Original Research Article

Prevalence of impaired fasting glucose in different grades of obesity

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ABSTRACT

Background: Impaired Fasting Glucose (IFG) is a pre-stage to type 2 diabetes mellitus (T2DM) in adults and generally in obese population. In different studies this occurrence varied significantly, but the true prevalence is unknown due to lack of larger representative cohort studies. Authors objectives was to study the prevalence of IFG in different grades of obesity.

Methods: One hundred obese subjects of obesity Grade1 (BMI >25 kg/m^2 but <30) and Grade 2 (BMI >30 kg/m^2) were studied at Gandhi Medical College, Bhopal from April 2019 to June 2019. Physical examination, blood investigations including fasting blood glucose and Oral Glucose Tolerance Test (OGTT) was carried out for all the patients.

Results: Out of 100 subjects, 18(9%) males and 18(9%) females had IFG. Among male subjects highest IFG was recorded in the age group of 60+ years and in the weight rage of 71 to 80 kg. In female subjects, highest prevalence was in the age group 51 to 60 years and in weight range of 51-60 kg. Out of 24 males and 34 females of with grade 1 obesity, 7% and 10.4% had IFG similarly, out of 25 males and 17 females with grade 2 obesity, 11% and 7.6% had IFG.

Conclusions: IFG is highly prevalent in different grades of obesity. Obesity is the risk factor for the development of diabetes.

Keywords: American diabetes association, Glucose tolerance, Impaired fasting glucose, Obesity grading, Prediabetes

INTRODUCTION

Obesity in childhood and adolescence has become a massive health problem in developed and developing countries. High Body Mass Index (BMI) in childhood is associated with an increased risk of cardiovascular heart disease events in adulthood.[1] As per WHO, obesity grades are defined based on the BMI of the patients as Grade 1 obesity (BMI >25 kg/m^2 <30) and grade 2 obesity (BMI >30 kg/m^2).[2]

An early metabolic consequence of obesity is disturbed glucose and insulin homeostasis. Majorly know consequence is Impaired Fasting Glucose (IFG), it was introduced in the late 1990s by the American Diabetes Association (ADA) and World Health Organization (WHO) as a pre-diabetic stage.[3]

Prediabetes is a precursor condition to diabetes like IFG, which can occur isolated or in combination with other causes. Pre-diabetes can be diagnosed by blood sugar test like Fasting Plasma Glucose (FPG). The American Diabetes Association (ADA) criteria for diagnosis of prediabetes are a) FPG =100 - 125 mg/dl, b) 2-h post-load glucose = 140 - 199 mg/dl, c) HbA1c of 5.7 - 6.4%.

As the prevalence and progression to diabetes continues to increase in India, diabetes related morbidity and mortality have emerged as major public healthcare issues. Diabetes related damage in small blood vessels leads to blindness, kidney failure, and amputation. Damage to larger blood vessels can result in heart disease, high blood pressure, and stroke.[4]

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

METHODS

Present study was conducted at the Gandhi Medical College, Bhopal from April 2019 to June 2019. In this cross-sectional study 100 subjects were included based on an informed and written consent before the commencement of this study.

Inclusion criteria

Subjects of either sex with age more than 20 years, no family history of type 2 diabetes mellitus, BMI >25 (obese) and consented to participate were included.

Exclusion criteria

Subjects who were diabetic and pursuing diet, exercise and on oral hypoglycemic agents or insulin were excluded from this study.

For this study all the subjects were physically examined, blood investigations were conducted and various anthropological details like weight, height, BMI, Waist Circumference (WC) and Waist-Hip Ratio (WHR) of all the participants was recorded.

Samples for FPG were taken in grade 1 (BMI >25 kg/m^2<30) and grade 2 (BMI >30kg/m^2) obese subjects. The prevalence of IFG was determined using the ADA guidelines. If FPG less than 100 mg/dl then subjects is normal, if FPG is 100 mg/dl to 125 mg/dl is indication of prediabetes and if FPG is 126 mg/dl or higher indicates the diabetes.

Data collection and analysis was done using the IBM SPSS ver. 20 software. Frequency distribution was performed record the data in tables. Data is expressed either as no of patients or percentage. No further statistical test was performed.

RESULTS

Out of 100 subjects 49 were male and 51 were female and mean age study cohort was 43.8 years.

Out of 49 males, 2.04% patients having age between 20-30 years had pre-diabetes, 3.06% patients with age 31-40 years had prediabetes, 4.08 patients with age 41-50 years has prediabetes, 4.08% patients with age 51-60 had prediabetes and 5.1% patients who had age >60 years were prediabetics. Among the males, prevalence of prediabetes increases with increasing the age. Among females, prevalence of prediabetes among age group 20-30 was 0.98%, with 31-40 years was 3.92%, with 41-50 years was 4.9%, and with 51-60 years was 7.84%. This also proves that prevalence of pre-diabetes increases with increasing age among females.

Table 1: Prevalence of IFG according to age and gender.

Age group	Male	Prediabetic		Female	Prediabetic	
		Number	%		Number	%
20-30	8	1	2.04	6	1	0.98
31-40	8	1	3.06	15	2	3.92
41-50	10	2	4.08	15	2	4.9
51-60	9	2	4.08	13	4	7.84
>60	14	3	5.1	2	0	0
Total	49	9	18	51	9	18

Table 2: Prevalence of IFG according to weight.

Weight in kg	Male	Prediabetic		Female	Prediabetic	
		Number	%		Number	%
40-50	3	1	1.02	9	1	2.04
51-60	8	1	2.04	20	3	7.14
61-70	13	2	4.08	12	3	6.12
71-80	14	3	6.12	10	2	3.06
80+	11	2	5.1	0	0	0
Total	49	9	18.36	51	9	18.36

Prevalence of pre-diabetes among male patients with weight between 40-50 kg was 1.02%, with 51-60 kg weight prevalence was 2.04, with 61-70 kg 4.08%, with 71-80 kg 6.12% and with more than 80 kg weight prevalence was 5.1%. Among females, prevalence of prediabetes in weight between 40-50 kg was 2.04%, with 51-60 kg weight, prevalence was 7.14, with 61-70 kg 6.12%, and with 71-80 kg 3.06%. Among male subjects IFG is highest in the weight rage of 71 to 80 kg and for female subjects it is highest in weight range of 51-60 kg.

Table 3: Prevalence of IFG based on obesity grade.

Obesity grade	Male	Prediabetic		Female	Prediabetic	
		Number	%		Number	%
Grade 1	24	3	7	34	5	10.4
Grade 2	25	6	11	17	4	7.6
Total	49	9	18	51	9	18

*Grade 1 obesity- if BMI >25 kg/m2<30 and Grade 2 obesity if BMI >30 kg/m2.

Majority of the males had grade 2 obesity (11%) followed by grade 1(7%) whereas among female's majority had grade 1 obesity (10.4%) followed by grade 2(7.5%).

DISCUSSION

The prevalence of IFG varies from study to study throughout the world. A study from the USA indicated that the prevalence of impaired fasting glucose in an adult population was nearly 26%.[5] This is much higher than the prevalence found in this study (18%).

The australian diabetes obesity and lifestyle study reported the prevalence of impaired fasting glucose to be 16.4%, which is similar to the prevalence found in this study.[6] As compared to this study, a lower prevalence of 11.2% was found in the Amrita Diabetes and Endocrine Population Survey (ADEPS), which was a community-based cross-sectional survey done in urban areas of Ernakulam district in Kerala.[7] A study in a developing rural area of Andhra Pradesh reported the prevalence of IFG to be 15.5% which was lower as compared to this results.[8] In a USA, based study the prevalence of IFG was significantly higher in male subjects, whereas this study have not observed any significant difference in prevalence of IFG among male and female subjects, which is in agreement with the study of Shaw et al, who also reported that prevalence of IFG was similar among male and female subjects.[9] In a study carried-out in a rural population of Tamil Nadu by Balagopal et al, the crude prevalence of IFG was 12.1% which was slightly lower than the prevalence found in this study. This is probably because of the purely rural setting against semi-urban in this study. They also found a significantly higher prevalence amongst men as compared to women.[10]

CONCLUSION

IFG in obese population is a precursor of diabetes. In grade 1 obese male subjects, prevalence of IFG was 7%, similarly in grade 1 obese female subjects IFG was found 11%. In grade 2 obese male subjects, prevalence of IFG was 11% and in grade 2 obese female subjects, it was recorded at 7%.

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