Risk factors of type 2 diabetes in population of Jammu and Kashmir, India

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Received 04 April 2013, Revised 23 May 2013, Accepted 28 July 2013, Epub 25 August 2013

Abstract

We sought to identify risk factors for type 2 diabetes (T2D) in Jammu and Kashmir populations, India. A total of 424 diabetic and 226 non-diabetic subjects from Jammu, and 161 diabetic and 100 non-diabetic subjects from Kashmir were screened for various parameters including fasting blood glucose level, 2 hour glucose level, urea, creatinine, triglycerides, total cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein (VLDL-C), uric acid, systolic and diastolic blood pressure level. We found that subjects aged 40-49 years had the highest rate of diabetes, with family income playing not much of a role. Kashmiri migrants or populations with rapid cultural, environmental, social or lifestyle change along with reduced physical activity, obesity and unhealthy lifestyle (smoking and alcohol consumption) were found to have higher rates of diabetes. High blood glucose, triglycerides and low HDL-C levels were found to be contributing to disease outcome. High blood pressure also contributed to a higher risk of developing T2D. Our study supports earlier reports confirming the contribution of comfortable life style, Western dietary habits and rapid life style change along with many other factors to the prevalence of diabetes. This may contribute to the epidemic proportion of diabetes in Jammu and Kashmir. Early diagnosis and routine screening for undiagnosed diabetes in obese subjects and subjects with parental diabetes history is expected to decrease the burden of chronic diabetic complications worldwide.

Keywords: type 2 diabetes, north India, life style, kashmiri migrants, body mass index

INTRODUCTION

Type 2 diabetes (T2D), the most common form of diabetes constituting 90% of the diabetic population^[1], if untreated, can lead to severe complications like retinopathy, coronary heart disease, nephropathy and neuropathy. The global prevalence of diabetes has been estimated to increase from 4% in 1995 to 5.4%

in 2025^[2]. The International Diabetes Forum (IDF) reported that the total number of people with diabetes in India was estimated to be 41 million in 2006, and could rise to as high as 70 million by 2025^[3] and 100 million by 2030^[4]. T2D is a lifelong disease with considerably increased co-morbidities and mortality; at the same time, it also compromises the quality of life of patients^[5]. There is no denying that the disease

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and its complications cause a heavy economic burden for people with diabetes, their families and society as well. It is therefore imperative to understand why Indians are developing T2D at such a high rate. Once the causes for the high development rate are known, appropriate strategic healthcare planning could be pursued and the burden of disease reduced^[5]. The present study was an attempt to identify various lifestyles, anthropometric, metabolic and socioeconomic factors that could contribute to the increasing number of T2D diabetes cases in the North Indian population of Jammu and Kashmir.

SUBJECTS AND METHODS

Subjects

The present study included a total of 585 T2D patients (336 males and 249 females) and 326 non-diabetic controls (151 males and 175 females) from Jammu and Kashmir. Of the total 585 patients, 424 were ancestral inhabitants of the Jammu region while 161 were migrants from the Kashmir region. Among the controls, 226 non-diabetic subjects were from the Jammu region while 100 were migrants from the Kashmir region presently living in Jammu. T2D was diagnosed according to the criteria set by the World Health Organization (WHO). The fasting plasma glucose levels ≥ 7.0 mmol/L or ≥ 126 mg/dL after a minimum of 12 hour fast, or a 2-hour post glucose level (oral glucose tolerance test, OGTT) ≥ 11.1 mmol/L or 2-h OGTT, ≥ 200 mg/dL^[6]. Those subjects who were on hypoglycaemic medication were considered diabetic.

Patient evaluation

A questionnaire was prepared and information regarding age, sex, dietary pattern, socio-economic status, exercise pattern, family history, age of onset, duration of diabetes, medication pattern, height, weight, fasting blood glucose level, 2 hour glucose level, urea, creatinine, triglycerides, total cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), very low density lipoprotein cholesterol (VLDL-C), uric acid, systolic and diastolic blood pressure were obtained. Standard procedures were followed to measure body height and weight. Body mass index (BMI) was calculated as [weight (kg)/height (m²)]. BMI values were defined according to the recent recommendations by the WHO for Asians^[7]. Blood pressure was measured by using a standard mercury sphygmomanometer in sitting position. Hypertension was defined as systolic blood pressure ≥ 140 mm Hg. Those subjects who were on antihypertensive medication were taken as hyperten-

sive despite low systolic blood pressure. Biochemical parameters were measured by using fully automated analyser. Information was taken regarding physical activity of the participants in 3 categories, very active (professionally requiring vigorous activity or > 2 hours/day exercise), moderately active (≤ 2 hours/day exercise), and mildly active (household work, no exercise). Economic status was calculated as monthly family income from all sources; low income class ($<$ Rs 5000), middle income class (5000-50,000), high income class ($> 50,000$). Written informed consent was obtained from all the participants and the study protocol was approved by the institutional ethical committee of the University of Jammu, Jammu, India.

Statistical analysis

Data has been presented as mean $\pm$ SD. Statistical analysis between patients and healthy controls was performed by using SPSS software 17.0 version (SPSS Inc., Chicago, IL, USA). Means for clinical parameters were compared by using Student's *t*-test, and *P* value after Bonferroni correction (*P*-value = $0.05/14 = 0.0036$) was considered statistically significant. We also estimated the risk provided by various clinical parameters [as odds ratio (OR)] of T2D patients in the combined population by using logistic regression analysis with T2D as dependent variable on the various clinical parameters. *P*-value was considered statistically significant after Bonferroni correction (*P*-value = $0.05/5 = 0.01$).

RESULTS

Demographic and baseline characteristics of the study participants

The demographic and socioeconomic characteristics of the participants of the two populations are shown in **Table 1**. There was no significant difference between T2D patients and normal healthy controls according to education, economic status and physical activity in the two populations. In the Jammu population, 81% of the diabetic subjects were in the middle income group, 14% in the high income group and 5% in the low income group while 77%, 18.5% and 4.5% healthy subjects were in the middle, high and low income group, respectively. In the Kashmiri population, 84% of the diabetic subjects were in the middle income group, 14% in the high income group and 2% in the low income group whereas 86%, 12% and 2% of the healthy subjects were in the middle, high and low income group, respectively. The educational status in both the Jammu and Kashmiri population was comparable between diabetic subjects and healthy controls.

Table 1 The demographic and socioeconomic characteristics of the two population groups from Jammu and Kashmir of North India

Characteristics	Jammu Region						Kashmir Region					
	Type 2 Diabetic Patients			Normal Healthy Controls			Type 2 Diabetic Patients			Normal Healthy Controls		
	(%)			(%)			(%)			(%)		
	Males (n=239)	Females (n=185)	Total (n=424)	Males (n=101)	Females (n=125)	Total (n=226)	Males (n=97)	Females (n=64)	Total (n=161)	Males (n=50)	Females (n=50)	Total (n=100)
Economic status												
High income class	14.65	12.98	13.92	17.82	19.2	18.58	14.43	14.07	14.29	12	12	12
Middle income class	79.50	83.24	81.13	76.23	77.6	77.00	84.53	82.81	83.85	86	86	86
Low income class	5.85	3.78	4.95	5.95	3.2	4.42	1.04	3.12	1.86	2	2	2
Education												
Illiterate		4.9	2.09	0.99		0.44		6.25	2.48		6	3
Middle	7.96	16.74	11.79	8.91	19.2	14.59	11.34	25	16.77	8	12	10
Secondary	21.76	23.24	22.4	15.85	14.4	15.04	21.65	29.70	24.85	16	24	20
Senior secondary	17.16	20.54	18.69	14.85	16.0	15.5	20.62	20.31	20.51	18	24	21
Graduate	46.0	30.26	39.14	51.48	40.0	45.13	36.08	14.06	27.32	56	28	42
Post-graduate and above	7.12	4.32	5.89	7.92	10.4	9.30	10.31	4.68	8.07	2	6	4
Alcohol consumption												
Teetotaler	46.84	100	70.04	38.61	100	72.57	79.4	100	87.58	52	100	76
Moderate	10.4		5.9	12.87		5.75	5.14		3.10	6		3
Heavy	3.33		1.9	0.99		0.45	1.03		0.62	2		1
Very heavy	8.39		4.71				1.03		0.62			
NR	30.95		17.45	47.52		21.23	13.40		8.08	40		20
Smoking												
No smoking	54.8	100	74.53	41.58	100	73.90	35.05	100	60.87	26	100	63
Moderate	8.0		4.48	7.93		3.54	11.35		6.83			
Heavy	6.20		3.54	1.98		0.88	6.18		3.72	2		1
NR	31		17.45	48.51		21.68	47.42		28.58	72		36
Eating habits												
Vegetarian	48.5	50.3	49.3	11.89	69.6	43.8	55.7	35.94	47.83	14	28	21
Non-vegetarian	51.5	49.7	50.7	88.11	30.4	56.2	44.3	64.06	52.17	86	72	79
Physical activity												
Mildly active	40.2	68.1	52.4	45.5	52	49.1	38.14	56.25	45.34	44	40	42
Moderately active	50.6	28.1	40.8	49.5	43.2	46.0	57.73	39.07	50.32	54	52	53
Very active	9.2	3.8	6.8	5.0	4.8	4.9	4.12	4.68	4.34	2	8	5

Economic status: Family income > Rs 50,000/month is defined as high income class; Family income between Rs 5,000/month to 50,000/month is defined as middle income class; Family income less than Rs 5,000/month is defined as low income class. Alcohol consumption: persons who take less than 500 mL/week are defined as moderate; persons who take between 500 mL to 1000 mL per week are defined as heavy alcohol consumption; persons who take more than 1000 mL/week are defined as very heavy alcohol consumption. Smoking levels are defined as follows: no smoking; Moderate 10 packs/week; Heavy > 10 packs/week. Physical activity levels are defined as follows: Moderate active means household work, profession requirement is sitting; Moderately active is < 2 hours exercise; Very active means > 2 hours exercise, profession with physical activity. NR: no response.

In the Jammu population, alcohol intake was higher in diabetic subjects (14%) compared to the non-diabetic subjects (6.19%) while no difference was found in the diabetic and healthy subjects in the Kashmiri population (diabetic, 4.34% vs. controls, 4.00%). In the Jammu population, 8% of the diabetic subjects were smokers compared to 4.5% of healthy controls. In the Kashmiri population, 10.5% of the diabetic subjects were smokers compared to 1% of healthy controls. In the Jammu population, 52% of the diabetic subjects were mildly active, 41% moderately active and 7% very active compared to 49% mildly active, 46% moderately active and 5% very active in the healthy controls. In the Kashmir region, 45% of

the diabetic subjects were mildly active, 51% moderately active and 5% very active compared to 42% mildly active, 53% moderately active and 5% very active in healthy controls.

Of the total 424 subjects with diabetes in Jammu, 3.54% were found to maintain glycaemic control by diet and exercise, 40% took oral hypoglycaemic drugs, 4% received insulin therapy and 4% took insulin only, and 8% were diagnosed as diabetic for the first time. The remaining subjects (40.5%) did not take any drug to control diabetes. Similarly, in the Kashmiri population, 15.5% received diet and exercise therapy, 39% received medication and 7% were given insulin therapy, and 7% were diagnosed as diabetic for

the first time. The remaining patients (31.5%) did not receive any medication. In the Jammu population, the age-wise distribution of diabetes showed that approximately one third of the diabetic patients were in the age group of 40-49 years [0.5% (< 30 years), 16.65% (30-39 years), 33.35% (40-49 years), 26.3% (50-59 years), 20.05% (60-69 years) and 3.65% (> 70 years)]. In Kashmiri population, the age-wise distribution of diabetes was 2.25% (< 30 years), 12.9% (30-39 years), 32.25% (40-49 years), 35.95% (50-59 years), 19.25% (60-69 years) and 2.4% (> 70 years).

Biochemical and anthropometric profiles of the study participants

Table 2 and **3** show the biochemical and anthropometric profiles of the participants of the two population groups in the study. In the Jammu population, there was a significant difference in urea (diabetic, 29.06 ± 13.8 mg/dL vs. controls, 23.13 ± 3.6 mg/dL, $P = 0.00$), creatinine (diabetic, 1.11 ± 0.13 mg/dL vs. controls, 1.0 ± 0.2 mg/dL, $P = 0.01$), total cholesterol (diabetic, 173.14 ± 29.9 mg/dl vs. controls, 169.9 ± 21.3 mg/dL,

$P = 0.001$), triglycerides (diabetic, 204.3 ± 114.5 mg/dL vs. 178.1 ± 73.13 mg/dL, $P = 0.001$), VLDL-C (diabetic, 42.34 ± 26.9 mg/dL vs. controls, 37.1 ± 18.1 mg/dL, $P = 0.007$), HDL-C (diabetic, 47.47 ± 5.1 mg/dL vs. controls, 49.10 ± 6.48 mg/dL, $P = 0.00$), systolic blood pressure (diabetic, 138.2 ± 17.9 mm Hg vs. controls, 129.5 ± 13.6 mm Hg, $P = 0.00$) and diastolic blood pressure (diabetic, 82.9 ± 5.8 mm Hg vs. controls, 81.4 ± 5.2 mm Hg, $P = 0.00$). In the Kashmiri population, there was a significant difference in triglycerides (diabetic, 211.9 ± 77.5 mg/dL vs. controls, 185.37 ± 59.3 mg/dL, $P = 0.02$), LDL-C (diabetic, 82.0 ± 28.12 mg/dL vs. 83.04 ± 16.7 mg/dL), VLDL-C (diabetic, 43.07 ± 18.31 mg/dL vs. controls, 36.95 ± 12.0 mg/dL, $P = 0.01$), HDL-C (diabetic, 47.5 ± 5.4 mg/dL vs. controls, 50.8 ± 11.4 mg/dL, $P = 0.006$) and diastolic blood pressure (diabetic, 83.39 ± 6.5 mm Hg vs. controls, 81.49 ± 4.2 mm Hg, $P = 0.00$).

Risk factors for type 2 diabetes

Logistic regression analysis (**Table 4**) of the combined populations showed a significant association of T2D with BMI, triglycerides, uric acid and hyperten-

Table 2 Anthropometric and biochemical characteristics of the study subjects by sex and disease status in the populations of Jammu

Variable	Cases ($n = 424$)			Controls ($n = 226$)			P value
	Males ($n = 239$)	Females ($n = 185$)	Total ($n = 424$)	Males ($n = 101$)	Females ($n = 125$)	Total ($n = 226$)	
Age (year)	50.48 ± 9.7	46.88 ± 10.5	49.87 ± 9.8	44.68 ± 10.7	43.64 ± 10.7	44.11 ± 10.7	
Onset of T2DM (year)	45.56 ± 8.7	45.54 ± 7.5	45.55 ± 9.1				
Duration of T2DM (year)	7.35 ± 7.0	6.24 ± 5.0^a	6.86 ± 6.25				
BMI (kg/m^2)	26.2 ± 4.7	26.9 ± 4.8	26.52 ± 4.8	25.4 ± 4.2	26.2 ± 4.3	25.9 ± 4.2	0.61
Blood sugar (mg/dL)							
Fasting	158.97 ± 57.3	159.7 ± 58.2	159.3 ± 57.6	82.3 ± 8.3	80.9 ± 7.3	81.6 ± 7.8	0.00001
2 hours	230.23 ± 74.2	228.5 ± 74.0	229.5 ± 74.0	108.0 ± 14.7	106.0 ± 24.1	106.8 ± 20.7	0.00001
Blood pressure (mm Hg)							
Systolic	136.9 ± 17.0	140.0 ± 18.9	138.2 ± 17.9	128.7 ± 13.0	130.2 ± 14.0	129.5 ± 13.6	0.000015
Diastolic	82.61 ± 5.3	83.3 ± 6.4^a	82.9 ± 5.8	81.5 ± 5.1	81.3 ± 5.2	81.4 ± 5.2	0.00003
Urea (mg/dL)	29.9 ± 11.7	27.9 ± 15.9	29.06 ± 13.8	24.7 ± 4.10	23.13 ± 3.6	23.97 ± 3.85	0.00002
Creatinine (mg/dL)	1.12 ± 0.35	1.09 ± 0.41	1.11 ± 0.3	1.01 ± 0.13	1.01 ± 0.25	1.0 ± 0.2	0.011
Total Cholesterol (mg/dL)	171.09 ± 28.1	175.8 ± 32.02	173.14 ± 29.9	170.9 ± 22.9	169.0 ± 19.8	169.9 ± 21.3	0.0012
Triglycerides (mg/dL)	214.92 ± 134.0	190.70 ± 81.2^a	204.3 ± 114.5	191.3 ± 89.6	166.5 ± 52.6^b	178.1 ± 73.13	0.0001
HDL-C (mg/dL)	45.0 ± 4.0	50.63 ± 4.7^a	47.47 ± 5.1	47.05 ± 6.17	51.14 ± 6.8	49.10 ± 6.48	0.00012
LDL-C (mg/dL)	81.01 ± 21.37	84.63 ± 23.09	82.6 ± 22.1	82.4 ± 21.5	82.7 ± 17.4	82.5 ± 19.4	0.052
VLDL-C (mg/dL)	45.67 ± 32.66	38.07 ± 16.08^a	42.34 ± 26.9	40.5 ± 23.0	34.2 ± 11.6^b	37.1 ± 18.1	0.007
Uric acid (mg/dL)	6.0 ± 1.1	5.48 ± 1.0^a	5.7 ± 1.1	6.2 ± 1.1	5.4 ± 0.7^b	5.8 ± 1.01	0.20
Waist length (cm)	94.8 ± 14.6	90.7 ± 15.5	93.28 ± 15.1	96.3 ± 8.8	88.8 ± 14.9^b	93.88 ± 11.50	0.28
Hip length (cm)	95.8 ± 11.8	92.8 ± 12.3	94.70 ± 12.05	98.0 ± 7.4	88.3 ± 13.0^b	94.91 ± 10.47	0.77
WHR	0.97 ± 0.13	0.97 ± 0.12	0.97 ± 0.13	0.98 ± 0.07	1.0 ± 0.05	0.99 ± 0.06	0.33

Values are expressed as mean $\pm$ S.D. P values represent the difference between the diabetic and healthy control samples; a represents the significant difference between male and female diabetic patients. β represents the significant difference between the male and female healthy controls. BMI: body mass index; HDL-C: high density lipoprotein cholesterol; LDL-C: low density lipoprotein cholesterol; VLDL-C: very low density lipoprotein; WHR: waist hip ratio.

Table 3 Anthropometric and biochemical characteristics of the study subjects by sex and disease status in the populations of Kashmir

Variable	Cases(n = 161)			Controls(n = 100)			P value
	Males (n = 97)	Females (n = 64)	Total (n = 161)	Males (n = 50)	Females (n = 50)	Total (n = 100)	
Age (year)	51.52±11.3	49.69±9.6	50.79±10.6	49.14±11.3	44.5±9.2	46.8±10.5	
Onset of T2DM (year)	46.19±11.0	47.21±10.3	46.62±10.7				
Duration of T2DM (year)	7.3±6.5	8.12±4.7	7.71±5.6				
BMI(kg/m ²)	25.54±3.9	27.92±6.1 ^a	26.4±5.0	24.61±3.4	25.8±4.6	25.2±4.1	0.279
Blood sugar (mg/dL)							
Fasting	147.45±46.0	168.09±60.02	155.6±52.85	84.4±7.7	81.5±7.7	82.9±7.8	0.00001
2 hours	210.96±61.3	226.8±81.1	217.3±70.1	113.15±19.6	107.2±19.8	109.9±19.8	0.00003
Blood pressure (mm Hg)							
Systolic	136.29±16.6	142.17±16.3	138.5±16.7	132.4±16.9	127.9±12.3	130.21±14.9	0.000014
Diastolic	82.44±6.7	84.91±5.8	83.39±6.5	82.1±4.4	80.8±3.9	81.49±4.2	0.00002
Urea (mg/dL)	30.94±16.6	28.30±8.7	30.0±14.2	27.6±7.4	23.0±4.5	25.3±6.6	0.039
Creatinine (mg/dL)	1.14±0.33	1.10±0.44	1.12±0.37	1.0±0.16	1.0±0.17	1.04±0.16	0.059
Total Cholesterol (mg/dL)	210.7±84.6	213.7±65.8	211.9±77.5	198.51±58.0	173.9±58.6	185.37±59.3	
Total Cholesterol (mg/dL)	167.07±24.2	178.09±36.4 ^a	171.32±29.9	168.51±22.2	168.8±21.7	168.6±21.8	0.088
HDL-C (mg/dL)	46.2±5.8	49.64±3.8	47.5±5.4	47.5±5.0	53.8±14.5	50.8±11.4	0.006
LDL-C (mg/dL)	79.61±24.84	85.79±32.4 ^a	82.0±28.12	82.01±15.9	84.0±17.6	83.04±16.7	0.014
VLDL-C (mg/dL)	42.09±17.4	44.59±19.6	43.07±18.31	37.8±11.9	36.12±12.3	36.95±12.0	0.012
Uric acid (mg/dL)	5.98±0.94	5.39±0.96	5.7±0.98	6.12±0.98	5.5±0.87	5.7±0.96	0.914
Waist length (cm)	93.12±8.7	93.63±13.5	93.31±10.6	96.7±13.0	86.0±8.4	94.33±12.5	0.719
Hip length (cm)	94.50±9.5	92.81±12.5	93.86±10.6	94.0±10.2	87.5±13.4	92.56±10.4	0.943
WHR	0.98±0.06	1.0±0.05	0.99±0.06	1.0±0.06	0.98±0.05	1.01±0.06	0.754

Values are expressed as mean ± S.D. *P* values represent the difference between the diabetic and healthy control samples; ^a represents the significant difference between male and female diabetic patients. ^β represents the significant difference between the male and female healthy controls. BMI: body mass index; HDL-C: high density lipoprotein cholesterol; LDL-C: low density lipoprotein cholesterol; VLDL-C: very low density lipoprotein cholesterol; WHR: waist hip Ratio.

sion. High BMI (more than 25 Kg/m²) also showed increased risk with an odds ratio of 1.81 (CI-1.01-2.82, *P* = 0.04). Uric acid and hypertension also showed a significant difference in diabetic patients with an odds ratio of 1.51 (CI-0.62-2.13, *P* = 0.01) and 4.24 (CI-2.59-6.92, *P* = 0.00), respectively.

DISCUSSION

The present study was carried out to identify the risk factors responsible for the rapid rise in the prevalence of T2D in Jammu and Kashmir. Although independent studies in the past were carried out in Jammu and Kashmir region (the regions being separated by approximately 300 Km and having different climatic conditions) but this is the first study wherein participants from both Jammu and Kashmir regions have been recruited. India has the dubious distinction of being dubbed as 'Diabetes capital' of the world with a total of 40.9 million diabetic patients, which is estimated to increase to 69.9 million by 2025^[8]. The prevalence of T2D in urban India has risen from 2.1%

in 1970s to 12-16 % in 2002^[9]. In general, Asian Indians have been identified as an ethnic group with high prevalence of T2D^[10]. There have been several studies on the increased incidence of T2D in India, especially South India^[11-12]. The maximum prevalence of diabetic patients in India is found in the age group of above 50 years^[13]. We found that a substantial number of people in their 40 s are developing T2D, as observed in another study from the Jammu region^[14]. This is in contrast to a study conducted 12 years back in the Kashmir region where a higher percentage of diabetic subjects were in the age group of 50-59 years old^[15].

T2D shows a clear familial aggregation. In Western populations, it has been demonstrated that the risk for T2D among offspring with a single diabetic parent was 3.5 folds higher, and for those with two diabetic parents was 6-fold higher compared with offspring without parental diabetes^[16]. A migration study in 1980's showed that 10% of Asian Indian patients had both parents diabetic, compared to only 1 % of European diabetic patients^[17]. In our study, a strong

Fig. 1 Percentage diabetic at the end of each decade in Jammu and Kashmir male and female population. A and B: males and females in Jammu population, respectively. C and D: males and females in Kashmir population, respectively.

family aggregation towards the development of T2D is seen with almost 60% of the diabetic patients with a positive family history, which suggests a genetic background. Similar genetic predisposition towards T2D development is seen in the North Indian Punjabi population and South Indian populations^[18-19].

Hypertriglyceridemia and low HDL-cholesterol are characteristically seen in Asian Indian population^[20]. Dyslipidemia characterized by high triglycerides, LDL, VLDL and low HDL-cholesterol has been observed in our population, which is a contributing factor for the development of T2D in the population of Jammu and Kashmir. It has been seen that Asian

Indians have a higher degree of central obesity at a given BMI^[21] and they develop insulin resistance even though having non-obese BMI^[22-23]. In our study, obesity characterised by BMI > 25 kg/m² has emerged as a significant risk factor for the development of T2D. Thus, high body fat content at the given BMI is responsible for the development of T2D in the Jammu and Kashmir population. The growth of middle class in Jammu and Kashmir is leading to the availability of high caloric junk food. At the same time, as the availability of resources, comfortable transportation facilities or at the working place, the physical activity is reduced with long hours of bench work. Moreover, a

Table 4 Logistic regression analysis of the combined population using T2D as dependent variable on the various clinical parameters

Parameter	Mean $\pm$ S.E	Test of association	
		P value	Odds Ratio (95% CI)
BMI (kg/m ²)			
Normal (18.5-25)		0.29	
High (> 25 ²)	0.524 $\pm$ 0.262	0.049	1.81 (1.01-2.82)
Uric acid (mg/dL)	0.141 $\pm$ 0.316	0.656	1.51 (0.620-2.13)
Blood pressure			
Normal/Hypertension	1.44 $\pm$ 0.25	0.006	4.24 (2.59-6.92)
Triglycerides (mg/dL)			
Desirable(< 150)	-1.73 $\pm$ 0.539	0.003	0.177 (0.06-0.50)
High (> 200)	0.945 $\pm$ 0.422	0.025	3.08 (1.3-7.1)
Creatinine (mg/dL)			
Normal(0.8-1.4)		0.233	
Risk(< 0.8)	-0.901 $\pm$ 0.668	0.177	0.406 (110-1.50)

BMI: body mass index.

huge number of Kashmiri pandits have migrated from Kashmir (temperate climate) and live in migratory camps (subtropical climate), which results in environmental and mental stress. The population living in valley is also under mental stress because of political unrest. The unfavourable changes in the modifiable risk factors, stress and genetic predisposition are leading to the decline in the age of onset and rise in T2D to epidemic levels in Jammu and Kashmir.

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