RISK FACTORS OF DIABETIC PATIENTS IN AN URBAN AREA OF AURANGABAD, MAHARASHTRA- A COMMUNITY BASED CASE CONTROL STUDY

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ABSTRACT

BACKGROUND

Prevalence of diabetes in India is 9.1%. Diabetes and its complications are major causes of early death. According to International Diabetes Federation (IDF) approximately 5.1 million people aged between 20 and 79 years died from diabetes in 2013, accounting for 8.4% of global all-cause mortality among people in this age group. This estimated number of deaths is similar in magnitude to the combined deaths from several infectious diseases which are major public health priorities, and is equivalent to one death every six seconds. Diabetes imposes a large economic burden on individuals, families and national health system.

The aim and objective of the study is to assess the risk factors of diabetes among diagnosed diabetic patients in field practice area of medical college in Aurangabad, Maharashtra.

MATERIALS AND METHODS

A community-based case control study was conducted in field practice area of medical college in Aurangabad during the period of July 2015 to October 2016.

RESULTS

High WHR (89% cases, 67.6% controls), high BMI (70.3% cases, 33.1% controls) were significantly associated with diabetes mellitus with a $p< 0.05$. Risk factors like inadequate physical activity (61.4% cases, 13.1% controls) and family history of DM (38.6% cases, 6.9% control) were also found to be significant.

CONCLUSION

Multiple Logistic Regression analysis showed that BMI, WHR, Family history of Diabetes and Physical inactivity were significantly associated with occurrence of Diabetes**.**

KEYWORDS

Diabetes mellitus, Risk factors, urban area.

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BACKGROUND

Diabetes and its complications are major causes of early death in most countries. According to IDF approximately 5.1 million people aged between 20 and 79 years died from diabetes in 2013, accounting for 8.4% of global all-cause mortality among people in this age group. This estimated number of deaths is similar in magnitude to the combined deaths from several infectious diseases that are major public health priorities, and is equivalent to one death every six seconds. With 1.2 million deaths in 2013, this Region (SEA) has the second highest number of deaths attributable to diabetes of any of the seven International Diabetes Federation Regions. That figure represents 14.2% of all adult deaths in the Region. India is the largest contributor to regional mortality, with 1.1 million deaths attributable to diabetes in 2013.[1]

Diabetes imposes a large economic burden on individuals and families, national health systems, and countries. Health spending on diabetes accounted for 10.8%

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of total health expenditure worldwide in 2013. Global health spending to treat diabetes and manage complications totaled at least USD 548 billion in 2013. An estimated average of USD 1,437 per person with diabetes was spent globally on treating and managing the disease in 2013. Despite the huge number of people with diabetes in the South-east Asia Region, healthcare spending on diabetes was estimated to be only USD 6 billion, accounting for less than 1% of the global total, with India estimated to have spent the largest proportion.[1,2] A recent study in south India reveal that, the average total cost per diabetic patient without complications was USD 29.91 and the average total cost for the treatment of diabetes with co-morbidities per patient was found to be USD 314.15.[3] It is predicted that by 2035 diabetes mellitus may afflict up to 109.0 million individuals in India, only second to China (142.7 million) followed by the United States (29.7 million) will also see significant increases in those affected by the disease. Many influences affect the prevalence of disease throughout a country, and identification of those factors is necessary to facilitate change when facing health challenges.[1,4,5]

Risk Factors for Type 2 Diabetes Mellitus

1) Family history of diabetes (i.e., parent or sibling with type 2 diabetes) 2) Obesity (BMI ≥25 kg/m^2) 3) Habitual physical inactivity 4) Race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander) 5) Previously identified IFG or IGT 6) Hypertension (blood pressure >140/90 mmHg) 7) HDL cholesterol level <35 mg/dL (0.90 mmol/L) and/or a triglyceride level >250 mg/dL (2.82 mmol/L) 8) Polycystic ovary syndrome or acanthosis nigricans 9) History of vascular disease.

Many studies have elaborated the associations between several risk factors and the risk of type 2 diabetes. Body mass index (BMI), lipids, smoking, physical inactivity, dietary patterns, and family history are significantly associated with risk of diabetes mellitus. Better recognition of distribution of pattern of risk factors in the population can help the policy makers in their decision making. This study evaluates the major risk factors of diabetes mellitus in the population.[6-10]

MATERIALS AND METHODS

The study was a community-based case control study; conducted in field practice area of medical college in Aurangabad which was conducted during the period of July 2015 to October 2016.

Sample Size (N)

As the total population of city was 38, 376 (in 2015); so adult population of age >20 years would be 60% of total population i.e. 23, 025 with a prevalence of 9.1% in the population. OpenEpi, Version 3 software was used for the calculation of sample size. At 95% confidence level sample size of 127 was attained. Assuming the non-response rate of 10% sample size was rounded upto 145. (6)

Study Subjects (Cases)

Previously diagnosed diabetic patients with age of ≥20 years were regarded as the study subjects and included in the study. Considering the inclusion & exclusion criteria, patients were selected for study.

Inclusion Criteria

1. Previously diagnosed diabetic patients aged ≥20 years.
2. Who were permanent resident (>6 months) of study area.
3. Who had given written informed consent.

Exclusion Criteria

1. Relative of the household who came for short duration.
2. Patients who were in other areas during data collection.
3. Patients aged <20 years.
4. Patients who were not willing to participate in the study

Controls

We took controls of same age group and sex as that of cases (Table 1). Controls were selected from family adjacent to the family of case in the same ward.

Sampling Technique

The study area (field practice area of RHTC) comprises of 20 wards with variable population so we used Probability proportionate to Size (PPS) sampling technique to identify number of participants to be selected from respective wards**.** (RHTC- a 30 bedded hospital is situated in Paithan city having a Municipal council.

In each ward central lane (road) was identified. Then at entry point of each lane right hand house was identified, and from that house; by keeping right hand direction; we continued door to door survey, till we got proportionate patients from each ward. All the households (aged ≥ 20 years) were asked about the known case of diabetes patients. Diabetic patients were interviewed based on our predesigned pretested questionnaire.

We took controls of same age group and sex as that of cases (Table 1). Controls were selected from family adjacent to the family of case in the same ward. Non-diabetic persons were interviewed based on our preformed pretested questionnaire. Anthropometries (like weight, height, waist circumference and hip circumference) of controls were taken by investigator himself.

Ethical Consideration

Ethical clearance of the study was obtained from ethical committee of our medical college. Informed written consent of each of the participant was obtained

Data Analysis

Statistical analysis was carried out with help of statistical measures, such as percentages, proportion, bivariate analysis and multiple logistic regressions along with other necessary statistical tools and techniques, using SPSS version 23. Statistical analysis plan: Data were analysed following data analysis plan.

RESULTS

1. High WHR was significantly associated with diabetes. 89% cases had abnormally high WHR as compare to 67.6% in controls.
2. High BMI was significantly associated with diabetes. 70.3% cases had abnormally high BMI as compare to 33.1% in controls.
3. Family history of DM was significantly associated with diabetes. 38.6% cases have positive family history of diabetes as compared to 6.9% in controls.
4. Inadequate physical activity was significantly associated with diabetes. 61.4% cases had inadequate physical activity as compared to 13.1% in controls.

Age Group (in years)	Cases		Controls	
	Male	Female	Male	Female
20 – 30	00	01	00	01
31 – 40	06	05	06	05
41 – 50	07	17	07	17
51 – 60	20	23	20	23
61 – 70	27	26	27	26
>70	08	05	08	05
Total	**68**	**77**	**68**	**77**

Table 1. Matched Cases and Controls Based on Age Group and Sex

Educational Status	Sex		Total (%)
	Male	Female	
Illiterate	20	34	54 (37.24)
Primary school	08	12	20 (13.79)
Middle school	12	13	25 (17.24)
High school	13	10	23 (15.86)
Intermediate/diploma	08	05	13 (8.96)
Graduate/PG	06	03	09 (6.20)
Professional	01	00	01 (0.70)
Total	**68**	**77**	**145 (100)**

Table 2. Distribution of Diabetic Patients According to Educational Status (Total=145)

(Figures in parenthesis indicate percentages)

χ^2 = 6.62, df = 5; p= 0.25 (Here we have merge the graduate and professional during applying chi square test)

Educational status	Sex		Total (%)
	Male	Female	
Illiterate	24	30	54 (37.2)
Primary school	08	7	15 (10.3)
Middle school	06	12	18 (12.4)
High school	15	11	26 (17.9)
Intermediate/diploma	06	09	15 (10.3)
Graduate/PG	09	07	16 (11.0)
Professional	00	01	01 (0.7)
Total	**68**	**77**	**145(100.0)**

Table 3. Distribution of Controls According to Sex and Educational Status (N=145)

(Figures in parenthesis indicate percentages) χ^2= 2.24, df = 5; p= 0.81

WHR	CASES (%)	CONTROLS (%)
More than cutoff*	129 (89.0)	98 (67.6)
Less than cutoff	16 (11.0)	47 (32.4)
Total	**145 (100.0)**	**145 (100.0)**

Table 4. Distribution of Cases and Controls According to WHR

* For male cutoff of WHR= 0.9 and for female cutoff of WHR = 0.8

χ^2 = 19.49, df = 1; p< 0.000011; Odds ratio = 3.87; C.I (2.07 – 7.23)

* For male cutoff of WHR= 0.9 and for female cutoff of WHR = 0.8

89% cases had abnormally high WHR as compare to 67.6% in controls.

BMI	Cases (%)	Controls (%)
Obese	28 (19.3)	10 (6.9)
Overweight	74 (51.0)	38 (26.2)
Normal	43 (29.7)	78 (53.8)
Underweight	00 (0.0)	19 (13.1)
Total	**145 (100.0)**	**145 (100.0)**

Table 5. Distribution of Cases and Controls According to Body Mass Index (BMI)

(Figures in parenthesis indicate percentages. For application of Chi square test Underweight and Normal categories were clubbed together) χ^2 = 40.93, df = 2; p<0.0000001.

Family History of DM	Cases (%)	Controls (%)
Present	56 (38.6)	10 (6.9)
Absent	89 (61.4)	135 (93.1)
Total	**145 (100.0)**	**145 (100.0)**

Table 6. Distribution of Cases and Controls According to Family History of DM

(Figures in parenthesis indicate percentages)

χ2 = 41.51, df = 1; p< 0.0000001

Physical Activity	Cases (%)	Controls (%)
Inadequate	89 (61.4)	19 (13.1)
Adequate	56 (38.6)	126 (86.9)
Total	**145 (100.0)**	**145 (100.0)**

Table 7. Distribution of Cases and Controls According to Physical Activity

(Figures in parenthesis indicate percentages)

χ^2 = 72.29, df = 1; p< 0.0000001; Odd ratio = 10.54; C.I (5.86 – 18.95)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95% CI for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.020	.066		15.372	.000	.889	1.151
	BMI	.113	.035	.180	3.246	.001	.044	.181
	WHR	.142	.060	.117	2.382	.018	.025	.260
	F_H_DM	.305	.059	.256	5.163	.000	.189	.421
	Phy_inact	.324	.059	.313	5.445	.000	.207	.421

Table 8. Multiple Logistic Regression Analysis of Risk Factors Associated with Diabetes Mellitus

Multiple Logistic Regression analysis showed that BMI, WHR, Family history of Diabetes and Physical inactivity were significantly associated with occurrence of Diabetes**.**

DISCUSSION

As other non-communicable diseases, Rule of Halves and Iceberg phenomenon also holds good for Diabetes. Almost 50% diabetic patients didn't know about their disease and they present late with different complication. Diabetes is a preventable disease and its occurrence and complication can be delayed by reducing or eliminating the known risk factors of diabetes. Knowledge of risk factors associated with Indian patients; among the health care providers and population, helps in diabetic screening programs and early detection so that community will have healthy life. Modification of risk factors helps in control as well as reversal of type 2 diabetes. So it is the need of diabetic patients to know about risk factors associated with diabetes.

To study the risk factors associated with diabetic patient we found that educational status among male and female were not significantly associated among cases as well as in control (Table 2 & 3). WHR was significantly associated with occurrence of Diabetes as 88.96% patients had abnormally high WHR than that of control group (67.59%) (Table 4). In this study we found that abnormally high BMI was significantly associated with occurrence of diabetes as 70.34% diabetic patients were overweight or obese (Table 5). Family history of diabetes was found statistically significant as 38.62% diabetic patients had positive family history of diabetes (Table 6). Inadequate physical activity was also found significantly associated with occurrence of diabetes as in 61.38% patients, physical activities were inadequate (Table 7). On applying the Multiple Logistic Regression analysis of Risk factors, we found that risk factors like abnormally high BMI, WHR, Family history of Diabetes and inadequate physical activity were significantly associated with diabetes with $p < 0.05$ (Table 8).

Sanjay D. Bhalerao et al (2014) conducted a community based cross sectional study to study the risk factors for type 2 Diabetes mellitus in rural population found that Age, occupation, Body Mass Index, diet, smoking, alcohol, truncal obesity and family history of DM were significantly associated with prevalence of T2DM whereas gender and literacy were not. They conclude that the prevalence of T2DM was influenced by predictors such as age, occupation, BMI, diet, Smoking, alcohol consumption, truncal obesity and family history of diabetes.[7]

Deepthi R et al (2013) reported Diabetes prevalence was significantly higher among people with family history of diabetes and those who were overweight or obese.[8] RomaanJallu et al (2015) conducted a Population Based Cross-Sectional Study to study the Risk of Type 2 Diabetes mellitus found that Body Mass index (BMI), diet and physical inactivity seemed to be strong predictors for diabetes mellitus.[9]

Mayur Patel et al (2011) reported that the majority (68%) of the T2DM subjects were obese, and 67% had a positive family history of diabetes. Results of chi-square analysis showed that higher BMI (≥25 kg/m2) was significantly associated with hypertension among the T2DM subjects. There were significant differences ($p<0.05$) between male and female subjects with respect to mean age, BMI, waist- and hip-circumference, and mean low-density lipoprotein (LDL) level. The results revealed that many factors, such as obesity, family history of diabetes, dyslipidaemia, uncontrolled glycaemic status, sedentary lifestyles, and hypertension were prevalent among the T2DM subjects.[10]

Javid Ahmad et al (2011) reported that there was significant increase in the prevalence of diabetes mellitus with increasing age (age 20-40 years: 3.02% vs> 60 years 16.66%, $P<0.05$). Furthermore, prevalence of obesity (body mass index > 25 Kg/m2) was 36.82 % more so central obesity, & family history were significantly associated with the presence of diabetes mellitus, $p<0.001$.[11]

Sumanth Mallikarjuna Majgi et al (2012)[12] found that in multivariate analysis age, BMI, family history of diabetes and occupation were significant risk factors for type 2 DM.[12]

Priti Kumari et al (2013) observed that Obesity had shown statistically significant association with diabetes.[13]

Raja Subramani et al (2014) revealed Some of the factors that had strong association with diabetes mellitus (physical activity, BMI, waist circumference).[14]

S Mangal et al (2014) found that the prevalence of diabetes increased significantly with advancing age. Similar results were obtained with central obesity also. Family history was present in 12% subjects, being more common in patients with diabetes and high-risk subjects i.e. pre-diabetics. Diabetic subjects were involved less in moderate activity compared to non-diabetics and more of light activity was seen among diabetics.[15]

Dr Ravindra Singh et al (2015) found that in his study statistically significant association was observed between

prevalence of diabetes mellitus with age, obesity and family history.[16]

All these studies (Mayur Patel et al (2011), Javid Ahmad et al (2011), Sumanth Mallikarjuna Majgi et al (2012), Deepthi R et al (2013), Priti Kumari et al (2013), Raja Subramani et al (2014), S Mangal et al (2014), Sanjay D Bhalerao et al (2014), Dr Ravindra Singh et al (2015), and Romaan Jallu et al (2015); supported our observations about risk factors of diabetes. These studies had elaborated the associations between several risk factors and the risk of type 2 diabetes. Body mass index (BMI), lipids, physical inactivity, and family history were significantly associated with risk of diabetes mellitus.

CONCLUSION

Multiple Logistic Regression analysis showed that BMI, WHR, Family history of Diabetes and Physical inactivity were significantly associated with occurrence of Diabetes**.**

Limitations

The study was conducted in a city which is a field practice area of our medical college. This area may not be representative of the other urban areas of India.

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