

## TO STUDY THE PREVALENCE OF IMPAIRED FASTING GLUCOSE AND ITS CORRELATION WITH VARIOUS ANTHROPOMETRIC VARIABLES

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**ABSTRACT:OBJECTIVE:** This study was conducted to find out the prevalence of 'impaired fasting glucose' and correlate it with other variables like age, sex, weight, body mass index, waist circumference, waist-hip ratio and family history of diabetes. **METHODS:** The present study has been carried out on 600 Punjabi patients attending the OPD and indoor of Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar having age more than 20 years. A diagnosis of impaired fasting glucose (IFG) was made as per the American Diabetes Association (ADA) guidelines. Data was analyzed using unpaired 't' test and Pearson's Chi-square test. **RESULTS:** The prevalence of impaired fasting glucose in the studied population was found to be 22% (male 21.4% and female 22.6%). It was observed that impaired fasting glycaemia was significantly correlated with advancing age, family history of diabetes and various anthropometric variables. **CONCLUSIONS:** This study shows that the prevalence of impaired fasting glucose is very high in Punjabi population. The traditional risk factors like body weight, body mass index along with waist-hip ratio, and family history of diabetes have a positive correlation with IFG and play a significant role in the prediction of impaired glycaemia and diabetes in Punjabi population.

**KEYWORDS:** Impaired fasting glucose, body mass index, waist-hip ratio, waist circumference, family history of diabetes.

**INTRODUCTION:** Diabetes Mellitus is defined by ADA as "a group of metabolic disorders characterized by hyperglycemia resulting from defects in either insulin secretion, insulin action, or both". Diabetes is a chronic disease but with proper management and treatment, diabetic individual can live a normal, healthy life. India is facing a big problem of having a large number of diabetic patients and the occurrence of diabetes in Indians is almost a decade earlier than in the western population and this problem is magnified by having a greater number of pre-diabetics. Pre-diabetes<sup>1</sup> is a state of impaired glucose tolerance (IGT), or, impaired fasting glucose (IFG) occurring either singly or in combination with each other. Individual in this range, are at higher risk for not only developing type 2 diabetes, but also for complications of diabetes.

It is reported that 314 million people are currently affected with pre-diabetes all over the world, and by 2025, it is estimated that approximately 500 million people will have pre-diabetes<sup>2</sup>. The current estimates are that up to 70% of pre-diabetic subjects eventually get diabetes. As per National Diabetes fact sheet (2011), 79 million Americans (35%) aged 20 years or older are estimated to be pre-diabetics<sup>3</sup>. In India, as per phase 1 of INDIAB (India DIABetes) study (2011), 77.2 million people are estimated to be pre-diabetics and 62.4 million people to be diabetic<sup>4</sup>.

The term 'pre-diabetes' has been recently reclassified as 'categories of increased risk for diabetes'. It helps in erasing the impression of 'inevitable progression to diabetes' associated with the term 'pre-diabetes' and generate hope for reversibility to normo-glycaemia. Hence, this group is

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an important target for vigorous intervention for primary prevention of diabetes.

**AIMS AND OBJECTIVES:**This study was conducted to find out the prevalence of 'impaired fasting glucose' in Punjabi population and correlate IFG with other variables like age, sex, weight, body mass index, waist circumference, waist-hip ratio and family history of diabetes

**MATERIAL AND METHODS:**In this cross-sectional study we included subjects attending the OPD and indoor of Sri Guru Ram Das Institute of Medical Sciences And Research Centre, Vallah Sri Amritsar of age more than 20 years. Fasting plasma glucose measurement was used as the screening test for the diagnosis of pre-diabetes, as recommended by the ADA 2004 guidelines. The prevalence of impaired fasting glucose was determined using the American Diabetes Association guidelines.

**Exclusion criteria:** The subjects with a history of diabetes mellitus, tuberculosis, chronic asthma, Addison's disease, adrenal insufficiency, hypopituitarism, patientson long-term corticosteroid therapy and diuretics wereexcluded from the study.

The body weight, body mass index, waist circumference and waist hip ratio were recorded according to the standard criteria. After this, FBS determination was done with Accucheck glucometer with compatible strips after an overnight fast.

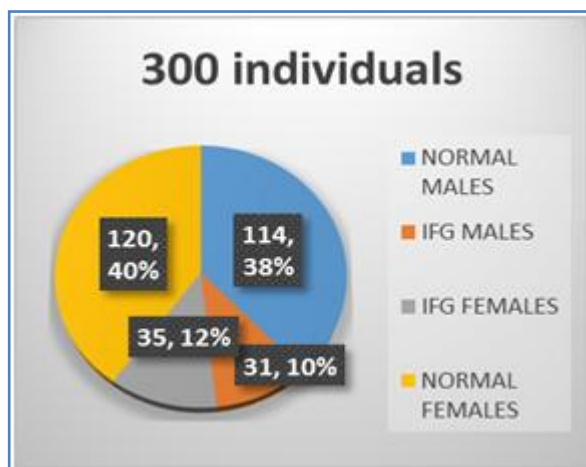
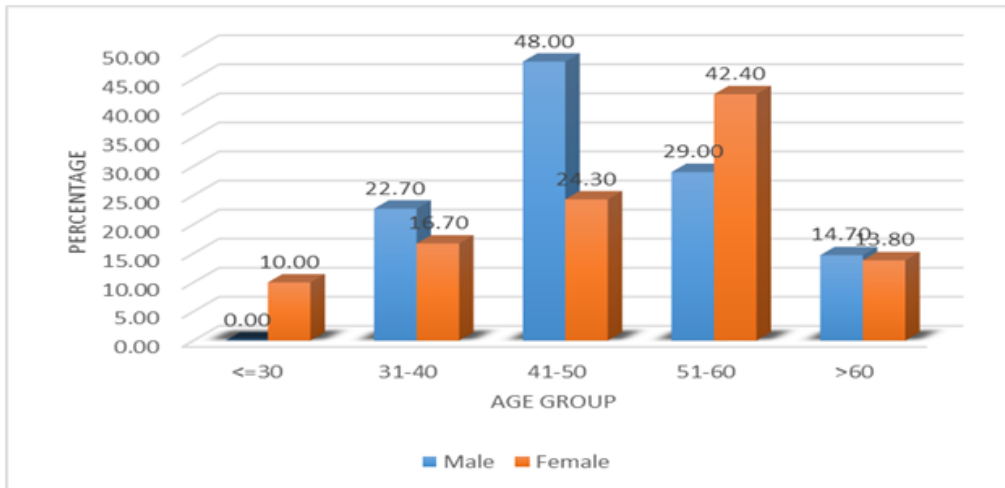


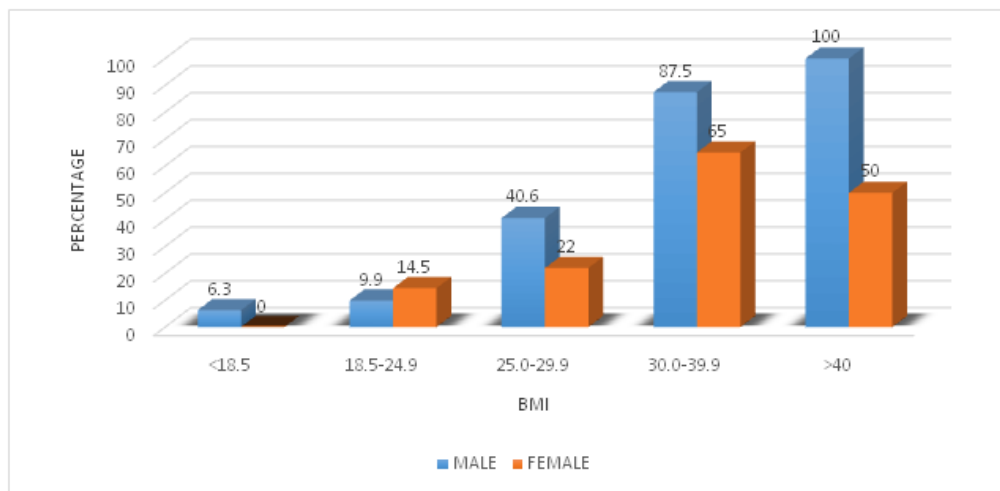
FIG. 1: PREVALENCE OF IFG

**RESULTS:**Out of 300 subjects 66 were observed to have impaired fasting glucose. The overall prevalence of pre-diabetes was 22%. Whereas, sex wise it was 21.4 % among males and 22.6% among females and the difference in the prevalence of IFG between male and female was statistically insignificant (figure no.1). The prevalence of IFG was lowest (3.8%) in the 21-30 age group and highest (35.9%) in the 51-60 age group. Thus the prevalence of IFG increased with increasing age. Among males, the highest percentage of pre-diabetics was observed in the 41-50 age group and lowest among 21-30 age group, whereas in females the highest percentage was observed in the 51-60 age group and lowest among the 21-30 age group (figure no. 2).

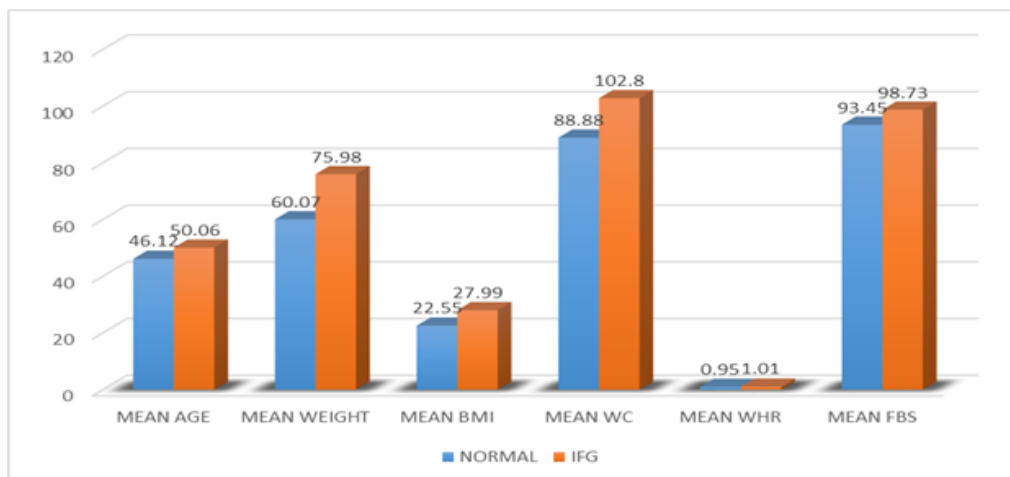
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**FIG. 2: PREVALENCE OF IFG ACCORDING TO AGE AND SEX**



**FIG. 3: PREVALNCE OF IFG ACCORDING TO AGE AND BMI**



**FIG. 4: ASSOCIATION OF IFG WITH VARIOUS VARIABLES**

There was a statistically significant difference between the mean age of IFG subjects (50.06 years) and mean age of normo-glycemics (46.12 years) ( $P < 0.05$ ) (figure no. 4). The prevalence of IFG was lowest (4.3%) in the underweight persons ( $<18.5 \text{ kg/m}^2$  group) and highest (71.8%) in the obese persons ( $\text{BMI} >30 \text{ kg/m}^2$ ). Thus, indicating that the prevalence of IFG increased with increasing BMI (figure no. 3). Mean body mass index was  $27.99 \pm 5.09 \text{ kg/m}^2$  in IFG group and  $22.55 \text{ kg/m}^2$  in normo-glycemics ( $P < 0.05$ ). Mean waist circumference and mean waist hip ratio of IFG individual were 102 cm and 1.01 respectively as compared to normo-glycemics in which mean waist circumference and mean WHR were 88 cm and 0.95 respectively ( $p \text{ value} = 0.001$ ). The mean total body weight of IFG subjects was 75.98 kg as compared to 60.07 kg in normo-glycemics. Thus, indicating higher prevalence of IFG in higher body weight individuals. Impaired fasting glucose was identified in 41.2% of subjects with family history of diabetes (FHD) and in 18.1% without family history of diabetes (FHD). Showing, FHD is significantly associated with development of IFG. The mean FPG of 98.73 mg/dl in subjects with FHD was significantly greater ( $p = 0.004$ ) than FPG of 93.45 mg/dl in those without FHD (figure no. 4).

**DISCUSSION:** In the present study, prevalence of pre-diabetes (IFG) in Punjabi population is observed to be 22%. In Punjabi population, IFG is significantly correlated with variables like age, body mass index, waist circumference, waist-hip ratio and family history of diabetes. The prevalence of pre-diabetes reported in India by different workers in different area varies considerably with each other. The prevalence rate of the present study is comparable to study done by Shweta et al. Shweta et al<sup>5</sup> did a cross-sectional study, involving 100 subjects of pre-dominantly rural and semi-urban population of central India. They found the prevalence of IFG to be 18%. The sample size taken in our study is three times more than them. Mohan et al<sup>4</sup> in their INDIAB study found that the prevalence of pre-diabetes in Chandigarh to be 14.6 % which was significantly higher than other states in the study. The overall prevalence of IFG found in Tamilnadu, Maharashtra, Jharkhand were 8.3%, 12.8%, and 8.1% respectively. Chandigarh contains majority of Punjabi population accounting for their high prevalence than other parts of India. The prevalence of impaired fasting glucose varies from study to study throughout the world. Rolka et al<sup>6</sup> analyzed the data of 2005–2008 National Health and Nutrition Examination Survey (NHANES) and found that the prevalence of impaired fasting glucose in U.S. adult population was nearly 26%. This was higher than the prevalence found in the present study. The Australian Diabetes Obesity and Lifestyle Study reported the prevalence of impaired fasting glucose to be 16.4 %<sup>7</sup>.

However prevalence rate of IFG of some studies are not comparable to our study. Balagopal et al<sup>8</sup> conducted a study in a village in Tamil Nadu and found that age-specific prevalence of IFG were 13.5% among adults. This is probably because of the purely rural setting against semi-urban in our 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<sup>9</sup>. Kumar conducted 'The Kolkata Policeman Study' and in their study prevalence of IFG was found to be only 6.2%<sup>10</sup>. The variation in the results of different studies on impaired fasting glucose is probably due to difference in cultural factors, genetic factors, lifestyle habits, ethnic variations, rural urban variations and selection of different age groups.

In the present study we have found significant association between IFG and age. In our study IFG population is predominantly older. This has been supported by studies done by Balagopal et al

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and Mohan et al. In the present study there is insignificant difference between prevalence of men (21.4%) and women (22.6%) which is in agreement with the study done by Shaw et al<sup>11</sup>, who also reported that prevalence of impaired fasting glucose (IFG) was similar among males and females. Shweta et al also found no difference in the prevalence of IFG in male (18.36) and female (17.64). Similarly, Mohan et al have not found any significant difference in prevalence of IFG in male and female. Whereas Rolka et al and Balagopal et al found a significantly higher prevalence amongst men as compared to women.

In the present study the overall body mass index is much higher (mean body mass index  $27.99 \pm 5.09$  kg/m<sup>2</sup> in IFG group and  $22.55$  kg/m<sup>2</sup> in normo-glycemics) than other studies accounting for higher prevalence of IFG observed in our study. Balagopal et al in their study on rural population of Tamil Nadu found that mean BMI in the IFG adult population was  $23.3 \pm 4.3$  kg/m<sup>2</sup>. Also the overall body mass index in the Kolkata Policeman study was  $23.87 \pm 2.83$  kg/m<sup>2</sup> in IFG group. Whereas, contrary to the present study Shweta et al in their study found the mean BMI  $19.2 \pm 2.8$  kg/m<sup>2</sup> in IFG patient compared to  $20.1 \pm 2.6$  kg/m<sup>2</sup> in normo-glycemics but the difference was not significant (p value = 0.1926).

High prevalence of IFG in the present study as compared to other studies is because of the fact that waist circumference and WHR in the present study are much higher as compared to other studies. High waist circumference measurements are indirect measure of visceral fat and are strongly associated with a high risk of IFG. The phenotypes of overweight and abdominal obesity are at high risk for developing type-2 diabetes. Shweta et al in their study found the mean WC and WHR to be 82 cm and 1.30 respectively. They have found significant relationship between waist hip ratio and IFG but not between waist circumference and IFG. Balagopal et al in their study found that mean waist circumference and mean waist hip ratio of IFG individual was 84.07 cm and 0.96 respectively. The waist circumference in most of the subjects was in the normal range, but waist-hip ratio was strongly correlated with rising prevalence of impaired fasting glucose, just like in our study.

The prevalence of IFG increases with increasing weight group in the present study. Contrary to our study, Shweta et al in their study found significantly higher prevalence of IFG among the low body weight population. Family history of diabetes (FHD) in first degree relative has been found out to be a major risk factor in the development of pre-diabetes and then consequently diabetes. Mohan et al in the INDIAB study also reported FHD as having significant correlation with IFG. Kumar et al in the Kolkata policeman study concluded that prevalence of IFG was strongly associated with family history of diabetes. Fritsche et al<sup>12</sup> analyzed 8,106 non-diabetic individuals of European origin and noted that the FHD increased the risk of isolated IFG by 37%.

At population scale, the burden of IFG on public health is heavy. To the extent that it is associated with a markedly increased risk of type 2 diabetes and cardiovascular disease, both largely preventable. It is clear that early identification of the IFG patient is of paramount importance. The limitation factor of the present study is that it was done in patients and their relatives attending the hospital and therefore may not represent the true status of the prevalence of impaired fasting glucose (IFG) in the community.

In conclusion, our findings underline the importance of anthropometric measurements, such as weight, BMI, WHR, waist circumference and family history of diabetes in routine clinical practice as a prompt for opportunistic screening for IFG.

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