Original Research Article

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Risk factors of type 2 diabetes mellitus in rural population of Karad, Maharashtra, India: an observational study

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ABSTRACT

Background: Non-communicable diseases like DM2, cardiac diseases, chronic respiratory disorders, brain disorders like stroke have created a havoc in developing countries, especially India which harbors 2nd largest population in the world. The present study was planned in this area to capture the data regarding epidemiology, risk factors of DM2, and use this information to plan health program to formulate effective preventive measures, including raising general awareness about the disease in that geographical area.

Methods: The present cross sectional study was carried out in population of Karad area of Satara district in Maharashtra state. The study duration was of 1 year, from 1st February 2018 to 1st February 2019.

Results: Out of total 1100 study population in the present study, 99 (9%) were diagnosed as diabetics (DM2) while 1001 were normal/non-diabetics. Majority of the diabetic patients were of the age group 41 to 50 years. Females (47%) showed slightly more prevalence of diabetes as compared to males (53%). Majority of the diabetic patients were having sedentary lifestyle, which consisted of 69 patients (70%), which was statistically significant, as compared to non-diabetic group.

Conclusion: Thus, findings of the present study amply clarifies that DM2 is on longer a disease of urban population. Its prevalence is increasing in rural population, as well. Lack of awareness, sedentary lifestyle, faulty dietary habits, etc. are some of the reasons for such high prevalence.

Keywords: Diabetes mellitus type 2, Prevalence, Risk factors, Sedentary

INTRODUCTION

Diabetes mellitus type 2 (DM2) is defined as multifactorial, diverse, autoimmune disorder of metabolism with multi-genetic involvement. The basic pathogenesis of DM2 is lack of insulin action at the receptors, and reduction in insulin secretion in some cases. Glucose metabolism is predominantly affected, which reflects in persistently elevated blood glucose levels i.e. hyperglycemia. Ultimately, this leads to disturbance in protein as well as fat metabolism. DM2 is

characterized by multifaceted interplay between various environmental and genetic elements. It has emerged as one of the commonest cause of morbidity and mortality on a global platform.²

Non-communicable diseases like DM2, cardiac diseases, chronic respiratory disorders, brain disorders like stroke have created a havoc in developing countries, especially India which harbors 2nd largest population in the world. This finding is particularly more problematic in people of working age group, since such diseases greatly hamper

productivity in such demanding years of a person's life.¹ Globally, number of DM2 patients will be doubled by 2030, affecting 550 million patients as per projections given by International Diabetes Federation (IDF).³ The same is expected to cross 100 million mark in India, by 2030.⁴ Epidemiological studies have shown that the prevalence of DM2 in urban and rural areas of India has risen by 2 times 4 times, respectively in past decade.⁵

Apart from environmental and genetic factors, this alarming increase in prevalence of DM2 has been attributed to various other factors like sedentary lifestyle, increased rate of urban development, industrialization, etc.⁶ Various risk factors have been found to be associated with increased incidence of DM2, that include sedentary lifestyle, hypertension, central type of obesity.^{7,8} Also, the number of patients of DM2 in young age group are increasing alarmingly. Thus, chronicity duration of the disease is also increasing, which further increases the risk of diabetic complications.⁹

Although, numerous epidemiological studies on DM2 have been conducted across the country, there is absolutely no published data regarding specifics of DM2 epidemiology in Karad area of Maharashtra. Therefore, the present study was planned in this area to capture the data regarding epidemiology, risk factors of DM2, and use this information to plan health program to formulate effective preventive measures, including raising general awareness about the disease in that geographical area.

METHODS

The present cross sectional study was carried out in population of Karad area of Satara district in Maharashtra, India. The study duration was of 1 year, from 1st February 2018 to 1st February 2019. Based on findings of previous studies, and preliminary prevalence of 12% in the area, confidence interval being set at 95% sample size came out be 1021, which was rounded to 1100.¹⁰

DM2 was diagnosed according to American Diabetes Association (ADA) criteria, as under:¹¹

- Fasting blood glucose ≥126 mg/dl,
- Post prandial blood glucose ≥200 mg/dl
- Glycosylated hemoglobin >6.5%.

Simple random sampling technique was used for the present study. Total sample size was 1100 subjects, which were screened thoroughly according to above mentioned criteria. After explaining the current study and its objectives, written informed consent was taken from the patients (all done in local language), blood samples were taken.

All the relevant information, like demographic details, dietary habits, history of addiction like smoking, alcohol,

tobacco chewing, physical activity, were captured and entered in predesigned and prevalidated format. Other parameters like body mass index (BMI), blood pressure (taken twice, with a 10 minute gap, in sitting position). Blood sugar was measured by performing oral glucose tolerance test (OGTT). All the data was analyzed using SPSS, version 18 and chi-square tests was applied to analyze the significance of association, if any.

RESULTS

Out of total 1100 study population in the present study, 99 (9%) were diagnosed as diabetics (DM2) while 1001 were normal/non-diabetics. Majority of the diabetic patients were of the age group 41 to 50 years, comprising of 34 patients (34%), followed by 21 patients in 51 to 60 years, and least in the age group <20 years.

Age difference between diabetics and non-diabetics was statistically significant. On analysis of sex distribution, it was found that females (47%) showed slightly more prevalence of diabetes as compared to males (53%), with male: female ratio of 0.9:1. However, differences between both groups was not statistically significant (p>0.05) (Table 1)

On analyzing literacy amongst the diabetics, it was found that majority of the diabetic patients were literate, comprising of 61 patients, and the literacy rate difference between diabetic and non-diabetics was statistically significant. Majority of the diabetic patients were having sedentary lifestyle, which consisted of 69 patients (70%), which was statistically significant, as compared to non-diabetic group. Major bulk of diabetic patients gave a positive history of tobacco smoking, comprising of 79 patients. (Table 1)

Out of 61% of the diabetic patients gave a positive history and current intake of alcohol, and this difference was highly statistically significant as compared to diabetic group.

Almost equal number of diabetic patients were vegetarians and taking mixed diet, and the difference between diabetic and non-diabetic groups was not statistically significant. Positive family history emerged as major predictor of DM2, as 80% of the diabetic patients gave a positive family history of DM2. (Table 1)

Majority of the diabetic patients were found to be hypertensive, comprising of 62 patients. This difference between diabetic and non-diabetic groups was statistically significant.

On analyzing, BMI, it was found that major chunk of diabetic patients had raised BMI, which comprised of 60 patients, and this was highly statistically significant. Waist: hip ratio was raised in 62% of the diabetic patients (p=0.0001) (Table 2).

Table 1: Demographic details and general details of the study population.

Category	Sub-category	Diabetic (n=99) (%)	Non-diabetic (n=1001) (%)	p value
Age	<20 years	6 (6)	45 (4.9)	
	21 to 30	12 (12)	156 (15.6)	
	31 to 40	16 (16)	351 (35)	<0.001
	41 to 50	34 (34)	200 (20)	<0.001
	51 to 60	21 (21)	141 (14.1)	
	≥ 61	10 (10)	108 (10.8)	
Sex	Male	47 (47)	480 (48)	>0.05
	Female	52 (53)	521 (52)	>0.05
Literacy	Literate	61 (61)	701 (70)	0.002
	Illiterate	38 (38)	300 (30)	0.002
Physical activity	Active	30 (30)	504 (50.4)	0.0001
	Sedentary	69 (70)	497 (49.7)	
Tobacco smoking	Yes	79 (79)	400 (40)	<0.0001
	No	20 (21)	601 (60)	<0.0001
Alcoholism	Yes	61 (61)	386 (38.6)	<0.0001
	No	38 (39)	615 (61.4)	<0.0001
Diet	Vegetarian	48 (48.5)	521 (52)	>0.05
	Mixed diet	41 (41.5)	480 (48)	>0.03
Family history	Yes	80 (80.5)	92 (9)	0.004
	No	19 (19.5)	909 (91)	0.004

Table 2: Anthropometric measurements and prevalence of hypertension in study population.

Category	Sub-category	Diabetic (n=99) (%)	Non-diabetic (n=1001) (%)	p value
Hypertensive	Yes	62 (62)	272 (27)	0.001
	No	37 (38)	729 (73)	
ВМІ	<25	39 (39.5)	789 (79)	0.0001
	≥25	60 (60.5)	212 (21)	
Waist: Hip ratio	< 0.85	37 (37)	779 (78)	0.0001
	≥0.85	62 (63)	222 (22)	

DISCUSSION

DM2 has created menace all over the world, especially in developing country like India, owing to its growing industrialization and urbanization of rural areas.⁵ In the present study, it was found that prevalence of DM2 in rural population of Karad area was found to be around 9.8%. This prevalence was high as compared to previously published study reports, which ranged in between 5 to 8.1%.^{10,12} On the contrary, Bhalerao et al, reported prevalence of DM2 in rural population of north Karnataka as almost 18%.¹³ This has multiple implications, like increased urbanization, reduced level of physical activity, reduced awareness about the diseases and its prevention, etc.

Male: female ratio of diabetic patients in the present study was found to be 0.9:1. Females showed a slight preponderance towards development of DM2. This was in contrast to findings of studies conducted in other parts of country, which reported male sex as most

affected. 10,13,14 Female preponderance was also reported in similar study. 15

The prevalence of DM2 was seen in advancing ages, in the present study. Similar results were reported by other researchers in their studies. ^{10,13} The possible explanation for such finding might be the chronic exposure to major risk factors like obesity, smoking, alcoholism, sedentary lifestyle, etc. ¹³ However, most worrisome finding of the present study was significant affection of DM2 in the age group 21-30 and 31-40, since this age group is comparatively young and most productive part of age pyramid. Hence, it is quite logical that screening should be focused more on this population group, so that their productivity is not hampered.

Majority of the patients with DM2 were literate, in the present study. It was mentioned in a study by Howard et al, that increased literacy is associated with significant lifestyle changes, which budge to sedentary lifestyle. ¹⁶ On the contrary, low literacy rates may also predispose to developing DM2, since there is lack of awareness and

understanding about the disease and its prevention in such population.¹⁰

The present study found significant number of DM2 patients with smoking and alcohol consumption. Similar trends were reported in other studies. 17,18 Smoking is known to contribute to development of insulin resistance, augmenting microvascular and macrovascular complications in DM2 patients. 19 Alcoholism is associated with development of insulin resistance, as it adversely pancreatic function, as well as alcoholism promotes obesity, due to adverse effect on lipid metabolism and liver homeostasis. 13

Positive family history of DM2 was one of the major risk factor in the present study. There was no disparity in terms of maternal or paternal family history in causing more predisposition to development of DM2. This was in contrast to findings of study done by Bhalerao et al, who reported maternal family history of DM2 to be riskier, as compared to paternal family history, for development of DM2. In the present study, the authors did not notice any patients whose both parents had positive family history of DM2. Various factors like genetic predisposition, stress, socio-economic status might play an important role in these cases. It is, however, important to note that positive family history can be used an effective screening tool for DM2.²⁰

Most of the diabetic patients in the present were found to be hypertensive. Hypertension is established leading cause of morbidity and mortality in diabetic patients.²¹ It is known to accentuate development of microvascular complications like nephropathy, neuropathy. Recommended target blood pressure in diabetic patients is <140/90, while the same target is <130/80 in diabetic patients with presence of major cardiac risk factors.²²

In the present study, BMI was found to be a major risk factor for DM2, as most of the diabetic patients were having raised BMI. Most of the studies have reported similar trends and raised BMI as independent risk factor for development of DM2. 10,13,14 In patients with raised BMI, there is increased release of free fatty acids, proinflammatory cytokines, glycerol all of which contribute to development of insulin resistance. 23 Thus, rigorous screening should be done in patients with raised BMI. Most of the patients of DM2, in the present study were having raised waist: hip ratio. This was in contrast to findings of other such study, which reported no increased risk of DM2 with increased waist: hip ratio. 13

CONCLUSION

Thus, findings of the present study amply clarifies that DM2 is on longer a disease of urban population. Its prevalence is increasing in rural population, as well. Lack of awareness, sedentary lifestyle, faulty dietary habits, etc. are some of the reasons for such high prevalence. Regular screening programs should be done in such

areas, and it should be formulated in such a way that all the major risk factors like, advancing age, positive family history, increased BMI, smoking and alcohol consumption should be rigorously screened.

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Institutional Ethics Committee

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