A Case Control Study on Risk Factors of Type-2 Diabetes Mellitus in a Primary Health Centre Area of Karnataka

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ABSTRACT

Introduction: *The developing country like India is often called "Diabetic capital of the world". According to the Diabetes Atlas 2012, the number of people with diabetes in India currently around 63.0 million and prevalence was 9.01%.*

Objectives: *To identify the risk factors of type2 diabetes mellitus and to study the association of risk factors with the development of the disease.*

Methods: *A case control study was undertaken at Yalagodu PHC area among 100 known cases of type-2 Diabetes Mellitus & 100 controls, between February and March, 2014 using a predesigned pretested pro-forma. Chi Square test was applied as test of significance and Odds ratio was used to measure the strength of association.*

Results: *Increased risk of development of Diabetes Mellitus as age advances and males were predominant sufferers. Majority of cases of type 2 diabetes mellitus were either overweight or obese. The odds ratio for stress was 3.95 indicating that the cases have 4 times more risk of occurrence of diabetes when compared to controls. About 60% of the cases and 27% of the controls had family history of type 2 DM. The odds ratio was 4.06 indicating that the risk of occurrence of type 2 DM is 4 times more in cases compared to controls. The odds ratio was 1.83 indicating that the risk of diabetes is 2 times in hypertensive compared to controls. About 72% of them were cases had ADA score of more than 30 and about 49% of the controls had ADA scores of more than 30.*

Conclusions: *Diabetes mellitus is associated with positive family history, occupation, education, religion, diet, marital status, stress, hypertension, sedentary life style, smoking and alcohol consumption. People with a higher ADA score tend to develop diabetes mellitus more frequently.*

Key words: *Type-2Diabetes Mellitus, Risk factors, ADA score.*

INTRODUCTION

Diabetes mellitus is an "Iceberg disease"; a ubiquitous malady of the world today, affecting more than 387 million people in 2014; and by 2035 this will rise to 592 million. The number of people with type 2 diabetes is increasing in every country; 77% of them live in low- and middle-income countries; greatest number is between 40 and 59 years of age and 179 million people are undiagnosed[1]. In 2014 the global prevalence of diabetes was estimated to be 9% among adults aged 18+ years[2]. In 2012, an estimated 1.5 million deaths were directly caused by diabetes[3]. WHO projects that diabetes will be the 7th leading cause of death in 2030[4].

India is often called "Diabetic capital of the world". According to the Diabetes Atlas 2014, the number of people with diabetes in India was around 66.0 million (35 million males & 31 million females respectively) and prevalence was 9.01%. There were around 1,013,057 deaths in 20 – 79 years age group[1].

In 2010 the Prevalence of Diabetes Mellitus in India was estimated 0.2% in individuals aged <20 years; 11.3% in individuals >20 years; and in Individuals aged >65 years the prevalence was 26.9 %[2]. Studies have shown the prevalence rate of diabetes mellitus to be 2.4% in rural and 4 to 11% among urban dwellers due to industrialization and urbanization[5].

The etiology of diabetes in India is multi factorial and includes genetic factors coupled with environmental influences such as obesity associated with rising living standards, steady urban migration, and lifestyle changes. Yet despite the incidence of diabetes within India, there are few multi-centric studies conducted on the prevalence of diabetes and its complications[6]. Since studies conducted to identify the risk factors of Diabetes Mellitus from Karnataka were scanty, the present hospital based case-control study has been undertaken to identify the risk factors of type-2 Diabetes Mellitus in this region.

AIMS AND OBJECTIVES

A study of risk factors of Type-2 Diabetes Mellitus in a PHC area by case control study.

Objectives

- To identify the risk factors of Type-2 Diabetes Mellitus.
- To study the association of risk factors with the occurrence of the disease.

MATERIALS AND METHODS

An Analytical case control study was undertaken in order to assess the risk factors of type-2 Diabetes Mellitus in Yalagodu PHC area of Chitradurga Taluk

and district, Karnataka State. About 100 known cases of type-2 Diabetes Mellitus visiting the PHC on regular basis were included as cases; based on non-probability purposive sampling technique. For the purpose of the study a case of Type-2 Diabetes Mellitus was described as **"**Type 2 Diabetic patients aged more than 15 years satisfying the inclusion and exclusion criteria" About 100 cases of age and sex matched controls attending PHC due to other disease who were not known cases of type-2 Diabetes Mellitus were included in the study as controls. An informed written consent was obtained from the patients in the local language. Permissions for the study were obtained from the higher health and family welfare authorities to conduct the study in PHC. This study was undertaken between February and March, 2014 for a period of two months.

Inclusion Criteria:

- All known cases of DM attending the PHC during the study period aged 15 years and above
- Not seriously ill
- Gave informed written consent
- Equal number of, age and sex matched group as "controls".

Exclusion Criteria:

- Diabetic pregnant women
- Cases of D.M. among children below 15 years of age
- Non co-operative cases
- Cases from whom required information was not available.

The study subjects thus selected were administered a predesigned and pretested proforma designed by 3 specialists of community medicine for the purpose of the study. The proforma was pretested on 10 patients to check the validity and the items were finalized. The proforma included the socio-demographic factors, family history of type-2 Diabetes Mellitus, Stress factor, and Anthropometric measurements, history of habits and treatment history. A stress assessment scale was employed to assess the level of stress in the cases and controls. The investigator filled the proforma by face-to-face interview.

All the study population were interviewed and the data thus collected was compiled using Microsoft excel. Then it was transferred to Statistical Package for Social Services (SPSS vs 20) the categorical variables were analyzed using Frequencies and Percentages. Chi Square test was applied as test of significance and Odds ratio was used to measure the strength of association by using the formula ad/bc. A p value of less than 0.05 was considered as statistically significant. The identified risk factors were considered in the study to find their association.

RESULTS

Table 1: Distribution of Cases and Controls According to Age (n=100)

Age Group (in years)	Cases		Control	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
30 – 40	08	08	08	08
41 – 50	28	28	28	28
51 – 60	38	38	38	38
61 – 70	21	21	21	21
71 – 80	05	05	05	05
Total	**100**	**100**	**100**	**100**

Table No 1 showed the distribution of the cases and controls according to their age group. The controls in this study were matched for the age. Above table showed increased risk of development of Type-2 Diabetes Mellitus as age advances. Maximum numbers of cases were noted in age group of 51-60 years.

Table 2: Distribution of Cases and Controls According to Sex

Gender	Cases		Control	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
Male	67	67	67	67
Female	33	33	33	33

The distribution of the cases and controls according to their gender had shown that two thirds of them were males.

The cases and controls of other occupation outnumbered agriculturists and housewives. However, this difference in occupation was not significantly different between cases and controls. This indicates that the patients of other occupational groups have more stress and risk of getting type-2 Diabetes Mellitus. The distribution of study population according to their literacy level had shown that about 56% of the cases and 63% of the controls were educated below matriculation. There was no significant difference in the literacy status between the cases and controls. The odds ratio was less than 1 for cases who were educated less than matriculation indicating the educated sections of society are affected more than those who were educated less than matriculation. Distribution according to religion shows that there is more risk of developing of Type-2 Diabetes Mellitus in Hindu patient followed by

patient of other religion which is not statistically insignificant. The odds ratio was also less than 1 indicating the risk of Type-2 Diabetes Mellitus less in Hindus compared to the patients of other religion.
Type-2 Diabetes Mellitus in this study was common in those who were married. Surprisingly 2% of the unmarried cases also had Type 2 DM. About 7% of the widowed subjects also had diabetes. There was no statistically significant difference in marital status between the cases and controls. About 51% of the cases were on vegetarian diet and 49% were on mixed diet. There was no significant difference in diet between cases and controls. The risk of type-2 Diabetes Mellitus was slightly more than 1 in the cases who were on mixed diet.

Table 3: Distribution of Cases and Controls According to Iotf Classfication Obesity

Nutritional status	Cases		Controls	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Underweight	01	01 %	06	06 %
Normal	30	30 %	56	56 %
Pre obese	33	33 %	14	14 %
Obesity class 1	10	10 %	13	13 %
Obesity class 2	11	11 %	08	08 %
Obesity class 3	02	02 %	03	03 %
Total	**100**	**100 %**	**100**	**100 %**

$\chi^2 = 19.368$ df = 1 p value = 0.002, Sig OR=2.08

Majority of cases of type-2 Diabetes Mellitus were either overweight or had obesity. About 56% of the controls had normal body weight. There was a statistically significant difference between different grades of obesity of cases and controls. The risk of getting type-2 Diabetes Mellitus was more than two times in cases compared to controls.

Table 4: Distribution of Cases and Controls According to Stress

Stress	Cases		Controls	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
Present	65	65 %	32	32 %
Absent	35	35 %	68	68 %
Total	**100**	**100 %**	**100**	**100 %**

$\chi^2 = 21.8$, df = 1 p value = 0.000, Sig OR=3.95

Table 4 showed the relation between the stress and occurrence of type-2 Diabetes Mellitus in the study group. About 65% of the diabetics had stress compared to 32% of controls. There was a statistically significant difference between the occurrence of stress in cases and controls. The odds ratio for stress was 3.95 indicating that the cases have 4 times more risk of occurrence of diabetes when compared to controls.
Distribution according to physical activity showed that about 34% of the diabetics were physically active and 66% were physically inactive. About 44% of the controls were physically active. However, there was no statistically significant difference in occurrence of type-2 Diabetes Mellitus between cases and controls. The odds ratio was also less than 1 indicating that there was no influence of physical activity in occurrence of type-2 Diabetes Mellitus.

Table 5: Distribution of Cases & Controls According to Family History

Particulars	Cases		Controls	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
Present	60	60 %	27	27 %
Absent	40	40 %	73	73 %
Total	**100**	**100 %**	**100**	**100 %**

$\chi^2 = 22.154$, df = 1 p value = 0.000, Sig OR=4.06

Table 5 shows the distribution of the study group according to family history of type-2 Diabetes Mellitus. About 60% of the cases and 27% of the controls had family history of type 2 DM. This difference was statistically significant. The odds ratio was 4.06 indicating that the risk of occurrence of type 2 DM is 4 times more in cases compared to controls.

Table 6: Distribution of Cases and Controls According to Hypertension

Particulars	Cases		Controls	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
Present	57	57 %	42	42 %
Absent	43	43 %	58	58 %
Total	**100**	**100 %**	**100**	**100 %**

$\chi^2 = 4.5$, df = 1 p value = 0.038, SigOR=1.83

About 57% of the cases and 42% of the controls had hypertension as co morbidity. There was a significant difference between the hypertension between cases and controls. The odds ratio was 1.83 indicating that the risk of diabetes is 2 times in hypertensive compared to controls. The relation of cases and controls according to alcohol consumption. About 40% of the cases and 36% of the controls were alcoholics. However, the difference in consumption of alcohol was not significant between cases and controls. About 28% of the cases and 36% of the controls in this study were smokers. The difference in smoking was not significant between the cases and controls. The odds ratio was also less than 1 indicating that there is no relation between the smoking status and cases and controls.

Table 7: Distribution of Cases and Controls According to Ada Score

ADA Score	Cases		Controls	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
10 – 20	5	5 %	17	17 %
20 – 25	12	12 %	21	21 %
25 – 30	11	11 %	13	13 %
30 – 35	38	38 %	32	32 %
35 and above	34	34 %	17	17 %

$\chi^2 = 15.348$, df = 4 p value = 0.004, Sig

Table no 7 shows the ADA scores of cases and controls. About 72% of them were cases had ADA score of more than 30 and about 49% of the controls had ADA scores of more than 30. However, there was significant difference between the ADA scores of cases and controls.

DISCUSSION

Diabetes is a major public health problem in India and the World. The prevalence of type 2 DM is increasing in trend. Many risk factors can lead to the problem of type-2 Diabetes Mellitus. Hence this case control study was taken with the aim of studying the association between the risk factors and occurrence of disease in type 2 DM.

Majority of the study subjects in this study belonged to 41 – 70 years age group. Ramaiya et al[7] reported that the prevalence rate was 21% in the age group of 40 to 54 and 41% in the age group of 55 to 64 years. Age above 40 years is a risk factor for occurrence of type-2 Diabetes Mellitus. In this study more than two third of the patients were males. Ramachandran et al[8] also observed that NIDDM was more among men than among women. In contrary to these findings, Wild et al[9] observed that occurrence of diabetes in both males and females were almost equal globally and slightly higher in males in above 60 age group. The cases and controls of other occupation outnumbered agriculturists and housewives. This indicates that the patients of other occupational groups have more stress and risk of getting type-2 Diabetes Mellitus. Pan et al[10] in a study in Beijing showed that intellectual workers have higher risk of getting Type-2 Diabetes Mellitus compared to the manual workers.

About 56% of the cases and 63% of the controls were educated below matriculation in this study. The educated sections of society are affected more than those who were educated less than matriculation. In contrary to these results, Pan et al[10] reported that lower literacy level in Chinese population is an independent direct risk factor for type 2 Type-2 Diabetes Mellitus. Religion had no influence on occurrence of type 2 DM in this study. Majority of the cases of type-2 Diabetes Mellitus Most of the diabetes cases in this study were consuming vegetarian diet as in other stuydy[11]. In contrary to these results, Montonen et al[12] observed that Finnish men with fruits and vegetable diet were less likely to get diabetes compared to other men who had diet of butter, milk and potatoes. Majority of cases of type-2 Diabetes Mellitus were either overweight or had obesity in this study. In WHO technical report no. 854 and no. 916, Obesity is recognized as a risk factor for DM. It emphasizes on the finding that weight gain of more than 5 kg in a period of 8 years or weight gain after 18 years of age increases the risk of type 2 DM. Bjorntorp et al [13] found that individual fat cell size directly correlates with the insulin insensitivity. Stress tends to promote type-2 Diabetes Mellitus. Stress releases certain factors that mediate decrease in peripheral receptor sensitivity to glucose, thus decreasing glucose metabolism. Thus it contributes in increasing glucose level resulting in hyperglycemia and

thus type-2 Diabetes Mellitus. Decreasing stress is thus a factor in controlling type-2 Diabetes Mellitus. Ramaiya et al[7] confirm the role of stress as a causative factor in diabetes in Indians. This study has pointed the concept of central nervous system control of insulin secretion, and stress influencing this mechanism in an unknown mechanism. Difference between stressed and unstressed is bizarre and unclear till date. But a diagnostic criterion was put up to differentiate the two overlapping groups superficially. Mild to moderate exercise has a decremental effect on occurrence of Type-2 Diabetes Mellitus. The peripheral receptors become more sensitive to insulin and more utilization of glucose helps in control type-2 Diabetes Mellitus. Physical activity plays a role in controlling type-2 Diabetes Mellitus[14].DM patients are thus asked to do mild exercises for its beneficial effects. W.H.O. Technical Report Series explained that the sedentary life style appears to be an important risk factor for the development of NIDDM. It also says that lack of exercise may alter the interaction between insulin and its receptors and subsequently lead to Type 2 D.M. Helmrich et al **[15]** in a study involving Pennsylvanian males found with an increase in energy expenditure of 500 kcal, the risk of developing DM decreases by 6%.

Physical activity can be

- No: Not doing any exercise
- Moderate: Going for walk daily
- Heavy: Doing regular exercises.

Family history of type 2 DM is an important factor in occurrence of type 2 DM. Banerjee**[16]** et al observed in their case control study of risk factors of Type-2 Diabetes Mellitus among 75 diabetic cases and 75 age sex matched controls, in R.G. Kar Medical College, Calcutta that Type-2 Diabetes Mellitus was found to be significantly higher among those patients having positive family history, belonging to Class IV and V of Kuppuswamy's socio-economic class and non-vegetarian dietary habit. Carlsson et al**[17]** found that high alcohol intakes is associated with increased risk of type-2 Diabetes Mellitus whereas Eric et al**[18]** found that high alcohol consumers had a reduced risk of developing type-2 Diabetes Mellitus.

It was found that restriction of calories provided by ethanol is a dieting strategy that is positively related success with weight loss and persons ingesting alcohol will have hypoglycemia (due to skipping of meals) via inhibition of gluconeogenesis. Thus diabetes does not have to abstain from alcohol. Some guidelines are there for consumption of alcohol. But people with hypoglycemia unawareness should be discouraged against strategy. Eric et al (1995)[18] found that men who smoked 25 or more cigarettes daily had a relative risk of DM of 1.94 compared with non-smokers.

CONCLUSIONS

- Type-2 Diabetes Mellitus is associated with positive family history as evident in this study. Patients with family history of type-2 Diabetes Mellitus are at the greater risk of developing it.
- Diabetes is also associated with the patient's occupation, education, religion, diet and Marital Status.
- People with a higher ADA score tend to develop type-2 Diabetes Mellitus more frequently.

Limitations:

- There are certain limitations in the study which could not be avoided.
- This is a hospital based study. It limits the study to a PHC area of Karnataka.
- Since only the people attending hospitals have been considered, the study lacks on considering the entire community, therefore this may not necessarily represent the actual trend of community.
- Only the oral question method has been used due to limitations and impracticability to other investigations.

RECOMMENDATIONS

The general public needs to adapt a more pragmatic view regarding epidemic of obesity. The current scenario is symptomatic of globalization with respect to its social, cultural, economic & political significance. Type II Diabetes Mellitus will not be prevented by traditional methods. What required are major & dramatic changes in the socio-economic and cultural status of people in developing countries? Risk factors in diabetes can be controlled by simple but more effective measures like exercise and diet control etc.

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