

Study of Risk Factors for the High Prevalence of Type 2 Diabetes in the People of Jammu

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KEYWORDS Type 2 Diabetes. Risk Factors. Jammu

ABSTRACT The study was carried out to identify the contribution of risk factors to the susceptibility to T2DM among the people of Jammu region of Jammu and Kashmir state in North India. For this, a total of 250 diabetic patients (140 male, 110 female) and 150 non-diabetic controls (90 male, 60 female) were recruited from Jammu. A general health questionnaire was used to collect information about age, sex, onset of diabetes, smoking, alcohol intake, diet pattern, physical activity, household information and family history of diabetes. Anthropometric measurements of height, weight, waist and hip circumference were also taken on all subjects. In our study mean age of diagnosis of T2DM was 53.28 ± 9.98 years. The average duration of diabetes was longer in males than in females (10.16 ± 11.37 yr vs. 7.17 ± 5.05 yr). The mean BMI value did not vary among diabetic and non-diabetic subjects (25.91 ± 3.82 vs. 24.91 ± 3.65 ; $P = .011$) but male diabetics have higher BMI as compared to females. Diabetic complications are higher in T2DM subjects than in Control population (28 percent CHD, 32 percent Hypertension, 40 percent Ocular Problem). It is concluded that the Jammu population in North India is at a higher risk of developing diabetes and its related complications.

INTRODUCTION

Type 1 diabetes (T1D) is a chronic autoimmune disease, characterized by autoimmune destruction of the insulin secreting β -cells of the islets in the pancreas (Mehra et al. 2007). Whereas in type 2 diabetes, body does not produce enough insulin or the cells are not able to utilize the insulin. Type 2 diabetes (T2DM) poses a major global health threat both in the developed and developing countries (Wild et al. 2004). The World Health Organisation has predicted that the major burden of T2DM will occur in the world and there will be a 42 percent increase in the developed countries and 170 percent increase in the developing countries. The countries with largest number of diabetic patients are and will be in the year 2025, India, China and United States (King et al. 1998; Ramachandran et al. 2002, 2007). The prevalence of T2DM in Asian Indians ranges from 2.7 percent in rural India to 14 percent in urban India and in the range 16-22 percent in migrant Indians living in Europe, USA, Africa and Fiji (Knight et al. 1992; Dhawan et al. 1997; Simmons et al. 1995; Chandalia et al. 1999). It has been suggested that the increase in prevalence of diabetes among Asian Americans is due to ageing of the population, urbanization and increased prevalence

of obesity and lack of physical inactivity (Marguerite et al. 2004). It was reported that the prevalence of type 2 diabetes is on the rise more in urban areas compared to rural areas (Sayeed et al. 2003; Hussain et al. 2005). Type 2 diabetes mellitus is a multifactorial disease with both genetic and environmental factors contributing to its development (Khan et al. 1996). Besides urbanization, other risk factors of particular importance are: - obesity, increased abdominal fat, hypertension, ethnic background and lack of physical exercise (De Fronzo et al. 1997). Various studies on the prevalence and risk factors associated with T2DM have been carried out in India in the past but most of them have been confined to south Indian populations (Shobhana et al. 2000). A few authenticated reports have been published on populations residing in Delhi (Ahuja et al. 1996; Misra et al. 2001; Ramachandran et al. 2001; Sadikot et al. 2004) and Kashmir by (Zargar et al. 2000). Jammu region of Jammu and Kashmir State in north India is facing rapid urbanization. However, to the best of our knowledge scarcely any information is available on the prevalence and risk factors associated with T2DM in the Jammu population taken up during the present study. The objectives of this study are to investigate risk factors associated with the T2DM in the selected population.

MATERIAL AND METHODS

A total of 400 individuals (250 T2DM and 150 unrelated non-diabetic controls) were taken. The patients and control subjects were collected both from different hospitals and private clinics with their consent and they were apprised about the nature of work. Those samples were considered as control samples whose blood sugar level is normal and they don't have any family history of diabetes. T2DM was diagnosed using the criteria of the American Diabetes Association (ADA 2004), that is, a medical record indicating either a fasting plasma glucose level ≥ 126 mg/dl or post glucose level ≥ 200 mg/dl. The diagnosis of T2DM is based on clinical records and medication. The study was approved by ethical committees of the participating hospitals and private clinics and informed written consent was obtained from all the subjects.

Examination Method: A general health questionnaire was designed and filled up before taking the blood sample of patients and unrelated controls. In the questionnaire information regarding the blood glucose level, age, sex, diet pattern, socio-economic status, physical activity, height, weight, waist hip ratio, family history (a detail family history was drawn to analyze the genetic inheritance of the disease), onset age and duration of diabetes, related health problems and information regarding biochemical parameters were included.

Anthropometry: The measurements for weight, height, and hip and waist circumference of each patient were recorded as per the standards fixed up by the WHO for Asians (WHO Expert Consultation 2004). Weight was taken with light clothes and without shoes by a digital weighing machine. Height was measured with the subjects standing fully erect on a flat surface by height measuring tape. Waist and Hip circumferences were measured by dressmaker's tape.

Body mass index (BMI) was calculated as weight in kg / height in m² and waist to hip ratio was taken as waist/hip circumference. BMI was defined according to the recent WHO recommendations for Asians (WHO Expert Consultation 2004). Abdominal obesity was diagnosed according to the new cut-offs proposed for South Asian Indians (WHR) ≥ 0.89 for men and ≥ 0.81 for women (Friedewald et al. 1972). Blood pressure was measured with a standard sphygmomanometer.

Statistical Analysis: Data are presented as mean $\pm$ SD. Statistical analysis between patients and controls were performed using SPSS software version 14. Means were compared using t-test and any p value of less than 0.05 was considered as statistically significant.

RESULTS

The demographic and the socio-economic characteristics of participants are summarized in Table 1, which shows that there lies a significant difference between diabetic patients and controls in respect of their economic status and education. Both alcohol intake and smoking (14.8%) were found to be significantly higher in diabetic subjects than in the controls (6.6%). Women culturally avoided alcohol intake and smoking.

Physical activity was found to be significantly lower in diabetic subjects in comparison to controls.

In case of diabetic subjects, intake of non-vegetarian diet was also found to be higher (55.6%) as compared to the control population (34.6%). The cooking media was found to be the same in both the groups of populations.

The present data shows that the prevalence of T2DM increases with age, especially after 40 years, and reaches to maximum between 40-60 years.

Pedigree Analysis: A detailed family pedigree was drawn for patients to analyze genetic inheritance pattern of the T2DM. The details included frequency, age at onset and familial ties. In the present study, 55.6% of patients were showing the transmission of diabetes through two or more generations.

From the pedigree data, it was found that as the age increases from 40 years onward, the risk of developing T2DM increases. Subjects having a family history of diabetes were at the highest risk in their productive years of life.

Table 2 describes the anthropometric profiles of the T2DM patients and controls. The mean age of diagnosis of T2DM was 48.53 ± 8.59 years for male and 46.52 ± 8.23 years for female diabetic subjects, and p value (0.131) was found to be insignificant between males and females. The average duration of diabetes was longer in males than in females, and p value (0.035) was found to be significant between the two sexes. The mean BMI values did not differ significantly

Table 1: Demographic and socio-economic characteristics of the diabetes study participants

S. No.	Characteristics		Type 2 diabetes (percent)			Controls (percent)		
			Male (n=140)	Female (n=110)	Total (n=250)	Male (n=90)	Female (n=60)	Total (n=150)
1	<i>Economic Status</i>	High class	28.57	10.90	20.8	33.3	23.3	29.33
		Middle Class	60.71	60.90	60.8	52.2	56.6	54.00
		Low Class	10.71	28.18	18.4	14.4	20.0	16.60
2	<i>Education</i>	Literate	82.85	74.54	79.25	66.6	75.0	70.00
		Illiterate	17.14	24.45	20.8	33.3	25.0	30.00
3	<i>*Alcohol Consumption</i>		62.85		35.2	33.3		20.00
		<i>*Smoking</i>	10.71		6.0	16.6		10.00
		<i>*Both</i>	26.42		14.8	11.1		6.66
4	<i>Tea/ Coffee</i>	Moderate	59.28	30.00	46.4	58.8	36.6	50.00
		Heavy	40.71	70.00	53.6	41.4	63.3	50.00
5	<i>Cooking Media</i>	Mustard/ Refined	25.71	30.90	28.0	22.2	20.0	21.30
		Desi ghee	14.28	9.09	12.0	15.5	16.6	16.00
		Mixed	60.00	60.00	60.0	62.2	63.3	62.60
6	<i>Eating Habits</i>	Non- vegetarian	76.42	29.09	55.6	35.5	33.3	34.60
		Vegetarian	23.57	70.90	44.4	64.4	66.6	65.30
7	<i>Physical Exercise</i>	Regular	58.57	40.00	50.4	75.5	71.6	74.00
		Sedentary	41.42	60.00	49.6	22.0	28.3	26.00

* No data were available for female samples in respect to alcohol and smoking.

between diabetic and control subjects (25.91 ± 3.82 and 24.91 ± 3.65 ; $p = 0.011$). However, comparatively higher BMI was observed in male diabetic subjects (25.93 ± 3.59 for males and 25.89 ± 4.10 for females; $p \geq 0.05$). The mean WHR revealed pronounced value in patients (0.97 ± 0.07) than in controls, (0.94 ± 0.08) which was statistically significant ($p=0.00$). Confirmation of data was done from the new BMI cut-offs advised by WHO Expert Consultation. Ahuja et al. (1996) observed central obesity in both the groups, patients as well as controls.

Most of our male patients were desk workers and others were business class. Apparently, sedentary lifestyle and intake of heavy non- vegetarian diet accounts for the higher BMI in case of male patients.

Knowledge Profile of the Patients: About 75 percent of our diabetic patients were familiar about the disease they were suffering from. About 30 percent were aware of the root cause and 40 percent of our patients were aware of preventive measure and treatment of the disease.

Associated Health Problems: The data on diabetes related complications were also collected from our patients, and was found that nearly about 28 percent had clinically diagnosed CHD (Coronary Heart Disease), 32 percent had hypertension and 40 percent had ocular complications (for example, cataracts, retinal problems and vision loss). 10-12 percent of affected individuals suffered from non- healing skin and soft tissue infection or ulcers of leg and foot, many of them had amputated fingers. Significantly higher frequency of hypertension, ocular problems and CHD were observed in T2DM patients than in controls. On the other hand, no significant differences were observed in the frequency of nephropathy, paralytic stroke and dental problems between patients and controls.

DISCUSSION

The present case control study was undertaken to establish the association, if any, of the risk factors associated with prevalence of dia-

Table 2: Characteristics of study subjects by sex and disease status

Variables	Type 2 diabetes			Controls			P Value
	Male (n=140)	Female (n=110)	Total (n=250)	Male (n=90)	Female (n=60)	Total (n=150)	
Age (Years)	54.5 $\pm$ 9.86	51.73 $\pm$ 9.96	53.28 $\pm$ 9.98	48.94 $\pm$ 5.31	47.81 $\pm$ 5.31	48.27 $\pm$ 7.28	0.000
BMI (kg/m ²)	25.93 $\pm$ 3.59	25.89 $\pm$ 4.10	25.91 $\pm$ 3.82	24.93 $\pm$ 3.44	24.89 $\pm$ 3.98	24.91 $\pm$ 3.65	.011
WHR	0.99 $\pm$ 0.07	0.94 $\pm$ 0.06	0.97 $\pm$ 0.07	0.97 $\pm$ 0.06	0.91 $\pm$ 0.07	0.94 $\pm$ 0.08	0.000

betes in Jammu in North India. Asian Indians have been identified as one of the ethnic groups with a high prevalence (Ramachandran et al. 2001; Sadikot et al. 2004) and familial aggregation with type 2 diabetes (Vishwanathan et al. 1996). The findings of this study helps in extending our knowledge about the present epidemic and associated risk factors of T2DM in people of Jammu. Nearly 67 percent of our diabetic subjects showed family history with one or both of the parents affected with the disease in Jammu population.

Physical activity has a great impact on many of the components of the metabolic syndrome of T2DM. The population in Jammu region is facing rapid globalization, and is changing as a result of developmental activities raising the socio-economic status of the population. These improved socio-economic conditions have resulted in a decrease in physical activity and an increase in obesity, which has led to an increase in the prevalence of T2DM and its related complications. The data from our study suggests that those leading a sedentary lifestyle or involved only in household work develop diabetes more frequently than those whose occupation or routine life involve more physical work. Similar findings were reported by Williams et al. (1994) and Hughes et al. (1990).

Age related prevalence of diabetes and its complications are high in both men and women inhabiting Jammu. Our study reports that most of the subjects developed T2DM in their productive years of age but exact age of onset was not clear because many individuals of our study do not undergo regular checkups until symptoms appear thus diabetes remain undiagnosed for some years. Votey et al. (2004) had made similar observations in their study.

Obesity is an established risk factor for type 2 diabetes, and a significant association was found between higher BMI ≥ 25 and occurrence of the disease in the present study as reported earlier Sayeed et al. 1998. The association of WHR and diabetes was also evident in our study reported by (Hussain et al. 2005).

ACKNOWLEDGEMENT

The authors are indebted to the Department of Biotechnology, Government of India, and New Delhi for financial support for the present study.

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