

## Original Research Article

# Prevalence of impaired glucose tolerance in different grades of obesity

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### ABSTRACT

**Background:** Surgical Background: Impaired glucose tolerance is known precursor of type-2 diabetes mellitus and more prevalent in obese people, different studies have varied results and true prevalence is still debatable. Aims of this study to investigate the prevalence of IGT in different grades of obesity.

**Methods:** Authors have studied 100 patients with obesity Grade 1 (BMI >25 kg/m<sup>2</sup> but <30) and Grade 2 (BMI >30 kg/m<sup>2</sup>) at Gandhi Medical College, Bhopal during April to June 2019. Complete physical examination and blood tests including fasting blood glucose and oral glucose tolerance test (OGTT) were done.

**Results:** Results shows that 16% male and 14% female subjects had IGT. Male of age more than 60yrs and female aged between 51 to 60 were more pre-diabetic. Males having weight 71 to 80 kg and female of 51-60 kg were more pre-diabetic. Subjects with grade 1 obesity, 6.12% male and 5.88% female had IGT. Similarly, in grade 2-obese subjects 10.20% males and 7.84% females had IGT.

**Conclusion:** IGT is more prevalent in grade-1 and grade-2 obese population and a strong indicator of diabetes.

**Keywords:** Body mass index, Impaired glucose tolerance, Pre-diabetes

## INTRODUCTION

Obesity and overweight in children and adolescents is a major health issue, not only in developed but in developing countries as well. High body mass index (BMI) in childhood is known to be associated with an increased risk of cardiovascular heart disease events in adulthood.<sup>1</sup> WHO defines the obesity grades based on the BMI as Grade 1 obesity (BMI >25 kg/m<sup>2</sup><30) and Grade 2 obesity (BMI >30kg/m<sup>2</sup>).<sup>2</sup>

As the spread to diabetes continues to increase in India, morbidity and mortality related to diabetes have emerged as major public healthcare problem. Diabetes related damage in small blood vessels causing blindness, kidney failure, and amputation. Damage to larger blood vessels becoming major cause of heart disease, high blood pressure, and stroke.<sup>5</sup>

Obesity cause metabolic changes which results in the disturbed glucose and insulin homeostasis. Major known consequences impaired glucose tolerance (IGT), which was introduced in the late 1990s by the American Diabetes Association (ADA) and World Health Organization (WHO) as a pre-diabetic stage.<sup>3</sup>

Prediabetes is a sign of type 2 diabetes; it is also a state of impaired glucose tolerance. Pre-diabetes diagnosis done by blood sugar testier. oral glucose tolerance test (OGTT). The ADA diagnosis criteria for of pre-diabetes are a) 2-hour post-load glucose = 140 - 199 mg/dl, b) HbA1c of 5.7 - 6.4%.<sup>4</sup>

Approximately 70% of India's population lives in rural areas in resource-poor settings where the increasing prevalence and chronic nature of type 2 diabetes become added burdens. Lack of awareness and poor access to

quality care increase diabetes-related complications. Lifestyle intervention is the most cost-effective strategy to prevent type 2 diabetes.<sup>10</sup>

There are not much study done to assess the prevalence of IGT among obese population and hence current study is an attempt in this direction. We have also taken the gender as a factor for this assessment.

## METHODS

Present study done at the Gandhi Medical College, Bhopal, Madhya Pradesh, India from April 2019 to June 2019, 100 subjects were enrolled based on an informed and written consent was secured before the commencement of this study.

Male and female subjects of age more than 20 years with family history of type 2 diabetes mellitus, BMI >25 (obese) and who were willing to participate in this study were included and patient who were diabetic; pursuing diet; exercise; oral hypoglycemic agents or insulin were excluded.

Physical and anthropological details were recorded along with the physical examinations and blood investigations.

OGTT was carried out by giving 75gm of oral glucose after overnight fasting, after 2 hour blood sample were taken from grade 1 and grade 2 obese subjects. Weight, height, waist and circumference (WC) were measured, and BMI and waist-hip ratio (WHR) were calculated.

Statistical analysis was done using IBM SPSSver. 20 software. Frequency distribution was performed to get the tabular data and data is expressed as number and percentage of patients.

## RESULTS

Study cohort had 49 male and 51 were female and 51 were female and mean age of sample was 43.8 years.

Table 1 show that a total 16.33% males were prediabetic whereas out of 51 females, 13.72% females were prediabetic. That means prediabetes was more prevalent in male population as compared to female gender. Males with age more than 41 years had more prediabetes as compared to females where prediabetes was more common in 51-60 years of age.

Table 2 show that a total 16.33% males were prediabetic whereas out of 51 females, 13.72% females were prediabetic. That means prediabetes was more prevalent in male population as compared to female gender. Among male subjects IGT is highest in the weight range of 71 to 80 kg and for female subjects it is highest in weight range of 51-60 kg.

Table 3 show that subjects with grade 1 obesity, 6.12% male and 5.88% female had IGT. Similarly in grade 2-obese subjects, 10.20% males and 7.84% females had IGT. IGT was more common in Grade 2 obesity in both males (10.20%) and females (7.84%).

**Table 1: Showing prevalence of IGT according to age and gender.**

Age Group	Male	Prediabetic		Female	Prediabetic	
		Number	%		Number	%
20-30	8	1	2.04	7	1	1.96
31-40	8	1	2.04	15	1	1.96
41-50	10	2	4.08	15	2	3.92
51-60	9	2	4.08	12	3	5.88
60+	14	2	4.08	2	0	0.00
Total	49	8	16.33	51	7	13.72

**Table 2: Prevalence of IGT according to weight.**

Weight in KG	Male	Prediabetic		Female	Prediabetic	
		Number	%		Number	%
40-50	3	0	0.00	9	1	1.96
51-60	8	1	2.04	21	3	5.88
61-70	13	2	4.08	12	2	3.92
71-80	14	3	6.12	9	1	1.96
80+	11	2	4.08	0	0	0.00
Total	49	8	16.33	51	7	13.73

**Table 3: Prevalence of IGT based on obesity grade.**

Obesity Grade	Male	Prediabetic		Female	Prediabetic	
		Number	%		Number	%
Grade 1	27	3	6.12	29	3	5.88
Grade 2	22	5	10.20	22	4	7.84
Total	49	8	16.33	51	7	13.73

\*Grade 1 obesity- if BMI >25 kg/m<sup>2</sup><30 and Grade 2 obesity if BMI >30 kg/m<sup>2</sup>.

## DISCUSSION

Impaired glucose tolerance is the blood glucose level above the normal range but not high that can be diagnosed as diabetes. IGT is pre-cursor of diabetes and cardiovascular diseases.

Treatment, healthy food habit, physical exercise and losing weight (in overweight) are the keyways to control and prevent the diabetes.

The prevalence of IGT varies from study to study throughout the world. In this study, prevalence of IGT is 16 % among males and 14% among female subject. Similar correlation of IGT in different genders was reported in a cross sectional study conducted in Jaipur, which reported the prevalence of pre-diabetes 8% in boys and 6% in girls.<sup>6</sup>

The prevalence of IGT was 16 % and 14 % in grade1 and grade-2 obese subjects, respectively.

Our results are in accordance to the similar studies done in USA by Sinha et al. reported that the prevalence of IGT and type 2 diabetes was as 21 percent and 15 percent respectively.<sup>7</sup>

David W.D. et al. in their Australian study reported the prevalence of IGT as 17.4% in men and 15.4% in women, which is similar to our study.<sup>8</sup>

Malini DS et al their study recorded that out of 100 women, 24 were having IGT. The incidence was highest in 46 to 55 yr age group, 75% of women with diabetes or IGT were in higher income group. Body Mass Index was more than 25 kg/m<sup>2</sup> in maximum (75%) women having diabetes or IGT. 92% women with diabetes or IGT had their Waist Hip Ratio  $\geq 0.85$ . Furthermore, inclination towards healthy life-style changes to control diabetes and its prevention was recorded poor among subjects. Current study also recorded the similar results where highest IGT was recorded in the age groups of 51 to 60 years. Also the highest weight among females subjects was in this age groups which indicates the less of physical exercise and less healthy lifestyle.<sup>9</sup>

Current study have some limitations like the small sample size, less number of parameters assessed, assessment of

IGT in isolation etc. for better understanding and more insight on IGT a large study with more variables and a larger cohort is necessary.

## CONCLUSION

This study conclude that the IGT in obese population is the strong indicator of diabetes. Obesity have direct impact on impaired blood glucose, Current study finds that both grade 1 obese male and female had ~6% IGT prevalence and in grade 2 obese male subjects prevalence of IGT was 10% in female subjects it was 8%. Current study conclude that the IGT should be taken seriously by clinicians so that the type2 diabetes can be controlled at initial stage and improve the overall morbidity and mortality due to diabetes.

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