Assessment of Pre-Diabetes in Young Adults of Age 18-40yrs in Andhra University College of Pharmacy, Visakhapatnam

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The incidence of diabetes is continuously increasing worldwide. Pre-diabetes (defined as impaired glucose tolerance, impaired fasting glucose or both) represents an intermediate state, which often to overt diabetes within a few years. The aim of the study is to assess the pre-diabetes in the students and staff of University College of Pharmaceutical Sciences, Andhra University. Methods: Diagnosis of Pre-diabetes was based on WHO diagnostic criteria. A cross-sectional study was conducted for a period of 9 months. A total 245 volunteers were taken for the study between the age group of 20-40 years. Fasting plasma glucose and oral glucose tolerance test was done and samples were estimated for different risk factors. The data was collected and analyzed in percentage. Results: 38(15.4%) subjects were in pre-diabetes stage (Impaired fasting glucose 30 (12.2%), Impaired glucose tolerance 8(3.26%) and with both features 6(2.4%). Apart from the familial history, elevated triglycerides levels, BMI and decreased levels of HDL was found to be leading risk factors prevailing in the subjects studied (N = 245). Conclusion: 15.4% of the subjects were found to be prediabetic. All the pre-diabetics are identified as male subjects. It was found that in more than 50% of the subjects apart from family history, hypertriglyceridemia, BMI and low levels of HDL cholesterol were elevated.

Keywords: Pre-diabetes, impaired fasting glucose, oral glucose test, triglycerides.

INTRODUCTION

India has a high prevalence of diabetes mellitus and the numbers are increasing at an alarming rate. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030[1]. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030[1]. The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between 2000 and 2030. Currently 220 million people are projected with type 2 diabetes[2]. Until recently, type 2 diabetes was typically regarded as a disease of the middle-aged and elderly. While it is still true that this age-group maintains a higher risk than younger adults, evidence is accumulating that onset in those aged under 30 years is increasingly common. Even children and adolescents are now becoming caught up in the diabetes epidemic. An Australian study revealed prevalence of 0.3% in age group of 20 to 40 yrs has not been studied in detail in India[3]. The prevalence of MODY in a cohort of 4560 patients was found to be 4.8% in South India[4]. Obesity has increased by 70% in adults aged 18–29 years, and type2 diabetes has increased in parallel by 70% in adults aged 30–39 years over the last decade, making young adults the fast growing adult group for both obesity and type2 diabetes[5]. The occurrence age of diabetes is in late 40's but a now a days it is occurring in early 30's. For all these reasons the number is increasing and the occurrence is also getting more in young adults. So screening for the prediabetes is one of the preventive measures to prevent or delay the onset of type 2 diabetes mellitus. By screening we can know the subjects with undiagnosed prediabetes and type 2 diabetes mellitus and suggest them lifestyle or pharmacological interventions and to prevent or delay the onset of diabetes and to reduce the number of young diabetics.

MATERIALS AND METHODS

Study subjects: The present study is an epidemiological study and it was designed to screen young adults of age 20 to 4O years to identify pre diabetes risk in the students and staff of University College of Pharmaceutical Sciences, Andhra University.

Sampling procedures: The objectives and procedures to be followed for the study were explained in detail by the study investigator, the day before the data and blood samples were to be collected. Informed and written consent was obtained from all eligible individuals. An overnight fast of 8–14 h, with

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no alcohol consumption on the previous night was requested and ensured before proceeding with the tests. Both fasting plasma glucose (FPG) and 2-h plasma glucose post-glucose load (2hPG) were measured in all eligible subjects, All subjects were asked to take 75 g of anhydrous glucose in 200mL of water within 5 min (equivalent to 82.5 g of Glucon-D [Heinz-India Pvt Ltd, Mumbai, India]). Subjects were asked not to indulge in any physical activity or to smoke during the study period. For the diagnosis of prediabetes the 1999 WHO criteria was used, impaired fasting glucose level from 6.1mmol/l (110mg/dl) to 6.9mmol/l (125mg/dl, Impaired Glucose Tolerance from 140–199 mg/dl after 2 hours. In this study the enzymatic; glucose oxidase-peroxidase (GOD – POD) method (Trinder, 1964) was used estimation of blood glucose level. To estimate serum triglycerides-Acetyl-acetone(Kinetic method), serum cholesterol-Liebermann-Burchard reaction (Kinetic method), serum HDL cholesterol-Watson (Kinetic method). All the biochemical parameters were analyzed in screen Master 3000 Auto Analyzer.

RESULTS

In the present study 250 were assessed for prediabetes, 5 were excluded because no glucose tolerance values were available. The male female ratio is 170:75. From the results of fasting blood glucose and OGTT values it was found that 38(15.4%) members were in prediabetic stage. 30 (12.2%) with impaired fasting glucose and 8 (3.26%) with impaired glucose tolerance [IGT], 6 (2.04%) had both features of IFG and IGT. Different risk factors may lead to prediabetic stage. The present study unveils that the prediabetic stage is observed in male subjects only. A national Diabetes Education Programme reported that men are more prone to prediabetes. IFG was commoner in men than women in virtually all age groups[6]. In the present study, only major risk factors were mentioned and they are only assessed. The risk factors considered are Family history, Waist circumference, Increased stress levels, Body mass index, Polycystic ovarian syndrome, Increased levels of cholesterol, Increased levels of triglycerides, Low levels of good cholesterol, Increased levels of bad cholesterol. The percentage of subjects with individual risk factors are shown in table no 1.The order of the individual risk factors: ↑ levels of Triglycerides (52.2%) > Family history (36.7%) > ↑ Body mass index (31.4%) > ↓ levels of HDL cholesterol (24.4%) > ↑ in Waist circumference (19.5%) > ↑ stress levels and total cholesterol (18.7%) > ↑ levels of VLDL cholesterol (12.6%) > ↑ levels of LDL cholesterol (10.2%) > Polycystic ovarian syndrome (2.44%). The subjects with Impaired Fasting Glucose [IFG] 30(12.2%) levels had these findings 73% with ↑ Triglyceride levels,

53% with ↓ Good cholesterol levels, 50% with BMI, 46.6% with Family history, 26% with ↑ Cholesterol levels, 26% with ↑ LDL levels, 26% with Waist circumference, 20% with ↑ VLDL levels. The subjects with IFG had also hypertriglyceridemia, low levels of HDL cholesterol and overweight may lead to prediabetic stage. The subjects with Impaired Glucose Tolerance [IGT]8 (3.26%) levels had these findings 87% with of ↑ Triglycerides, 75%with of ↑ Cholesterol levels, 50% with of ↑ VLDL levels, 37%with of BMI, 37%with of Waist circumference, 37% with of Family history, 25% with of ↑ LDL levels, 12% with of ↓ Good cholesterol levels

DISCUSSION

Increased Triglycerides (Table 1)

Table 1:Percent Prevalence of Subjects with Individual Risk Factors:	
RISK FACTORS	PERCENTAGE
Family history	36.7%
↑ Waist circumference	19.5%
↑ Stress levels	18.7%
↑ Body mass index	31.4%
Polycystic ovarian syndrome	2.44%
↑ Total cholesterol	18.7%
↑ Triglycerides	52.2%
↓ Good cholesterol	24.4%
↑ Bad cholesterol (LDL)*	10.2%
↑ Bad cholesterol (VLDL)**	12.6%

*LDL-Low density lipoproteins; **VLDL-Very low density lipoproteins, ↑ -increased, ↓ -decreased

Past studies reported that the high triglyceride levels in adults also reflect lifestyle factors such as a high intake of saturated fat and cholesterol, excess weight and a low physical activity level[7]. Higher BMI was associated with higher triglyceride levels, lower HDL levels and higher cholesterol levels[8]. High TG levels in adults also reflect lifestyle factors such as high intake of saturated fat and cholesterol, excess weight and low physical activity. Inactivity and sedentary lifestyle contribute to overweight and obesity. Studies have shown that diet and exercise can effectively reverse overweight, obesity and other related co-morbidities and there is no occurrence of prediabetes[9]. More the triglyceride levels, there is reduction of insulin sensitivity and develop into insulin resistance. So, insulin resistance may develop prediabetic stage and leads type 2 diabetes mellitus. The above table no:1 demonstrates

that increased levels of triglycerides among all subjects may develop prediabetes. So, by implying lifestyle modifications such as food habits, physical activity etc may reduce the risk.

Obesity:

Insulin resistance characterized by an inability of the body to respond to and use pancreatic insulin, which it produces, resulting in high blood glucose levels and high levels of insulin in the blood-and subsequent DM are complications of obesity. There is a 4.5% increase in risk of DM for every 5 kg of weight gained[10]. Overweight and obese adults in comparison to their non-obese counterparts, have a greater susceptibility for subsequently developing diabetes mellitus an altered visceral expanding adipose tissue furthering the prediabetic stage[11]. There is a link between higher degree of obesity and prediabetes and postulate a sequence for progression from prediabetes to diabetes. The beneficial effects of a change in diet, an increase in exercise, and securing a weight loss need to be the primary measures for early intervention in this condition[12]. The present study reveals that increase in body weight causes insulin resistance so this may lead to the condition of prediabetes. The consumption of junk food having high content of saturated fatty acids may lead to the overweight and causes insulin resistance.

Family history:

Many studies in normal glucose tolerant (NGT) populations have shown that a positive family history of T2DM is associated with an increased risk of T2DM[13]. The disease has strong genetic and environmental (acquired) components its inheritance is polygenic, meaning that the simultaneous presence of several abnormal genes or polymorphisms is necessary for development of the disease; impairment of insulin sensitivity and insulin secretion, each of which is under genetic control[14]. If one of the parents is having diabetes mellitus and the offspring is suffering with hypertriglyceridemia, Central adiposity and Hypercholesteremia definitely leads to prediabetes and type 2 diabetes mellitus.

Low levels of HDL cholesterol:

Decrease in high density lipo- proteins and insulin resistance were the most common criteria to develop prediabetes in 12-19 yr old adolescents[15].

The table no 2 discusses that the presence of single risk factor may or may not lead to diabetes. But the presence of multiple risk factor leads to prediabetic stage and it progresses to type 2 diabetes mellitus. Past studies had shown that there is an increase in the prevalence of metabolic syndrome in the

Table2: Percent Prevalence Of Subjects With Multiple Risk Factors	
Total no. of risk factors	% of subjects
10/10	None
9/10	0.4%
8/10	1.63%
7/10	1.63%
6/10	3.26%
5/10	4.89%
4/10	11.4%
3/10	13.06%
2/10	20.8%
1/10	17.9%

offspring of Asian Indian diabetic parents even during adolescence[16]. Metabolic syndrome is a group of clustered risk factors such as hypertriglyceridemia, low levels of HDL cholesterol, Hypercholesteremia and insulin resistance. The combination of two or more risk factors causes the severity of getting prediabetes. More than 50% of subjects are suffering from multiple risk factors.

CONCLUSION

Apart from the familial history, elevated triglycerides levels, BMI and decreased levels of HDL was found to be leading risk factors prevailing in the subjects studied (N = 245). From the present study it was observed more than 50% of the subjects and having multiple risk factors. From the results of fasting blood glucose (FBG) and OGTT values, it was found that 15.4% of the subjects were found to be prediabetic. All the prediabetics are identified as male subjects. In the case of prediabetics, it was found that in more than 50% of the subjects apart from family history, they are having the risk of hypertriglyceridemia, BMI and low levels of HDL cholesterol. From this we can conclude that there is a chance of prediabetes with hypertriglyceridemia, BMI, low levels of HDL cholesterol apart from the family history of diabetes mellitus. So subjects who are having these risk factors should be careful and undergo for fasting blood glucose levels and OGTT tests periodically and follow lifestyle modifications for to prevent or delay the onset of prediabetes and diabetes.

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