ORIGINAL ARTICLE

Impaired Fasting Glucose and Associated Anthropometry among Students of a Medical College in Coastal Kerala, India

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Abstract:

Background: India being the diabetic capital need to emphasize on preventive strategies to reduce the incidence of diabetes and thus reduce the burden on health services and resources of the country. The identification of high risk group like those with impaired fasting glucose stresses the need for simple interventional measures to bring down the diabetic community in the country. *Aim and Objectives:* Medical students have a busy schedule for their studies due to huge syllabus and they generally do not have much physical exercise which emphasizes the need to identify the risk factors for diabetes and also to sensitize them on the need to identify the prediabetics in the community. So the study was carried out to determine the prevalence of impaired fasting glucose and the associated anthropometric measurements among medical students in a rural area in Kerala, India. *Material and Methods:* A cross sectional study was done to assess the fasting blood glucose using a glucometer and anthropometric measurements like waist circumference ,waist hip ratio and body mass index among the students of a medical school in coastal Kerala India. A pretested questionnaire was used to collect the data after obtaining informed consent. *Results:* The prevalence of impaired fasting glucose was found to be very high 55(21.6%) among the study group, significantly higher among males 43(51.8%) (p=0.000) and body mass index was significantly associated (p=0.044) with impaired fasting glucose which was consistent with many other studies. *Conclusion:* The study throws light on the fact that the prevalence of prediabetes and anthropometric risk factors are high among youth and highlights the need for immediate measures to identify the risk group right from the young age and initiate simple interventional measures to reduce the diabetic load in the community.

Keywords: Impaired Fasting Glucose, Prediabetes, Youth, Medical Students, Anthropometry

Introduction:

The World Health Organization (WHO) predicts that non-communicable diseases will account for two-third of all deaths within the next 25 years in South East Asian countries [1]. Diabetes is one of the major non-communicable diseases of the world. India has the dubious distinction of being the diabetic capital of the world with 58 million individuals having type II diabetes which will reach 79.4 million by 2030 [2]. The rise in diabetes in India may be due to genetic predisposition, the sedentary lifestyle and the changing food habits [3]. Recent years have

revealed the fact that there is sudden shift in the age of onset of diabetes to a younger age. The progression from Normal Glucose Tolerance (NGT) which turned to Type 2 Diabetes Mellitus (T2DM) passes through intermediate stages of Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT), also known as prediabetes. Multiple factors can lead to the glucose metabolic alterations [4]. Impaired fasting glucose or the prediabetic state possesses a greater risk of conversion to full blown diabetes, which in turn is a risk factor for cardiovascular diseases. The transition from prediabetes to T2DM in adults happens gradually that occur over 5-10 years [5, 6]. Early onset of T2DM seems to be associated with an increased risk of morbidity during the most active years of life [7]. IFG and IGT have been associated with other features of insulin resistance, including dyslipidemia, hypertension, abdominal obesity, micro albuminuria, endothelial dysfunction, and markers of inflammation and hypercoagulability, traits collectively referred to as the metabolic syndrome. Primary prevention is significant because it offers the most cost-effective approach to prevent T2DM and maintain the changes long term [1]. Early identification of prediabetes and insulin resistance provides an important window of opportunity for diabetes prevention [8]. The global emergence of T2DM in youth reflects the increasing epidemic of childhood and adolescent obesity [9]. Medical students have a busy schedule for their studies due to huge syllabus and they generally do not have much physical exercise which emphasizes the need to identify the risk factors for diabetes and also to sensitize them on the need to identify the prediabetics in the community. So this study was carried out to determine the prevalence of prediabetes and the associated anthropometric risk factors among students in a medical college in Central Kerala. A health promotion programme starting with the future health providers may be beneficial for developing a favorable attitude within the group and later transferring this to the community in their future practice

Material and Methods:

A cross sectional study was conducted to satisfy the objectives of the research. The study was conducted in a tertiary care teaching hospital in Kochi with 100 admissions per year. The study was conducted for a period of two months, from 1st August 2013 to 1st October 2013. All students of both gender enrolled in the medical institution willing to participate in the study were included in the study. Students known to have diabetes or not willing to participate in the study were excluded. The study was conducted with prior approval from the Institutional Ethics Committee. Written informed consent was taken from all the participants. Confidentiality of information is assured.

IFG (Prediabetes) is defined as the presence of elevated fasting glucose (100-125 mg%) or abnormal glucose tolerance or glycosylated hemoglobin (5.7%-6.4%) [3]. In this study, we have used fasting blood glucose as the criteria to

define prediabetes. After obtaining the ethics committee's approval, 254 medical students gave written informed consent and they were included in the study. The investigators addressed the students in each class during class hours to explain the objectives and procedure for the study to request and ensure maximum participation.

The data collection day was fixed in consultation with the faculty and the students and the participants were instructed to come in prelisted groups of 20-25, during 6.30-7.30 am, after regular dinner and fasting for 8 hours. The instruments and procedures were standardized. The instruments used were stethoscope, standardized weighing machine, stadiometer, Accu-check glucometer and strips, disposable needles, pre-designed questionnaire, standardized sphygmomanometer and a measuring tape. On the day of the data collection, the students were asked to come in between 6.30-7.30 in the morning. With all sterile precautions fasting blood glucose was taken by a skin prick using disposable needles and analyzed using a glucometer (accu–check). The values were entered into the questionnaire. Weight and height was measured by standard technique, with light clothes on, using a weighing machine and a stadiometer respectively. Waist and hip circumference were measured using measuring tape by standard technique and waist-hip ratio was calculated. The measurements were taken with the subjects in minimum clothes and when they were breathing quietly at the end of their expirations. Waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest using a stretch resistant tape. Hip circumference was measured around the widest position of the buttocks with the tape parallel to the floor. The final data was entered in to excel sheet and analyzed using appropriate statistical methods like frequency, percentages, mean and chi square etc by Statistical Package for Social Sciences Version 15.

Results:

Out of the four batches of 100 students each i.e. 400 medical students, 254 gave permission for the study (a batch of 100 was not available because of exam and the day scholars were not willing to participate), the mean age of the group was 21.4 years and there were 83(32.7%) boys and 171(67.3%) girls**.** There were no known diabetics in the study group. Among all anthropometric measurements, only the mean height in females was statistically significantly higher in prediabetics as compared normal females. The prevalence of IFG or prediabetics in this study group was 21.6%.The prevalence was found to be higher in boys (51.8%) than girls (7.02%).There was significant difference in prevalence between both the sexes (p=0.000) (Table 3). In the study group 83(32.7%) were having abnormal waist hip ratio.25.1% of subjects with normal waist hip ratio and 14.5 % with abnormal waist hip ratio were prediabetics (Table 4). There was no significant association between prediabetics and waist circumference (Table 5).

Table 1: Anthropometric and Biochemical Profile of Normal and Prediabetics among Male Subjects

Parameters	Male		t	p
	Normal Subjects	Prediabetic Subjects		
	Mean ± S.D	Mean ± S.D		
Weight	70.41±12.11	72.39±12.59	1.0330	0.3033
Height	171.13±14.00	173.67±5.11	1.5530	0.1224
BMI	23.522±3.41	23.98±3.42	0.8640	0.3889
Waist Circumference	83.20±11.68	86.18±8.19	1.9030	0.0588
Hip Circumference	87.81±10.98	90.37±9.51	1.6060	0.1103
Waist/Hip Ratio	0.95±0.09	0.96±0.09	0.7158	0.4751
Fasting Blood Glucose	94.60±3.81	105.27±5.59	14.369	<0.0001*

**Statistically significant difference between normal and prediabetics*

Table 2: Anthropometric and Biochemical Profile of Normal and Prediabetics among Female Subjects

Parameters	Female		t	p
	Normal Subjects	Prediabetic Subjects		
	Mean ± S.D	Mean ± S.D		
Weight	53.09±7.91	52.77±6.87	0.3994	0.6898
Height	159.00±6.13	160.91±4.42	3.3050	0.0011
BMI	21.046±2.86	20.71±2.65	1.1270	0.2606
Waist Circumference	74.30±8.14	73.166±6.19	1.450	0.1480
Hip Circumference	88.20±8.141	89.79±8.57	1.759	0.0795
Waist/Hip Ratio	0.84±0.09	0.84±0.10	0.000	-70.999
Fasting Blood Glucose	88.53±5.74	101.58±2.27	27.647	<0.0001*

**Statistically significant difference between normal and prediabetics*

Table 3: Prevalence of Impaired Fasting Glucose among Study Subjects

Class	Sex	Normal Subjects	Prediabetic Subjects	Total	χ^2	p
Final Year	Girls	61(100.0%)	00(0.0%)	61(100%)	36.83	0.001
	Boys	16 (50.0%)	16(50.0%)	32(100%)		
	Total	77(82.8%)	16(17.2%)	93(100%)		
	Girls	48(88.9%)	06(11.1%)	54(100%)	20.928	0.001
	Boys	10(40.0%)	15 (60%)	25(100%)		
	Total	58(73.4%)	21 (26.6%)	79(100%)		
First Year	Girls	50(89.3%)	06(10.7%)	56(100%)	13.017	0.001
	Boys	14(53.8%)	12 (46.2%)	26(100%)		
	Total	64(78.0%)	18 (22%)	82(100%)		
Total			55(21.6%)	254(100%)		

χ^2=66.077, df=1, p= 0.000

Table 4: Association between Waist-Hip Ratio and Prediabetic Status

Waist - Hip Ratio	Normal Subjects	Prediabetic Subjects	Total
Normal	128 (74.9%)	43 (25.1%)	171 (100%)
Abnormal	71 (85.5%)	12 (14.5%)	83 (100%)
Total	199 (78.3%)	55 (21.7%)	254 (100%)

χ^2=3.763, df=1, p= 0.052

Table 5: Association between Waist Circumference and Prediabetic Status

Waist Circumference	Normal Subjects	Prediabetic Subjects	Total
Normal	185(77.4%)	54(22.6%)	239(100%)
Abnormal	014(93.3%)	01(6.7%)	015(100%)
Total	199(78.3%)	55(21.7%)	254(100%)

χ^2=1.276(with continuity correction), df=1, p=0.259

Out of the total 254 subjects, 35 subjects were underweight of which 5(14.3%) subjects were prediabetics and 30 were normal. Among 173 subjects having normal body mass index, 34(19.7%) were prediabetics. Out of the 46 who were overweight, 16(34.8%) subjects were found to be prediabetics. Higher body mass index (overweight) was found to be a significantly associated with IFG (Table 6).

Table 6: Association between Body Mass Index and Prediabetic Status

Body Mass Index (BMI)	Normal Subjects	Prediabetic Subjects	Total
Underweight (<18.5)	030(84.7%)	05(14.3%)	035(100%)
Normal (18.5-24.9)	139(80.3%)	34(19.7%)	173(100%)
Overweight (25.0-29.9)	30(65.6%)	16(34.8%)	046(100%)
Total	199(78.3%)	55(21.7%)	254(100%)

χ^2= 6.202, df =2, p=0.0445

Discussion:

The prevalence of IFG or prediabetes among medical students in this study was 21.6% compared to only 5.1% in adults and youth aged 15-29 years in a rural area in Tamilnadu [1]. Studies conducted in different parts of the world reported the prevalence of impaired fasting glucose to be Caucasian (16%) and African American adolescents (27%) [10], Australia (8.0% in men and 6.8% in women) [11], US adolescents (11%) [12]. In South Asia, the prevalence in the regional countries like Bangladesh, India, Maldives, Nepal, Pakisthan and Srilanka were reported to 4.7%, 4.6%, 3%, 19.5%, 3% and 11.5% respectively [13]. National Urban Diabetes Survey reported that the prevalence of impaired glucose tolerance was 16.8 % in Chennai, 14.9 % in Bangalore, 29.8 % in Hyderabad, 10 % in Kolkata, 10.8 % in Mumbai and 8.6 % in New Delhi [14]. The incidence of prediabetes in a selected urban South Indian population (CUPS) reported to be13.1 per 1,000 person years [15]. In a study conducted in three states (Tamilnadu, Maharashtra, Jharkhand) and one union territory (Chandigarh) of India ,the prevalence of prediabetes were found to be 8.3%,12.8%,8.1% and 14.6% respectively [16] The range of prevalence may be because of the different diagnostic cut off values used for the diagnosis of prediabetes. There was impaired fasting glucose in 43 boys (51.8%) and 12 girls (7.02%) in this study (p=0.000) compared to only 5.3% and 5.2% respectively in men and women in a study conducted in urban population in India [17].

Body mass index was found to be a significantly associated with IFG in this study (p<0.05). In the subjects with Body mass index>25, 34.8% were prediabetic whereas only 19.7% among normal

body mass index were prediabetic. Balagopal *et al* [1] reported similar results among adults but not among youth .The higher body mass index in our study group may be due to the dietary pattern which has lead to IFG. Waist circumference and waist hip ratio and were not found to be a significantly associated with IFG whereas studies conducted by Anjana *et al* [10], Balagopal *et al* [1] reported them to be significant risk factors .The lack of association between waist circumference and waist hip ratio and IFG may be a clue that lean diabetes may be more common in Kerala.

Conclusion:

The findings show that the prevalence of prediabetes in this group was very high and it was higher among males and those with higher BMI. This study, first of its kind in this area reveals the fact that prevalence of impaired fasting glucose was very high in the study group. The need of the hour is to identify the high risk group in the community right from the young age and initiate trials or intervention studies to prevent or delay the onset of diabetes or other non communicable diseases in the high risk group.

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