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Original Article

Diabetes Risk Assessment among Adults- A Cross Sectional Study

Meera George*, R S Krishnakumar, Jincy Sam, Jyothi Sasi, Ijas Ahmmed, Haries K Habeeb

ABSTRACT

Introduction: Diabetes Mellitus (DM) is a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbance of carbohydrate, protein and fat metabolism resulting from impaired insulin secretion, insulin action, or both. Knowledge of the risk of diabetes development act as a primary prevention measure among the high-risk population. **Objectives:** To assess the risk of developing Type 2 Diabetes Mellitus using Indian Diabetic Risk Score among adults of age more than 30 years in a colony. **Methods:** A cross sectional study was undertaken among adults of age more than 30 years to assess the risk of development of DM. A pre-validated, structured questionnaire was used to assess the risk of development of DM including the Indian Diabetes Risk Score. The total scores were classified into low, medium and high-risk categories. **Results:** Mean age of the study population was 46.12±10.9 yrs. Nearly 62% of study population were female, 42.7% had high school education and 44.7% were daily wage employees. Majority (47%) of the study population belonged to high risk and 36.5% belonged to medium risk category for development of DM. Increasing age, BMI, waist circumference, high Blood Pressure, a positive family history, female gender, higher education, current usage of alcohol and tobacco, sedentary to mild physical activities and high waist to height ratio were significantly associated with increased risk of development of Diabetes Mellitus. **Conclusion:** The risk assessment should be put forward as a major prevention tool in the DM management.
Key words: Assessment, Danger, Diabetes, Grown person, Risk.

INTRODUCTION

Diabetes mellitus is a global health menace which is increasing in an alarming rate.[1] The projected global prevalence of diabetes among adults as 9.9% by 2030 from 8.3% in 2011.[2] While communicable diseases are slowly getting controlled in India, there is a significant increase in the burden of non-communicable diseases, including but not restricted to diabetes. The age of man-made and degenerative diseases characterized by a life expectancy close to 50-60 years and unhealthy lifestyles which promote diseases like cardiovascular disease and hypertension and Diabetes Mellitus. The prevalence rate of diabetes mellitus among the adult population ranges from 3% in rural areas to 9% in urban areas in India.[3]

A study by the American Diabetes Association reports that India will see the greatest increase in people diagnosed with diabetes by 2030. The high incidence is attributed to a combination of genetic susceptibility plus adoption of a high-calorie, low-activity lifestyle by India's growing middle class.[4]

Complications of Diabetes Mellitus are mainly acute complications like hypoglycemia, hyperglycemic crisis, diabetic ketoacidosis (DKA), hyperglycemic hyperosmolar state (HHS) and Chronic complications like diabetic retinopathy, diabetic nephropathy, diabetic neuropathy (micro vascular complications) macro vascular complications-cardiovascular diseases such as heart attacks, strokes and insufficiency in blood flow to legs, diabetic foot disease.[5] Other rare complications like impaired growth and development, associated autoimmune conditions, hypothyroidism, hyperthyroidism, celiac disease, vitiligo, primary adrenal insufficiency (Addison's disease), lipodystrophy (lipoatrophy and lipohypertrophy), necrobiosis lipoidica diabeticorum, non-alcoholic fatty liver disease, infections seen in patients with diabetes, limited joint mobility, edema.[6,7] These complications are also on the rise and contribute significantly to overall morbidity and mortality. The low levels of education and poor awareness of the disease in the country are enhancing its impact on health of the population.[8]

While comprehensive data are not available, smaller studies have been performed in various states of India to study the prevalence of diabetes. Based on these studies, the highest prevalence reported is from Ernakulum in Kerala (19.5%) and the lowest from Kashmir valley (6.1%). Most other areas have prevalence above 10%.[9] According to National Family Health Survey 4, the prevalence of high blood sugar level among men is 13.1% and women 8.7% in Kerala.[10]

A majority of our population are at high risk of developing Diabetes Mellitus and are not aware of it until

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complications arise. Our study aims to identify these people and bring about measures to prevent the early onset of Diabetes.

MATERIALS AND METHODS

The study was done among adults of age more than 30 years without a history of Type 2 Diabetes Mellitus in a Colony, Kollam, Kerala, India during a 2 months period.Sample size of 170 was reached using the formula, $n = z^2pq/d^2$, Where, z = relative deviate (at 95% confidence interval) i.e. 1.96, p = i.e. estimated 36.5% prevalence of high risk of development of DM from a study done in Pune, Maharashtra.[11]

Pretested, structured interview schedule was administered to collect the data after obtaining Institutional Ethics Committee approval. The interview schedule was divided into 2 parts. The first part consisted of socio demographic details of study subjects and risk factors of diabetes. The second part was Indian Diabetic Risk Score[12] which comprised of two modifiable (Waist circumference and Physical activity) and two non-modifiable risk factors (age and family history of T2DM).

Indian diabetic risk score (IDRS) is the screening tool widely used to assess the risk of diabetes among general population. An IDRS ≥60 had a sensitivity of 83.8%; specificity of 81.0% in prediction of T2DM, while an IDRS <60 had a sensitivity of 79.9% and specificity of 83.8%, in prediction of non-T2DM in Indian Settings[13]

Operational definitions

High-risk cases of diabetes[12] participants with IDRS ≥60 were considered at high risk of diabetes. Family history of diabetes[14] If either or both of a subject's parents had diabetes, they were considered to have a positive family history. Physical activity[15] levels were graded based on WHO STEPS definitions of sedentary, mildly, moderately or vigorously physically active. Waist circumference[16] measured to the nearest 0.1 cm at the midpoint between the tip of the iliac crest and the last costal margin in the back and at the umbilicus in the front, using a non-stretchable tape, at the end of normal expiration, with the subject standing erect in a relaxed position. Abdominal/central obesity was considered to be present when the waist circumference was ≥80 cm in women and ≥90 cm in men. Weight was measured to the nearest 0.1 kg using a digital weight recorder. Height was measured to the nearest 0.1 cm using a wall fixed stadiometer. Body Mass Index was evaluated as weight divided by height squared (kg/m^2). Waist to Height Ratio was calculated as waist circumference divided by height. The data collected was entered in Microsoft Excel and analyzed using Statistical Package for Social Sciences version 16 software. Descriptive analysis was done by calculating frequencies, proportions, mean, median, standard deviations. Chi square tests and Fischer's exact were used to calculate associations. An adjusted analysis was performed using multivariate logistic regression.

RESULTS

Mean age of the study population was 46.12±10.9 yrs. Among 170 study population 87 (51.2%) belonged to the age group of 35-49 years. Nearly 67% of study population were female, 42.7% had high school education. About 39 (23%) and 41 (24%) were currently using alcohol and tobacco respectively. Nearly 98% were following non-vegetarian diet. 32 (18.8%) of study subjects had associated hypertension and on treatment. About 58 % of study subjects have family history of Diabetes. Mean waist to height ratio was 0.61±0.11. Majority 149 (87.6%) had a high waist to height ratio. 44 (25.9%) of study subjects had raised blood pressure during the interview. (Table 1)

Majority (90%) had a family size <5 and nearly 62% belonged to nuclear family. About 70% of females were homemaker and 44.1% of study population were daily wagers. Nearly 56% of study population didn't have any comorbidities. 32 (18.8%) had associated hypertension and 23 (13.5%) had osteoarthritis, 20 (11.7%) had others like asthma, stroke, Acid Peptic Disease, migraine. (Figure 1)

About 80 (47%) of the study population belonged to high risk and 36.5% belonged to medium risk category for development of Diabetes Mellitus according to Indian Diabetic Risk Score (IDRS). (Table 2)

Increasing age, BMI, waist circumference, high Blood Pressure, a positive family history and female gender had a strong association with high risk of development of diabetes. We found that higher the education higher the risk for Diabetes. Current usage of alcohol and tobacco were also associated with higher risk of development of Diabetes Mellitus. Sedentary to mild physical activities and high waist to height ratio were also associated with increased risk of development of Diabetes Mellitus. (Table 1)

DISCUSSION

The purpose of our study was to assess the risk of developing Type 2 Diabetes Mellitus using Indian Diabetic Risk Score among adults of age more than 30 years Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation. Over time, diabetes can damage the heart, blood vessels, eyes, kidneys and nerves. Early prediction of the increased risk of developing it can prevent complications, multi organ failure and untimely death. In this study we had found that majority of our study population belonged to age group 36-49years, nearly 62% of study population was female, 42.7% had high school education and 44.7% were daily wage employees. This was similar to a study done in Maharashtra.[11] Using the IDRS we found that majority of 36-49 years age group belonged to moderate risk and in age group of >50, majority was under high risk of development of Type 2 Diabetes Mellitus. Many studies conducted in India showed that increasing age increases the risk of Diabetes. In another study which used Diabetes Risk Score, the age group of 55-64yrs was high risk of developing Diabetes.[17]

In our study nearly 58% of overweight study subjects and 71% of obese people had a high risk of development of Diabetes. Studies have shown that obesity plays a major factor in the development of diabetes. Obesity and diabetes are interrelated and the term 'diabesity' has been coined to describe the relationship between obesity and diabetes.[18]

Another significant association was waist circumference with risk of developing Diabetes. Our study showed waist circumference and risk of developing Diabetes is directly proportionate as increased waist circumference clearly denote deposit of fat around internal organs leading to insulin resistance. Other studies showed similar results.[11,17]

Among our population with high BP, about 77.3% were in the high-risk group of developing Diabetes. Diabetes damages arteries and makes them targets for hardening and atherosclerosis leading to hypertension. A population-based study done in Chennai, India among the NGT (normal glucose tolerance) subjects showed about 38.2% with Hypertension came under the high-risk group of IDRS.[19]

Apart from obesity the other risk factors for type 2 DM are age, life style factors like sedentary life style, smoking and alcohol consumption and the most important risk factor was family history of type 2 dm which has a critical role in the development of the disease which is similar to a study done in Chennai.[20]

We have reported that the change in anthropometric variables preceded the risk of development of Diabetes and the same trend was reported earlier linking modifiable risk factors like obesity and physical inactivity as risk for developing Diabetes in the span of five years.[21] Sedentary life style or inactivity decrease the usage of insulin which turns the excess food into fat there by increasing blood sugar levels and Diabetes.

We did not find any significant association b/w socioeconomic status and risk of developing Diabetes. A cross-sectional study conducted at

Table 1: Association between Risk score and sociodemographic variables.

Variable	Category	Low Risk	Moderate Risk	High Risk	Total	Chi square value	*p* value
Age (years)	<35	18(66.7%	8(29.6%)	1(3.7%))	27(15.9%)	76.82	<0.05 # Fishers exact
	35-49	9(10.3%)	41(47.1%)	37 (42.5%)	87 (51.2%)		
	>50	1(1.8%)	13(23.2%)	42(75%)	56(32.9%)		
BMI (Kg/ m²)	<18.49	3(25%)	8(66.7%)	1(8.3%)	12(7%)	28.7	<0.05 # Fishers exact
	18.49-24.9	15(24.2%)	29(46.8%)	18(29%)	62(36.5%)		
	25-29.9	8(15.4%)	14(26.9%)	30(57.7%)	52(30.6%)		
	>30	2(4.5%)	11(25%)	31(70.5%)	44(25.9%)		
Waist Circumference (cm)	Normal	15(38.5%)	19(48.7%)	5(12.8%)	39(22.9%)	29.6	<0.05 * Chi square test
	High	13(9.9%)	43(32.8%)	75(57.3%)	131(77.1%)		
Education	No formal education	1(7.1%)	4(28.6%)	9(64.3%)	14(8.2%)	18.19	0.01#
	Primary School education	8(13.6%)	19(32.2%)	32(54.2%)	59(34.7%)		
	High school education	12(16.2%)	27(36.5%)	35(47.3%)	74(43.6%)		
	Pre-University	6(33.3%)	11(61.1%)	1(5.6%)	18 (10.6%)		
	College education	1(20.0%)	1(20.0%)	3(60.0%)	5(2.9%)		
Tobacco usage	Never	15(12.9%)	41(35.3%)	60(51.7%)	116(68.2%)	7.07	0.01#
	Quit	3(20%)	4(26.7%)	8(53.3%)	15(8.8%)		
	Current	10(25.6%)	17(43.6%)	12(30.8%)	39(22.9%)		
Alcohol usage	Never	13(10.8%)	44(36.7%)	63(52.5%)	120(70.6%)	10.73	0.02#
	Quit	2(22.2%)	3(33.3%)	4(44.4%)	9(5.3%)		
	Current	13(31.7%)	15(36.6%)	13(31.7%)	41(24.1%)		
Blood pressure	Normal	24(19%)	56(44.4%)	46(36.5%)	126(74.1%)	21.96	0.00*
	High	4(9.1%)	6(13.6%)	34(77.3%)	44(25.9%)		
Family history of Diabetes Mellitus	No	22(30.6%)	29(40.3%)	21(29.2%)	72(42.4%)	24.04	0.00*
	Yes	6(6.1%)	33(33.7%)	69(60.2%)	98(57.6%)		
Gender	Male	18(31.6%)	19(33.3%)	20(35.1%)	57 (33.5%)	14.73	0.001*
	Female	10(8.8%)	43(38.1%)	60(53.1%)	113 (66.5%)		
Physical activity	Sedentary to mild	3(13%)	2(8.7%)	18(78.3%)	23(13.5%)	11.7	0.00#
	Moderate to vigorous	25(17%)	60(40.8%)	62(42.2%)	147 (86.5%)		
Waist circumference to height ratio	Normal	11(52.4%)	9(42.9%)	1(4.8%)	21(12.4%)	26.43	0.00#
	High	17(11.4%)	53(35.6%)	79(53%)	149(87.6%)		

p value- Fischer's exact test <0.05 is significant
*p value-Chi-square test<0.05 is significant

Pune, Maharashtra showed that the association between socioeconomic class and risk status was highly significant statistically ($P = 0.001$).[11] We did not find any association between type of diet, occupation, family income and risk of developing Diabetes.

Every adult more than 18 years should be assessed for risk of development of Diabetes Mellitus using IDRS or any other simple tool. It will not just aid in early detection and prevention of complication of Type 2 DM but also helps to reduce the morbidity and mortality associated with it. This tool can be used as a primary prevention measure to motivate people against metabolic diseases and cardiovascular diseases. As majority of study population belonged to high and moderate risk for development of Diabetes, urgent follow up and health education are needed in the area with a Random Blood Sugar testing for all followed up by definitive diagnostic tests. Development of comprehensive health approaches including dietary and lifestyle modifications and awareness regarding the risk of Diabetes Mellitus and its complications should be done.

Our study was a questionnaire based one, more value would have added if few invasive procedures were also involved. The assessment of risk would have been complete if qualitative component also added. That

Table 2: Indian Diabetic Risk Score.

Indian Diabetic Risk Score	Frequency (%)
Low risk (<30)	28(16.5%)
Medium risk (30-50)	62(36.5%)
High risk (>60)	80(47%)

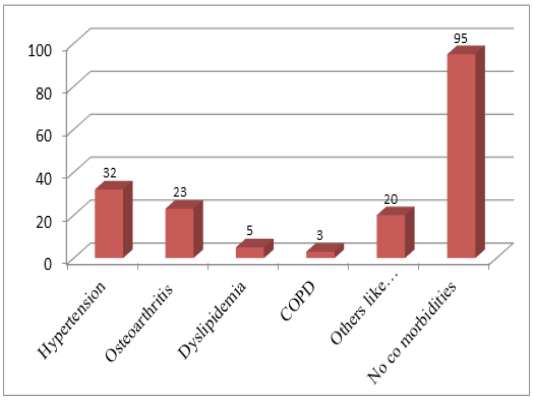

Figure 1: Presence of co-morbidities.

would have shed a light regarding the resistance towards adapting the healthy lifestyle.

CONCLUSION

Majority (47%) of the study population belonged to high risk and 36.5% belonged to moderate risk category for development of Diabetes Mellitus. Increasing age, BMI, waist circumference, high Blood Pressure, a positive family history and female gender had a strong association with high risk of development of diabetes. We found that higher the education higher the risk for Diabetes. Current usage of alcohol and tobacco were also associated with higher risk of development of Diabetes Mellitus. Sedentary to mild physical activities and high waist to height ratio were also associated with increased risk of development of Diabetes Mellitus.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

DM: Diabetes Mellitus; **DKA:** Diabetic Keto-Acidosis; **HHS:** Hyperglycemic Hyperosmolar State; **IDRS:** Indian Diabetic Risk Score.

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