SHORT COMMUNICATION

IMPAIRED GLUCOSE TOLERANCE : A PILOT STUDY IN RANDOMLY SELECTED POPULATION OF CHENNAI

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Abstract : Impaired glucose tolerance (IGT) is considered as a prediabetic state that occupies a grey area between Diabetes mellitus (DM) and normal glucose tolerance (NGT). If diabetes is detected at the stage of impaired glucose tolerance, it may be possible to halt the progression to overt diabetes. The study was conducted to assess the prevalence of impaired glucose tolerance and its relation with age, sex, body mass index (BMI), waist-hip ratio (WHR) and family history of diabetes mellitus in a randomly selected Chennai population of 200 subjects of both sexes as per the inclusion and exclusion criteria. Blood glucose concentration, body mass index and waist-hip ratio were measured by approved methods. All the data were statistically analyzed. Prevalence of IGT in this study population is 8.5%. BMI and family history of diabetes showed association with IGT. WHR showed association with IGT in males, but not in females. The prevalence of IGT is similar with differing age groups and sex.

Key words : impaired glucose tolerance (IGT)   diabetes mellitus (DM)
                normal glucose tolerance (NGT)   waist-hip ratio (WHR)
                body mass index (BMI)

INTRODUCTION

Diabetes mellitus represents a spectrum of metabolic disorders, which has become a major health challenge worldwide. The unprecedented economic development and rapid urbanization in Asian countries, particularly in India has led to a shift in health problems from communicable to noncommunicable diseases. Diabetes and

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cardiovascular diseases lead this list. It is predicted by the World Health Organization that India would contribute nearly 57 million people to the global burden of diabetes by the year 2025 (1) and it would become the "Diabetic capital" of the world (2). Recent reports suggest that these figures are based on conservative estimates and do not include rise in diabetes related risk factors like obesity and aging of the population. Hence, the original numbers projected may be too low and the actual figures may be around 80 million by the year 2030 (1).

Diabetes is fortunately one of the most preventable of all non-communicable diseases. Primary prevention strategies can be formulated based on the known risk factors for diabetes. However, as the risk of diabetes varies between different ethnic groups, it is possible that the risk factors such as obesity could also differ between different populations. Hence, it is necessary to have population-based data in different regions of the world to identify the risk factors for diabetes. This forms the basis of the present study where we have attempted to determine the risk factors for diabetes in native Indians, who are considered to be at high risk for diabetes.

Risk of developing type 2 diabetes is high in subjects with Impaired Glucose Tolerance (IGT) (3). A great deal of heterogeneity exists in the conversion rate of IGT to diabetes. Diagnosis and intervention to prevent the progression of IGT to diabetes has been targeted as an important tool in primary prevention of type 2 diabetes.

MATERIALS AND METHODS

This study was conducted at Sri Ramachandra Medical College & Research Institute, Porur, Chennai, after getting the approval of the Institutional Human Research Ethics Committee. The subjects residing in the suburban area of Chennai were chosen from the outpatient department of Medicine. Before enrollment, written informed consent was obtained from each subject after explaining the nature of the study. A complete clinical examination was done. Sample size of this study was 200 (n) which was divided in to 4 groups. Group I (n=50): males between 26–35 years; Group II (n=50): females between 26–35 years; Group III (n=50): males between 36–45 years; Group III (n=50): females between 36–45 years.

Subjects criteria

Inclusion criteria included: Age between 26 years and 45 years, and both males and females.

Exclusion criteria were: Known diabetic patients, Subjects having acute illness like fever, Subjects taking steroids/females taking oral contraceptive pills, known hypertensives, subjects with thyroid dysfunctions.

Estimation of blood glucose

Venous blood samples were taken from the antecubital vein after an overnight fast. Then the subjects were given 75 gm of glucose dissolved in 250 ml of water. Again venous samples were taken at 2-hour post glucose level. Plasma glucose concentration was estimated by glucose oxidase (GOD) peroxidase (POD) method at the SRMC clinical laboratory using auto analyzer (DADE BEHRING). Fasting plasma glucose was estimated to exclude diabetic patients from the study. In diabetes mellitus the fasting plasma glucose is (FPG) >126. If the 2-hour post glucose plasma concentration of glucose was found between 140 mgs% and 199 mgs% then it was decided that the person was

having impaired glucose tolerance (4).

Anthropometric   calculations

Height in cm and weight in kg were measured. Body mass index (BMI) was calculated using the formula. BMI: weight (kg)/Height (m²). As per the revised WHO criteria for Asian Indians BMI from 18.5 to 22.9 is normal, BMI from 23 to 24.9 is overweight and above 25 is Obese.(1). WHR was calculated using the following formula. Waist (cm)/Hip (cm). Waist was measured at the level of umbilicus using standard tape. Hip was measured at the level of greater trochanter of head of femur. Normal cut off value is 0.88 m in men and 0.81 m in women (5).

Statistical   analysis

All the data were expressed as Mean±SD. Linear association between glucose level and anthropometrical measurements were assessed using two tailed Pearson's correlations. Differences between the groups were determined using a one way ANOVA with Post-Hoc (Scheffe) tests. The null hypothesis was rejected at P<0.05. (Level of significance was taken as P<0.05).

RESULTS

Prevalence of IGT in this study population was 8.5%. Age specific prevalence of IGT in this study group: Subjects having IGT in the age group >35 was 10 and subjects having IGT in the age group <35 was 7. Statistically there was no difference in the prevalence of IGT between the two age groups (<35 and >35). Gender specific prevalence of IGT: The prevalence of IGT in male group was 9 and it is 8 in female group. Statistically there was no significant difference in the prevalence of IGT between males and females in this study population.

IGT and BMI: All the subjects having IGT were from the group having BMI >22.9. There was a statistically significant difference between normal and obese subjects with IGT (P<0.001) (Table I).

TABLE I : Basal parameters among males and females subjects.

	Male (n=100)	Female (n=100)	P Values
Age (yrs)	36.11±5.31	35.63±5.07	0.5140
BMI (kg/m²)	23.65±3.68	24.84±4.60	0.0447
FBS (mg%)	88.09±28.86	86.94±25.30	0.7648
PPBS (mg%)	123.03±65.00	117.13±48.42	0.4675

Values are mean±SD. P values <0.05 was considered significant.

IGT and WHR: (in males) : The number of subjects having IGT in abnormal WHR group was more than the subjects having normal WHR. So, statistically there was a significant difference between group with normal WHR and group with higher WHR in males (P<0.001) (Table II, III). IGT and Waist hip ratio: (In females): The number of subjects having IGT in normal WHR group (<0.81) is 4 and it is 4 in the group having abnormal WHR (>0.81). So, statistically there was no significant difference between group with normal WHR and group with higher WHR in females.

TABLE II : Correlation of FBS with BMI and WHR.

	Male		Female	
	r	p	r	p
FBS Vs BMI	0.105	0.301	0.135	0.179
FBS Vs WHR	0.312	0.002	0.149	0.139

P values < 0.05 was considered significant.

TABLE III : Correlation PPBS with BMI and WHR.

	Male		Female	
	r	p	r	p
PPBS Vs BMI	0.168	0.094	0.236	0.018
PPBS Vs WHR	0.356	0.000*	0.172	0.088

P values <0.05 was considered significant.

IGT and Family history of diabetes mellitus: The number of subjects having IGT from positive family history group is more than the group having negative family history. So, statistically there was a significant difference in IGT between group with positive family history of diabetes and group with negative family history of diabetes.

Correlation analysis of 2-hr postprandial glucose level with anthropometric variables indicated that BMI (r=0.34) and weight (r=0.24) significantly correlated with the 2-hr postprandial level. There was no association seen with age and WHR.

DISCUSSION

In our study, the prevalence of IGT in the randomly selected south Indian population was 8.5%. As per the study of Ramachandran et al the prevalence of IGT was 14% (6) and it was 5.9% (1) as per the report of Mohan et al in the same geographical area (Chennai). Comparing our study with that of Ramachandran et al, the prevalence was low and it was high when compared with the report of Mohan et al. This could be due to the mixture of urban and rural population, variations in the socio-economic status and physical activity of the people recruited to this study. In our study the prevalence of IGT in men was 9% and in women it was 8%. This is in accordance with the study of Hilary King et al conducted in Madras where the crude rate of prevalence of IGT in men was 10.5% and in women it was 8.0% (7).

In our study, there was no difference in the prevalence of IGT between the two age groups (<35 and >35 years of age). This is in accordance with the study of Ramachandran et al (3). Probably, the physical activity in both the age groups, in the semi urban area from where we have selected our subjects,

might be equal which keeps the BMR same. In an another study, Ramachandran et al have reported that the prevalence of IGT showed increasing trend with age and subjects under 40 years of age had a higher prevalence of IGT than Diabetes (8). Mohan et al have analyzed and concluded that the prevalence of IGT increased until 40 years and plateaued until 60 years of age (1).

While analyzing the prevalence of IGT related to sex, statistically there was no difference in the prevalence of IGT between men and women. In this study population the prevalence of IGT in men was 9% and 8% in women. Ramachandran et al also got similar results in a survey conducted by them(8). Probably, the level of physical activity in men and women, in the semi urban area from where we have selected our subjects might be equal. The study conducted by Torguato MT et al in Brazil also confirms that the prevalence of IGT had similar rate in males and females (9). But, the majority of IGT studies reviewed by WHO showed that IGT was more common in men than women. In our study all the subjects (n=17) found to have IGT were obese (BMI >22.9). This shows convincing association in both the sexes between obesity and IGT. According to Ramachandran et al a healthy BMI for an Asian Indian is below 23 kg/m². Obesity has been related to insulin resistance and hyperinsulinaemia. Ele Ferranini et al have reported that the conversion of IGT to diabetes is rapid in obese persons (10)

As per our study, there was a significant association was found between WHR and IGT in men. Increased WHR a predictor of android obesity has been shown to be an important marker for glucose intolerance. As per Arthur J Hartz et al, the prevalence of diabetes has an association with WHR (11)

In our study no significant association was found between IGT and WHR in women. The reason could be due to reduced level of androgens in women which prevents insulin resistance. Robert D Morris et al also reported that the prevalence of diabetes increases with WHR (12). A significant association was found between IGT and family history of diabetes in our study. This could be due to genetic factors, which cause IGT as genetic studies in the south Indian subjects showed that an uncoupling protein 2 gene variant (UCP2) was associated with a raised BMI.

To conclude, the prevalence of IGT in this study population is 8.5%. BMI and family history of diabetes showed association with IGT. WHR showed association with IGT in males, but not in females. The prevalence of IGT is similar with differing age groups and sex. This study can be used as a preliminary step in the sample size for planning a large-scale epidemiological study in this geographical location. Large-scale studies are required for generation of predictor equations taking in to account various variables such as age, socio-economic status, nutritional status etc. Such studies will help in the implementation of preventive measures to reduce the morbidity and mortality associated with diabetes mellitus and to reduce the burden of diseases due to diabetes mellitus in our country.

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