

T2DM Risk Factors: A Population Based Cross-Sectional Study in Rural Area of Northwest India

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Abstract

Introduction: The largest numbers of diabetic patients are present in our India. Research in diabetes has largely focussed on estimating the burden of disease. However identifying the risk factors is also important. The current study was undertaken with the aim to determine the risk factors of type 2 diabetes mellitus among rural population (30 yrs and above) of Jammu and Kashmir, India.

Material and Methods: A two stage design was used for assessment of risk factors. The first stage involved a questionnaire based assessment for risk factors and second stage involved taking blood samples for fasting plasma glucose. Results: A total of 170 adults out of 2085 submitted to investigation were found to be diabetic giving us a crude prevalence of 8.1%. Body Mass index (BMI), diet and physical activity seems to be strong predictors for diabetes mellitus.

Conclusions: Identifying the risk factors for Diabetes mellitus is the key in planning prevention strategies

Keywords: Diabetes; Body mass index; Diet; Shorter life expectancy; Lifestyle

Introduction

Type 2 Diabetes Mellitus (T2DM) is a metabolic disorder that is characterized by hyperglycaemia in the context of insulin resistance and relative lack of insulin [1]. It is typically a chronic disease associated with a ten year shorter life expectancy. T2DM which comprises 90% of cases of diabetes has increased markedly since 1960 in parallel with obesity [2]. Every year 3.8 million people lose their lives due to diabetes complications which is almost equivalent to loss of life associated with HIV/AIDS [3].

The disease has been recognised as a global epidemic by WHO [4]. The largest numbers of diabetic patients are present in our country making India as the diabetes capital of the world [5]. By 2030, India will lead the world at 79.4 million people with diabetes followed by China with 42.3 mn and USA with 30.3 mn [6]. Though the disease is common both in developed as well as developing countries, it remains uncommon in underdeveloped world [7]. Number of diabetic patients is showing discerning upward trend both in urban as well as rural areas. About 2/3rd of population is residing in rural areas and the rural population have different lifestyles, environment and socio-cultural factors as they are mostly involved in agrarian and allied work pattern. The diabetic patients of the developing world are in 45-65 yrs of age group in contrast to 64-70 years age group in developed world and the figures are likely to touch 50 mn and 85 mn in developed and developing world respectively [8].

Various studies from developed world [9-11] and urban studies from India have pointed to lifestyle changes [12], sedentary lifestyle [13], diet and epidemiological transition [13] as major factors in genesis of T2DM. Among the various risk factors, gender and age have been confirmed by many studies [14] besides area of residence and socio-economic factors like income, literacy, marital status and employment status [15,16]. Among lifestyle risk factors exercise and physical activity are known to be protective while stress has been found to be a specific risk factor for women. Among the physiological risk factors, hypertension, serum triglyceride, high density lipoprotein, cholesterol and body mass index have been incriminated [17,18]. These risk factors may not all be applicable to rural population and it is imperative to identify factors predisposing to the disease in rural areas in particular.

Majority of the studies in India are on prevalence of T2 DM and only a few have focussed on risk factors of T2 DM. Hence the current study was undertaken to determine the risk factors of T2DM among rural population (30 yrs and above) of Jammu and Kashmir, India.

Methodology

This was a cross-sectional population survey using multi-stage cluster randomized sampling conducted from January to April 2013 in Miran Sahib Area of Jammu district in north India, involving 2085 adult subjects. The study was approved by the institution ethics committee. The PHC Miran Sahib caters to a population of 22000 and has 5 sub health centres to deliver health and family welfare services.

The study was planned across all sub health centres and was restricted to all adults 30 years and above available in their house on the day of survey. With an estimated prevalence for diabetes among adults in urban areas of India at 12%, confidence limit of 5% and design effect of 1, the estimated sample size for population survey comes to 448. So it was decided that 448 adults will be selected from each sub centre area totalling 2240 from Miran Sahib Area. The first house was selected from within each selected sub centre area by simple random sampling. Starting from that house, all the eligible people ≥ 30 yr of age were screened from the consecutive houses till a sample size of at least 448 was reached in that sector. Subjects having any acute illness like fever and/or on medications likely to increase plasma glucose such as glucocorticoid, and pregnant females were excluded from the study. The study protocol was approved by Institutes Ethics Committee. The procedure was explained to the participants at least a day prior to the study and informed written consent was obtained from each.

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Detailed history regarding age, gender, level of literacy, any chronic illness in the participants or their family was recorded. Physical activity of the participants was recorded on a proforma adapted from Global Physical Activity - Questionnaire 2 (GPAQ-2) of World Health Organization (WHO), and classified as high, moderate or low physical activity. The Socio-Economic Status (SES) scale as described by Kuppuswamy which takes into account the education of the head of the family, occupation of the head of the family, and monthly income of the family was followed. Height and weight was measured thrice and mean was noted. Height was recorded on a stadiometer to the nearest mm. Weight was measured by a digital weighing machine to the nearest 100 g and was calibrated using standard weight every day. All the study participants were invited for investigation for Diabetes and for that were asked to remain empty stomach in the morning.

After an overnight fast of 8-14 h, capillary plasma glucose estimation was done with a glucometer using glucose-oxidase method (One Touch Ultra 2, Johnson and Johnson, Mumbai). For the diagnoses of diabetes the 1999 WHO criteria for capillary plasma glucose were used. Diabetes was defined as Fasting Plasma Glucose (FPG) ≥ 126 mg/dl (≥ 7 mmol/l) or 2 hPG ≥ 220 mg/dl (≥ 12.2 mmol/l), or both.

Statistics

The data was analysed used SPSS-21. The relative importance of each variable was expressed using odds ratio.

Results

A total of 155 adults were found have eaten something in the morning and were therefore excluded from the study giving us a response rate of 93%. The remaining 2085 adults aged 30 years and above comprised the study population. Male subjects (53.53%) slightly outnumbered the females. Majority (42.30%) of the population was between 30-39 years of age. As the age increased the number of subjects kept on decreasing with least number of them belonging to the age group of ≥ 70 years (Table 1 and Figure 1).

A total of 170 out of 2085 subjected to estimation of fasting plasma glucose were identified as diabetic as per the definition, gives us a crude

Age group	Males	Females	Total (%)
30-39 years	506	376	882 (42.30)
40-49 years	263	261	524 (25.13)
50-59 years	206	160	366 (17.55)
60-69 years	81	101	182 (08.74)
≥ 70 years	60	71	131 (06.28)
Total	1116	969	2085 (100)

Table 1: Age and Sex wise distribution of study population aged ≥ 30 Years.

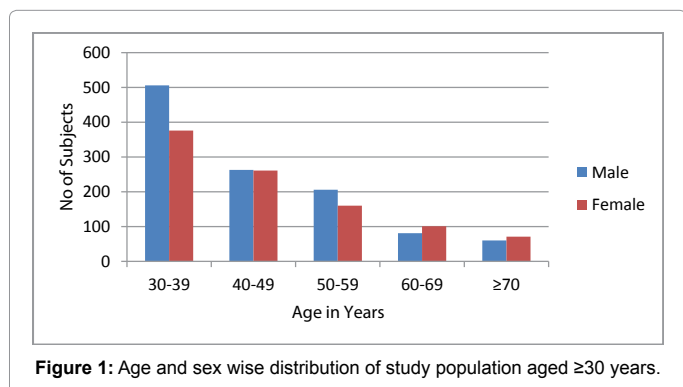


Figure 1: Age and sex wise distribution of study population aged ≥ 30 years.

prevalence of 8.1% (170/2085).

Results have shown that the people with literacy level upto SSC had maximum (36.36%) number of diabetic cases. The odds of having diabetes decreased as the literacy level decreased, however those subjects who were illiterate had more odds of having diabetes than those studied up to primary level. On the basis of socio-economic status, upper middle class had maximum prevalence of diabetes (11.47%) followed by middle class (8.67%) (Table 2 and Figure 2).

As the amount of physical activity done by subjects increased, the risk of them having diabetes decreased. It was found that people doing vigorous physical activity are at 4 times (OR=0.25) lower risk of having diabetes than those involved in mild activity. Similarly those subjects who had their BMI in normal range had only 0.02 odds of suffering from T2DM than obese subjects. Occupation wise also heavy workers had minimum (5.19%) prevalence of diabetes with almost 3 times (OR=0.34) lower risk than sedentary workers. Statistical association of physical activity, BMI and occupation with diabetes was found to be significant (Table 3).

The dietary pattern showed that diabetes was more prevalent (18.57%) in those consuming non-vegetarian diet ($p < 0.001$). Smokers had slightly lower risk of diabetes (OR=0.8) than non-smokers ($p = 0.28$) while alcoholics had only 1.12 odds of having diabetes than non-alcoholics ($p < 0.001$). Family history of diabetes proved to be one of the most significant risk factor for diabetes with those with positive family history having 237 times higher chances of having diabetes than those with negative history ($p < 0.0001$) (Table 4).

Discussion

The present study assessed the association of various risk factors with T2DM among known cases of diabetes in a rural area of northern India. Advancing age was found to be a non-modifiable risk factor as 68/170 (40%) subjects were in 50-59 years of age. The results concur with those reported by Valliot et al. [14] King et al. [8] NUDS [19] and CUPS [16] studies.

A higher prevalence of T2DM was found in diabetic patients who belonged to the upper and middle socio-economic class and these results are in agreement with those reported by Sarfraj et al. [20] and Mohan et al. [16] This shows that although non communicable diseases have started to spread over rural areas but with a higher prevalence in those people enjoying better socio-economic status. However, Emile Agardh et al. [20] and Denis et al. [21] reported contrasting results and hence points towards the slow spread in lower socioeconomic class also.

Higher literacy status was thought of being protective in the causation of T2DM however to our surprise it was seen in the current study that those with higher literacy levels had more chances of suffering from diabetes ($p < 0.01$). The most likely explanation could be that more literate T2DM patients were involved in occupations involving sedentary habits which ultimately lead to obesity. The findings concur with those reported by Bharati et al. [22] but disagree with the facts reported by Kautzky-Willer et al. [23].

Occupation wise, heavy and moderate workers had lesser odds of getting T2DM in comparison to sedentary workers and similar results were reported by Kelestimer et al. [24], Hu et al. [25] and Jayawardane et al. [26] BMI as a risk factor for T2DM was found to be statistically significant and the results were in line with those reported by Gupta et al. [17] Peer et al. [16] and Singh et al. [27].

Socio-demographic variable	Diabetics N (%)	Non diabetics N (%)	Total N (%)	OR ± 95% CI	P value
Literacy Level					
Illiterate	95 (08.71)	995 (91.29)	1090 (100)	0.16 (0.09-0.31)	<0.01
Primary	14 (02.05)	666 (97.95)	680 (100)	0.03 (0.01-0.08)	
Middle	30 (14.15)	182 (85.85)	212 (100)	0.28 (0.14-0.60)	
SSC	20 (36.36)	035 (63.64)	55 (100)	1	
HSC and above	11(22.91)	037 (77.09)	48 (100)	0.52 (0.19-1.34)	
Socio economic status					
Upper middle	07 (11.47)	054 (88.53)	061(100)	1	0.12
Middle	62 (08.67)	652 (91.33)	714 (100)	0.73 (0.31-1.99)	
Lower middle	68 (08.00)	781(92.00)	849 (100)	0.67 (0.28-1.81)	
Lower class	29 (08.20)	324 (91.80)	353 (100)	0.69 (0.27-1.96)	
BPL	04 (03.70)	104 (96.30)	108 (100)	0.29 (0.06-1.23)	

Table 2: Association of literacy level & socio economic status with diabetes mellitus among study population.

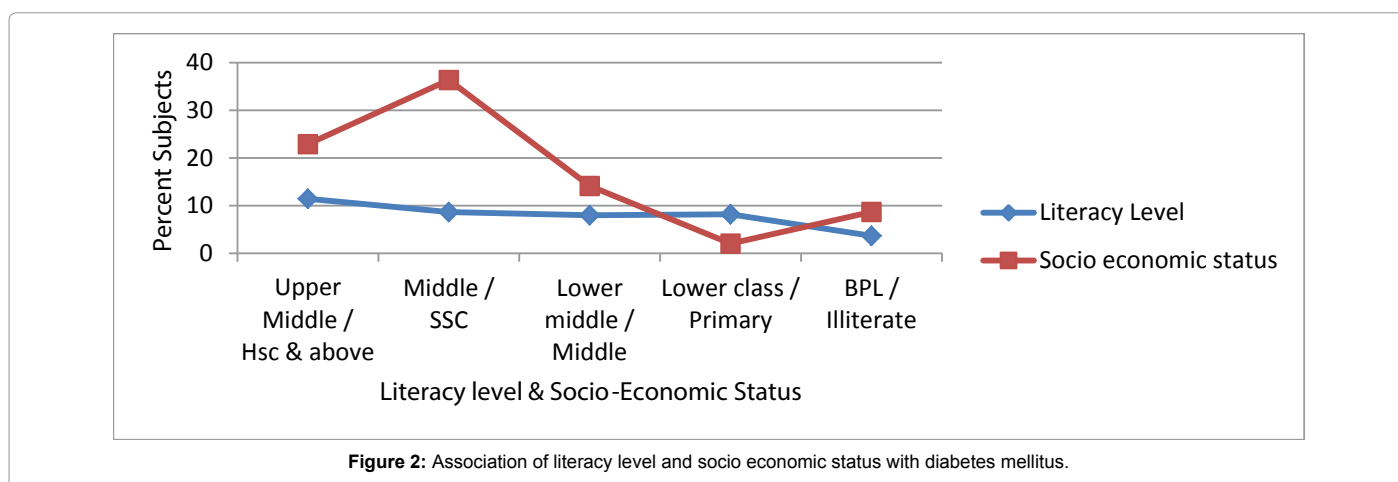


Figure 2: Association of literacy level and socio economic status with diabetes mellitus.

Risk Factor	Diabetics N (%) (n=170)	Non diabetics N (%) (n=1915)	Total N (%) (n=2085)	OR ± 95% CI	P value
Physical activity					
Mild	110 (14.43)	652 (85.57)	762 (100)	1	<0.001
Moderate	52 (04.61)	1075 (95.39)	1127 (100)	0.28 (0.19-0.40)	
Vigorous	8 (04.08)	188 (95.92)	196 (100)	0.25 (0.10-0.52)	
Physical Status*					
18.5-24.99 (Normal)	20 (1.36)	1444 (98.64)	1464 (100)	0.02 (0.01-0.05)	<0.05
25-29.99 (Over weight)	88 (20.60)	339 (79.4)	427 (100)	0.55 (0.37-0.82)	
≥ 30 (Obese)	62 (31.9)	132 (68.10)	194 (100)	1	
Occupation					
Sedentary Worker	68 (13.68)	429 (86.32)	497 (100)	1	<0.001
Moderate Worker	98 (06.48)	1413 (93.52)	1511(100)	0.43 (0.31-0.61)	
Heavy Worker	4 (05.19)	73 (94.81)	77 (100)	0.34 (0.08-0.97)	

Table 3: Relation of physical activity, body mass index (BMI) and occupation with diabetes mellitus among study population.

A higher number of T2DM patients in the current study were found to be non-vegetarian and these results concur with the results reported by EPIC Inter Act study [28].

For T2DM, it has been aptly said ‘Genetics loads the cannon and obesity fires it.’ The current study found that 60% of T2DM patients had a positive family history of the disease which is in agreement with other studies [28-30]. Both alcohol and smoking have been documented as independent risk factors for T2DM. The higher prevalence of T2DM in alcoholics in the current study concurs with those reported by Dutt et al. [31] and Kokiwar et al. [32] Further, T2DM was more in non-smokers

in the present study. Similar results were reported by Benjamin et al. [33] though Carde Will et al. [34] reported a dose response relationship between smoking and T2DM.

Conclusion

India emerging as ubiquitous capital of T2DM needs urgent primary and secondary preventive measures to check discerning upward trend of disease. A variety of risk factors incriminated in the genesis of T2DM have regional and ethnic variation. The results have reinforced various risk factors like age, family history, higher socio-economic status, sedentary

Risk Factor	Diabetics N (%) (n=170)	Non diabetics N (%) (n=1915)	Total N (%) (n=2085)	OR ± 95% CI	P value
Dietary pattern					
Vegetarian	89 (05.39)	1560 (94.61)	1649 (100)	0.25 (0.17-0.35)	<0.001
Non vegetarian	81 (18.57)	355 (81.43)	436 (100)	1	
Smoking status					
Smoker	33 (6.96)	441(93.04)	474 (100)	0.80 (0.52-1.20)	0.28
Non smoker	137 (8.50)	1474 (91.5)	1611(100)	1	
Alcohol intake					
Alcoholic	43 (8.84)	443 (91.16)	486 (100)	1.12 (0.76-1.63)	<0.001
Non alcoholic	127 (7.95)	1472 (92.05)	1599 (100)	1	
Family h/o DM					
Present	102 (89.47)	12(10.53)	114(100)	237.87 (121.83-493.50)	<0.001
Absent	68 (3.45)	1903(96.55)	1971(100)	1	

Table 4: Relationship of dietary pattern, smoking, alcohol and family history with DM among survey population.

lifestyle and higher BMI as significant in T2DM genesis.

Higher diabetes rates in non-vegetarians, alcoholic's points that patients should follow balanced diet plan and at the same time should refrain from any kind of substance abuse.

Limitations

The authors recommend more studies in different rural areas of India before the results could be generalised. Many of the other risk factors which have a role to play in causation of T2DM need to be explored.

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