) as compared to normal weight subjects ($18.5 \text{ kg/m}^2 \leq \text{BMI}$) across all age groups (Table-1, 2 and Fig-1), with the highest hazard ratio observed in the youngest group aged 40-59 year. In our study group, type 2 diabetic mellitus ratio was also significantly higher ($p < 0.0001$) in obese subject than in normal weight subjects in men aged 40-59 and 70-79 year and in women aged 40-59 years. Analysis for the interaction between age groups and obese subjects versus normal weight subjects revealed significant weakening of the effect of obesity in women in both subjects aged 60-69 and 70-79 years compared to younger subjects aged 40-59 years (Table-1, 2 and Fig-1). In men however a significant weakening of the effect was observed only in subjects aged 60-69 year within study group. The interaction between BMI categories including an extremely obese group's age category was significant in women but not in men.

DISCUSSION AND CONCLUSION

The serious cardiovascular complications of obesity and diabetes could overwhelm developing countries that are already straining under the burden of communicable diseases. The risk of cardiovascular disease is considerably greater among obese people, and this group has an incidence of hypertension that is five times the incidence among people of normal weight. The effect of diabetes on complications of cardiovascular disease is also more severe among members of most ethnic minority groups in Western countries as well as among the populations of developing countries, where an increased waist-to-hip ratio is a strong predictor of ischemic heart disease and stroke.

Globally, the prevalence of chronic, non communicable diseases is increasing at an alarming rate. About 18 million people die every year from cardiovascular disease, for which diabetes and hypertension are major predisposing factors. Propelling the upsurge in cases of diabetes and hypertension is the growing prevalence of overweight and obesity — which have, during the past decade, joined underweight, malnutrition, and infectious diseases as major health problems threatening the developing world [1]. Based on data from the study group; the effect of obesity on incidence of type 2 diabetes was found to decline with age in Indian women but not in men. In our study incidence of type 2 diabetes was significantly higher in obese subjects ($25.0 \text{ kg/m}^2 \leq \text{BMI}$). The highest hazard observed in the youngest group aged 40-59 year. In our study group type 2 D.M was also significantly higher in obese subject than in normal weight subjects in men aged 40-59 and 70-79 year and in women aged 40-59 years. Analysis for the interaction between age groups and obese subjects versus normal weight subjects revealed significant weakening of the effect of obesity in women in both subjects aged 60-69 and 70-79 years compared to younger subjects aged 40-59 years. In men however a significant weakening of the effect was observed only in subjects aged 60-69 year within study group.

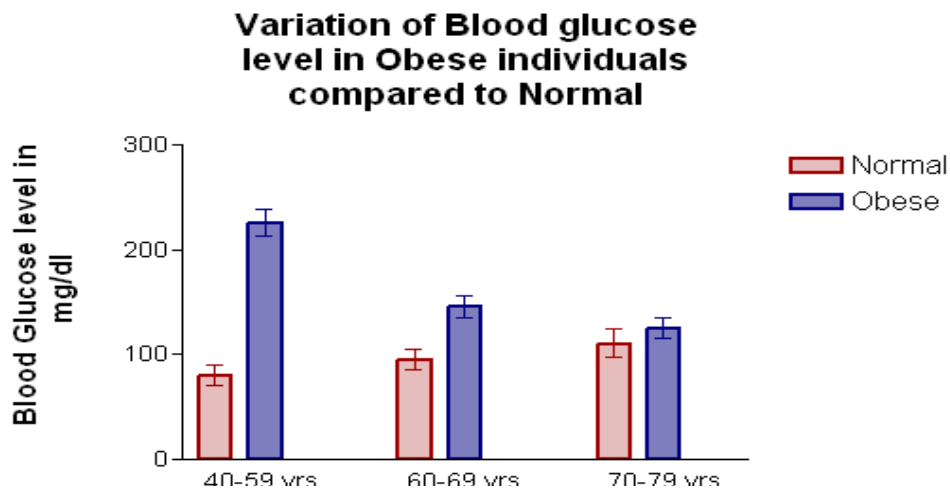
Table 1: Blood sugar level in Normal and obese Individuals of different age group
 Values are expressed in Mean± SD.

Parameters	40-59 yrs	60-69 yrs	70-79 yrs
Normal	81.10 ± 10.3	94.05 ± 9.45	112.8 ± 13.5
Obese	222.6 ± 12.3	148.30 ± 11.30	127.23 ± 9.5
P Value	<0.0001	<0.0001	<0.0001

Table 2: Blood glucose level of obese men & women and Normal men and women of different age group.
 Values are expressed in Mean± SD.

Parameters	Normal Men	Obese men	Normal women	Obese women
40-59 yrs	81.40 ± 3.70	222.10 ± 10.30	74.06 ± 2.7	215.30 ± 3.22
60-69 yrs	92.50 ± 6.52	159.4 ± 5.7	89.65 ± 3.8	131.7 ± 4.62
70-79 yrs	111.30 ± 5.40	194.60 ± 5.39	117.30 ± 5.79	139.7 ± 5.26
P Value	<0.0001	<0.0001	<0.0001	<0.0001

Fig-1: Comparison of blood glucose levels in Obese and Normal individuals belonging to different age groups.



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