RESEARCH ARTICLE

AN ALARMING PREVALENCE OF DIABETES AND ITS ASSOCIATED RISK FACTORS AMONG COLLEGE GOING INDIAN ADULTS: A RETROSPECTIVE STUDY

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ABSTRACT

Background: The prevalence of diabetes among college going Indian adults is lacking.

Aims & Objective: This study was aimed to bring in awareness about the prevalence of diabetes and its associated risk factors among college going Indian adults.

Material and Methods: This was a cross sectional retrospective study. Data were collected from the records maintained in VIT University Health Centre, Vellore, India. The records were selected randomly and observed for parameters such as blood glucose, blood pressure, cholesterol, triglycerides and anthropometric measurements. The chi-square test, P value and odds ratio indicating the association between each risk factor and diabetes were calculated using the statistical program SPSS v 16.0 for windows.

Results: Of the 1001 records scrutinized, 9% were found to be diabetic. Among the diabetic population, 95.5% had type-2 diabetes and only 4.5% had type-1 diabetes. Obesity (OR 2.21, 95% CI 1.37-3.57), hypertension (OR 4.65, 95% CI 2.87-7.55), hypercholesterolemia (OR 5.5, 95% CI 3.08-9.93), hypertriglyceridemia (OR 4.1, 95% CI 2.2-7.63), anaemia (OR 2.4, 95% CI 1.2-4.82), and stress (OR 1.53, 95% CI 1.01-2.32) were found to be significantly associated with diabetes.

Conclusion: We conclude that the sedentary and affluent life style accompanied by stress among college going adults have made them fall prey to obesity, hypertension and dyslipidaemia which is ultimately reflected by an increase in the prevalence of diabetes. Hence it is high time to encourage the adults to be aware of the importance of physical activities and protect them from metabolic disorders such as diabetes and obesity.

KEY-WORDS: Diabetes; Indian Adults; Prevalence; Risk Factors; Stress; Obesity

Introduction

Diabetes is an issue of great concern for many years all over the world because of its debilitating effects. It is solely responsible for 4 million deaths per year accounting for 9% of global mortality.[1] There is a huge clinical and economic burden all over the world because of the exponential increase in the prevalence of diabetes in the last 20 years.[2] It has been reported by the World Health Organization that there are currently 220 million people living with diabetes worldwide. According to the International Diabetes Federation, the developing countries contribute for more than 75% of the world's diabetic population.[3] India, with the largest number of diabetic patients is often referred to as the diabetes capital of the world. This statement cannot be denied because diabetic population in India is expected to rise from 40.6 million in 2006 to 79.4 million by 2030.[4]

The prevalence of diabetes varies widely between populations, reflecting the influence of both environmental and genetic susceptibilities.[5] The so called "Asian Indian phenotypes" are highly susceptible to diabetes because of the clinical and biochemical anomalies such as increased insulin resistance, central obesity and c-reactive proteins with a decreased adiponectin level.[6] Apart from the genetic factors, the sedentary life style and the change in dietary pattern has contributed to a great extent to the increased frequency of diabetics in India. This is very well reflected by the increased prevalence of diabetes in urban areas.[7] It has been evinced that the percentage of diabetics in urban Indian adult is 12.1, the onset of which is about a decade earlier than their western counterparts.[8] This means that the Indian adults have a greater chance for getting various diabetic complications even during their productive period of life. So it is high time to bring in awareness about the prevalence of diabetes among college

going adults and to encourage them in daily physical activities in order to prevent the risk factors such as stress, obesity, hypertension and dyslipidaemia.

The present study was designed to identify the prevalence of diabetes and its associated risk factors among the students and faculty members of VIT University (VITU), Vellore, India. Since VITU houses a diverse population from different parts of India, it can be considered as a representative for the prevalence of diabetes among college going adults of the entire nation.

Materials and Methods

Data Collection

The data were collected from the health centre housed in VIT University, Vellore, India. All the students and faculty members undertake a health check-up during their enrolment, in which both the serum and urine biochemistry is being analyzed and recorded. Since VITU health centre caters and maintains the record of both the students and faculty members of the university, a retrospective study was performed in VITU health centre. The data were collected from the records and filed manually. The records were selected randomly and scrutinized for specific parameters pertaining to our study. Different parameters such as the blood glucose level, type of diabetes, family history of diabetes, blood pressure, cholesterol, triglycerides and the general parameters such as age, gender, nativity and anthropometric measurements (height and weight) were identified and gathered. Body Mass Index was calculated as (weight in kg) / (square of height in meters), which reflects the measure of body fat. Patients who were reported to visit the health centre with headache and tiredness, at a frequency of one visit per month were considered to be under stress.[9]

Data Segregation

The data collected were segregated into different groups and the groups were coded as 1, 2, and 3 for easy reference and analysis. The grouping was done such that the entire study population pertaining to a risk factor could be accommodated in any of the three groups. The study population

with different BMI were segregated as normal (18.0-24.9), overweight (25.0-29.9), and obese (above 30). Patients with a cholesterol level above 200 mg/dl and triglyceride level above 180 mg/dl were considered to be at risk for dyslipidemia according to the classification by World Health Organization.[10]

Statistical Analysis

Statistical analyses were done using SPSS version 16.0 for windows. The chi square test was used to compare the distribution of the risk factors among the subjects with and without diabetes. Odds ratio indicating the association between each risk factor and diabetes were also calculated.

Results

Of the 1001 records collected and scrutinized, 9% (n = 90) were found to be diabetic. Among the diabetic patients, 95.5% belong to type-2 and only 4.5% had type-1 diabetes. The percentage distribution of the diabetic population with respect to each parameter is listed in Table 1. The chi-square value, *P* value and odds ratio value for each risk factor and its association with diabetes is shown in Table 2.

Table-1: Distribution of Study Population

Parameters		Diabetic N (%)	Non-diabetic N (%)	Total N (%)
Age	15-35	19 (21.1)	664 (72.8)	683 (68.3)
	35-55	58 (64.4)	221 (24.3)	279 (27.8)
	Above 55	13 (14.5)	26 (2.9)	39 (3.9)
Gender	Male	73 (81.1)	661 (72.6)	734 (73.3)
	Female	17 (18.9)	250 (27.4)	267 (26.7)
Nativity	Urban	73 (81.1)	787 (86.4)	860 (85.9)
	Rural	17 (18.9)	124 (13.6)	141 (14.1)
Diabetes	Type-1	4 (4.5)	-	4 (0.4)
	Type-2	86 (95.5)	-	86 (8.6)
Heredity of Diabetes	Yes	14 (15.5)	119 (13.1)	133 (13.3)
	No	76 (84.5)	792 (86.9)	868 (86.7)
BMI	Normal	63 (70.0)	782 (85.8)	845 (84.4)
	Overweight	22 (24.4)	99 (10.9)	121 (12.1)
	Obese	5 (5.6)	30 (3.3)	35 (3.5)
Blood Pressure	Normal	59 (65.6)	819 (89.9)	878 (87.7)
	Hypertensive	31 (34.4)	78 (8.6)	109 (10.9)
	Hypotensive	0.0	14 (1.5)	14 (1.4)
Cholesterol	Normal	70 (77.8)	872 (95.7)	942 (94.1)
	At risk	20 (22.2)	39 (4.3)	59 (5.9)
Triglycerides	Normal	74 (82.2)	871 (95.6)	945 (94.4)
	At risk	16 (17.8)	40 (4.4)	56 (5.6)
Stress	Yes	34 (37.8)	316 (34.7)	350 (34.9)
	No	56 (62.2)	595 (65.3)	651 (65.1)
Anaemia	Yes	11 (12.2)	44 (4.8)	55 (5.5)
	No	79 (87.8)	867 (95.2)	946 (94.5)

Table-2: Analysis of Risk Factors and their Association with Diabetes

Parameters	Chi-Square Value	Adjusted Odds Ratio	95% CI	P value
Urbanization	1.49	0.71	0.41- 1.24	0.221
Obesity	11.0	2.21	1.37- 3.57	0.001
Hypertension	45.11	4.65	2.87- 7.55	0.0001
Heredity	0.05	1.1	0.59- 1.94	0.825
Hypercholesterolemia	39.85	5.5	3.08- 9.93	0.0001
Hypertriglyceridemia	22.77	4.1	2.20- 7.63	0.001
Stress	3.98	1.53	1.01- 2.32	0.0001
Anaemia	6.49	2.40	1.20- 4.82	0.011

Age and Gender

21.1% of the diabetic people were affected by diabetes during their productive period (age group of 15-35) of life. These patients are more prone to various diabetic complications even when they are young. 64.4% of the diabetic patients were within the age group of 35-55, which shows that the prevalence of diabetes increased with age.[6] Since it is a university based study, the percentage of diabetic patients who were above 55 is relatively low (14.5%). 81.1% of the diabetic patients were found to be male whereas only 18.9% were found to be female. The inclination of diabetes towards the male population might be because of their increased exposure to various external factors such as junk food, smoking and alcoholism.

Obesity

The sedentary and affluent lifestyle has increased the prevalence of obesity among college going students and faculties. Though obesity shows a familial aggregation among Indian population, central obesity which is caused by lack of physical activity and consumption of junk food has a greater impact on diabetes.[8] In our study, we observed that 24.4% of the diabetic patients were overweight and 5.6% obese, which revealed that obesity plays a role in causing diabetes. In accordance with other results, obesity was found to be associated with diabetes in our study (chi-square value = 11.0; OR = 2.21; P = 0.001).

Hypertension and Stress

Stress is a kind of mental disturbance that arises due to various environmental and physiological factors. During a stressed situation, there is a constant release of stress hormones and glucocorticoids that act systematically to increase the abdominal fat, thus increasing obesity.[11] Studies have shown that stress is associated with high BMI and thus related to diabetes.[12] In our study, 37.8% of the diabetic patients were found to be under stress. Simultaneously, 34.9% of the study population was found to be under stress, which shows that stress has become inevitable among college going students. From the results we found that stress is correlated to diabetes with an odds ratio of 1.53, 95% CI 1.01-2.32, chi-square value of 3.98, and P value of 0.0001. Interestingly, there is no hypotensive patient among diabetic population in our study. However, 34.4% were found to be hypertensive and there exists a strong correlation between hypertension and diabetes (chi-square value = 45.11; OR = 4.65; 95% CI = 2.87-7.55; P = 0.0001).

Dyslipidaemia

Patients with a cholesterol level above 200 mg/dl and triglyceride level above 180 mg/dl were considered to be at risk for dyslipidaemia.[10] The prevalence of dyslipidaemia, which is very common in diabetics, varies between 20-90% based on the ethnic group, type of diabetes, obesity and control of diabetes.[13] In our study, 22.2% and 17.8% of the diabetic population was found to have hypercholesterolemia and hypertriglyceridemia respectively. Both hypercholesterolemia (chi-square value = 39.85; OR = 5.5; P = 0.0001) and hypertriglyceridemia (chi-square value = 22.77; OR = 4.1; P = 0.001) were found to be strongly associated with diabetes.

Anaemia in Diabetics

Of the observed diabetic population, 12.2% were found to be anaemic. Though anaemia is common among type-2 diabetic patients, type-1 patients were also reported to have anaemia.[14] Interestingly, in our study, anaemia was observed in all the type-1 diabetic patients and we have also observed a strong correlation (chi-square value = 6.49; OR = 2.40; P = 0.011) between the prevalence of diabetes and anaemia.

Family History of Diabetes and Urbanization

In rural Indian population, the prevalence of diabetes is reported to be in the range of 1-5%.[15] However, in urban population the prevalence ranged from 1.6-9% which revealed the impact of urbanization in causing diabetes.[7] The dietary practices and life style factors among urban population has contributed to the increased prevalence of diabetes in them. In our study, 81.1% of the diabetic patients were from urban areas and only 18.9% were from rural areas. The reason for the inclination towards urbanization might be because of the fact that VIT is a deemed university and most of the students enrolled are from urban background. Though diabetes is proven to have familial aggregation, we could not observe any association between family history and diabetes (chi-square value = 0.05; *P* = 0.825). The reason might be because the family history of diabetes may not have been entered in the record for all diabetic patients.

Discussion

This study was performed in VITU health centre, Vellore, India to find the prevalence of diabetes and its associated risk factors among college going adults. The results obtained in this study symbolize the prevalence of diabetes and its risk factors such as stress, obesity, dyslipidaemia, and hypertension of college going adults of the entire nation.

Stress has become very common among college going young Indian adults because of the improvised education system, competitive peer pressure, uncertainty about future, and emotional factors. This is very well reflected by our observation that 34.9% of the study population are under stress. Stress has been proven to be associated with high BMI and obesity in several studies.[11,16] Heracildes et al. have shown that there exists a strong correlation between stress, obesity and type-2 diabetes mellitus. But it was found that the association is gender specific and it also depends on body weight.[17] Women who were observed with high epinephrine level, which is an indicator of stress and high abdominal fat, were found to have high blood glucose level. However, the nature of association is not yet understood.[9] In our study, we observed that stress is correlated with diabetes with an odds ratio of 1.53.

Several studies have reported that obesity is strongly associated with diabetes.[18,19] It is considered as the most important modifiable risk factor for diabetes. In our study, we observed that 24.4% of the diabetic population was overweight and 5.6% were obese, and obesity is associated with diabetes with an odds ratio of 2.2. The sedentary life style and lack of physical activity among college students have enhanced the persistence of obesity. Though obesity shows a familial aggregation, central obesity typified by high waist to hip ratio (WHR) is found to be a risk factor for diabetes.[20] Every 0.04 unit increase in WHR was associated with four fold increase in diabetes in Asian Indians. The increased risk posed by central obesity on diabetes and other metabolic disorders could be related to high fat cell number in adipose tissue, high blood flow and increased receptor level for cortisol and testosterone.[21] Though the endocrine, inflammation, neural and cell intrinsic pathways have been found to be down regulated in obesity, the exact mechanism mediating the insulin resistance is not known.[22]

The deposition of visceral fat, indicated by central obesity is found to be a risk factor for dyslipidaemia.[21] Dyslipidaemia and hypertension are associated with diabetes through its link to BMI.[23] Prevalence of hypertension in adults with diabetes is found to be higher than without diabetes, which substantiates the association between diabetes and hypertension.[24] The prevalence of dyslipidaemia was reported to be high (27%) in an urban Indian study.[25] On the other hand, only 7.1% were found to be dyslipidaemic in a rural community of Punjab.[26] This signifies the impact of urbanization on dyslipidaemia.

The modern life style has attracted the people from village to move towards cities and this migration has increased in the last two decades. There exists a strong correlation between urbanization and diabetes, because of the change in dietary practices, which has been demonstrated by various studies.[27,28] Though we identified the

association between diabetes and urbanization in our study, the result has to be interpreted with caution because 85.9% of the study population was from urban background. In India, nearly 75% of type-2 diabetics are reported to have first degree family history of diabetes, indicating a strong familial aggregation.[29] However, we could not find any association with familial aggregation in our study, because of the fact that family history of diabetes may not be noted down in the record.

Study Limitations

Since it is a clinic based study, it would have introduced referral bias to some degree. The genetic susceptibilities to various risk factors such as obesity, hypertension, and dyslipidemia were not taken into consideration in our study. Further, since it is collected from records, the study is highly restricted to the data that are available in the record. Both the staffs and students would have visited some other clinics other than the health center, when they were encountered with severe illness. So there is a chance to miss out few parameters which were not recorded.

Conclusion

From our results, we found that diabetes and its associated risk factors are highly prevalent among the college going students and faculty members. Since it is a university based analysis, it gives a glimpse for the prevalence of diabetes among adults of the entire nation. The sedentary and affluent life style along with stress, which has become inevitable among college going adults has been added to the list of contributing factors for diabetes along with obesity, hypertension and dyslipidemia. Since stress is associated with obesity and obesity has a strong association with diabetes, stress becomes a risk factor for diabetes through its link to BMI. As a result, it is high time to encourage the adults for daily physical activities to avoid the burden of metabolic disorders such as diabetes during their productive period of life.

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