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The nightmare of impaired fasting glucose in young adults: a cross-sectional study

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ABSTRACT

Introduction: Prediabetes, a precursor of frank Diabetes Mellitus, can be diagnosed before it gives rise to the actual disease condition if a screening strategy is adopted in young adults. Once diagnosed, lifestyle modifications can make prediabetes reversible thereby preventing the morbidity and mortality associated with frank Diabetes Mellitus.

Objective: To determine the prevalence of impaired fasting glucose (IFG), a precursor to type 2 diabetes, among young adults (aged 17–24 years) at Nowshera Medical College, Nowshera.

Materials & Methods: A cross-sectional descriptive study was conducted in the Department of Physiology, Nowshera Medical College, Nowshera, from June 2023 to November 2023 on 124 students (73 males, 51 females) aged 17-24 years using nonrandom consecutive sampling. After informed consent, participants underwent anthropometric measurements (height, weight, and BMI) and fasting blood glucose (FBG) testing. Prevalence of impaired fasting glucose (defined as FBG ≥100 mg/dl and <126 mg/dl per ADA criteria) was determined. Statistical analysis was performed using SPSS version 22, with $p \leq 0.05$ considered significant.

Results: The mean age was 20.70 ± 1.42 years. Of the participants, 23.4% (n=29) had impaired fasting glucose, while 76.6% (n=95) had normal FBG levels. No significant gender differences were observed in the prevalence of IFG. Among those with IFG, 68.9% (n=20) had normal BMI, and 20% (n=6) were pre-obese.

Conclusion: The study found that 23.4% of participants exhibited impaired fasting glucose, emphasizing the need for early interventions and lifestyle modifications to prevent the progression to type 2 diabetes. There was no significant gender-based difference in prevalence, though IFG was more common among participants with normal BMI.

Keywords: Glucose Intolerance; Hyperglycemia; Glucose Metabolism Disorders; Metabolic Syndrome; Body Mass Index; Young Adult.

The authors declared no conflict of interest. All authors contributed substantially to the planning of research, data collection, data analysis, and write-up of the article, and agreed to be accountable for all aspects of the work.

INTRODUCTION

Diabetes mellitus is one of the most common diseases and major public health problem that plagues the world, causing significant morbidity and mortality. The International Diabetes Federation's (IDF) 2021 statistics report states that diabetes mellitus affects over 10.6% population globally, accounting for over 540 million people worldwide.[1] The IDF projects this toll to rise by about 46% by the year 2045 and likely affect approximately 783 million people.[1] The associated burden on healthcare system is self-explanatory.

Onset of Diabetes mellitus is, however, not an overnight phenomenon. It is preceded by a constellation of pathophysiologic metabolic changes collectively termed as "Impaired fasting glucose" or "Prediabetes".[2] Prediabetes is a chronic metabolic condition where the blood glucose levels are above the upper threshold considered normal but below the threshold for diagnosis of diabetes mellitus. Prediabetes is an independent risk factor for the development of hypertensive retinopathy, peripheral neuropathy, chronic kidney disease (CKD) and causes increased risk of cardiovascular disease, coronary heart disease, stroke and all-cause mortality when compared with normo-glycemic individuals.[3]

Prediabetes is a precursor of frank diabetes mellitus and will progress to overt type 2 diabetes (T2DM) in approximately 25% of subjects within 3–5 years, and as many as 70% of individuals with prediabetes will develop overt diabetes within their lifetime.[3-5] Fortunately, Prediabetes may be reversible through the adoption of appropriate lifestyle modifications (e.g. healthier diet and increased levels of physical activity) and/or medications such as metformin or acarbose.[3,6-7]

The reported prevalence of diabetes mellitus in Pakistan in 2018 and 2019 was 16.98% and 17.1% respectively.[8] According to IDF statistics 2022, about 26.7% of Pakistani adults were affected by diabetes mellitus, accounting for approximately 330,000,000 cases.[8,9] Such an alarmingly high prevalence coupled with poor health infrastructure, makes this population to be highly vulnerable to diabetes related complications and deaths. An emphasis on earlier detection at the pre-diabetes stage and appropriate interventions to halt the

progression to overt diabetes mellitus is mandatory to deal with the catastrophic consequences in terms of health care costs and associated morbidity and mortality.

MATERIALS & METHODS

This cross-sectional, descriptive study was conducted on 124 students of Nowshera Medical College: Nowshera aged 17-24 years. After approval from institutional Research Ethics Committee, a total of 124 students including 73 males and 51 females were enrolled in the study through random, consecutive sampling during the study period of six months from June 01, 2023 to November 30, 2023. After informed consent, participants underwent anthropometric measurements (height, weight, and BMI) and venous blood sampling for measurement of fasting blood glucose (FBG) by trained clinical technicians. All the blood samples were tested for fasting blood glucose using Microlab 300 chemistry analyzer.

American Diabetes Association (ADA) criteria[3] was used to define Impaired Fasting Glucose as a marker of prediabetes, as under.

- Normal FPG: <100 mg/dl
- Impaired Fasting Glucose (IFG): 100–125 mg/dl
- Diabetes Mellitus: ≥126 mg/dl (on multiple occasions)

Data were analyzed using SPSS version 22. Descriptive statistics (frequencies and percentages) were computed for categorical variables and presented in tables. The Chi-square test was used to compare prevalence across gender and BMI categories. A p-value of <0.05 was considered statistically significant.

RESULTS

The demographic and anthropometric characteristics of the participants are shown in Tables 1 and 2. The mean age of the participants was 20.70 ± 1.43 years, and the mean BMI was 23.23 ± 3.32.

Table 1: Descriptive statistics of subjects.

Variables	N	Mean	SD
Age (Years)	124	20.70	1.43
Body Mass Index	122	23.23	3.32

Table 2 depicts the presence of prediabetes in subjects based on the cutoff value of Fasting Plasma Glucose levels of 100mg/dl. Of the 124 participants, 29(23.4%) exhibited impaired fasting glucose, while 95(76.6%) had normal fasting glucose.

Table 2: Presence of prediabetes in subjects.

Fasting Plasma Glucose levels (mg/dl)	Frequency	Percent
< 100	95	76.6
100 - 125	29	23.4
Total	124	100.0

There was no statistically significant gender difference in the prevalence of impaired fasting glucose (p>0.05). Among those with impaired fasting glucose, a majority of 68.9% (n=20) had normal BMI while only 20% (n=6) were pre-obese.

Table 3: Association between Impaired Fasting Glucose and BMI

BMI (Obesity) Class	Fasting Plasma Glucose (mg/dl) f (%)		Total
	< 100	100 - 125	
Underweight	4 (3.2)	3 (2.4)	7 (5.6)
Normal weight	63 (50.8)	20 (16.1)	83 (66.9)
Pre-obese	22 (17.7)	6 (4.8)	28 (22.6)
Obesity Class-I	3 (2.4)	0	3 (2.4)
Obesity Class-II	1 (0.8)	0	1 (0.8)
Obesity Class-III	2 (1.6)	0	2 (1.6)
Total	95 (76.6)	29 (23.4)	124 (100)

p value = 0.639.

DISCUSSION

This study aimed to explore the prevalence of impaired fasting glucose as a marker of prediabetes among young adults aged 17-24 years at Nowshera Medical College. We found that 23.4% of participants had Impaired Fasting Glucose (IFG) as per ADA criteria suggesting a significant burden of disease within this cohort. The ADA criteria uses a lower cut-off value of fasting blood glucose (100-125 mg/dl) for diagnosis of impaired fasting glucose and therefore, tends to yield higher prevalence as compared to the WHO criteria (that uses a higher cut-off value of >110 mg/dl for the same).[3,10]

Our findings are comparable with the results of studies conducted on the same age groups in other regions. For instance, a study of USA adolescents and young adults (ages 12–34 years) by Andes LA et.al[11] found a similar prevalence of 24%. Similarly, the TIDE study[12] – a large scale epidemiological study from mainland China reported a comparable prevalence of prediabetes of 20.2% among the 18-29 years age group. Both these studies revealed impaired fasting glucose to be more common in males as compared to females and in those with higher BMI. Interestingly, despite existing evidence of a higher prevalence of IFG among males and those with obesity in previous studies, our findings did not demonstrate significant gender differences.

The lack of significant gender differences in our study could be due to the younger age of participants, as young adults tend to be more physically active and conscious of their health. Additionally, lifestyle factors, such as diet and exercise, which were not controlled for in this study, may play a significant role in the prevalence of IFG. Moreover, the relatively high physical mobility and concern with body image in the study population may explain why IFG was more common among participants with normal BMI rather than those who were overweight or obese.

A group of researchers from India analyzed the National Family Health Survey- 4 (NFHS-4) data of 2015-2016 and reported a prevalence of 4.56% in Indian men aged 18-25 years,[13] with almost equal gender distribution. Unfortunately, the study employed the WHO criteria for diagnosis of prediabetes and overt diabetes mellitus. As pointed earlier, owing to use of higher cut-off value of >110 mg/dl for diagnosis of prediabetes, the WHO criteria shows a lower prevalence when compared with the ADA criteria.[3]

Similarly, our study findings align closely with the results of a study on medical students of similar age group from Quetta, Pakistan which reported a prevalence of 23.1% of prediabetes with almost equal gender distribution.[14] Conversely, the Diabetes Prevalence Survey of Pakistan (DPS-PAK)[15] – a large scale, national survey reported a prevalence of 10.6% among comparable age group of 20-30 years with male predominance and increasing prevalence with age. The difference in reported prevalence may be partly explained by the use of Glycated Hemoglobin (HbA1c) as a diagnostic tool in the afore-mentioned study. Secondly, epidemiological surveys tend to emphasize more on under-privileged rural population whose more active lifestyle and relatively simple diet are known to offer protection against development of diabetes and its precursors.

LIMITATIONS OF THE STUDY

Several limitations must be acknowledged:

Sample Selection Bias: The study population consisted of medical students, a relatively educated and health-conscious group, which may not reflect the general population.

Single Diagnostic Measure: The study relied solely on fasting blood glucose as a diagnostic tool for prediabetes. The inclusion of additional tests, such as the oral glucose tolerance test (OGTT) or HbA1c, would have provided more comprehensive data.

Cross-Sectional Design: As a cross-sectional study, we cannot establish causal relationships between BMI, gender, and the risk of impaired fasting glucose.

CONCLUSION

A relatively high proportion of young medical students harbor impaired fasting glucose, highlighting the need for early detection and intervention.

RECOMMENDATION

Since prediabetes is reversible with lifestyle modifications, there is a clear public health opportunity to implement targeted screening programs aimed at earlier identification of impaired fasting glucose and timely adoption of appropriate lifestyle interventions thereby preventing further progression.

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