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Research Article

# ASSESSMENT OF RISK FACTORS OF DIABETES MELLITUS IN THE URBAN FIELD PRACTICE AREA OF A TERTIARY CARE HOSPITAL OF SOUTHERN ODISHA: A CROSS-SECTIONAL STUDY

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**ABSTRACT**

**Objective:** Diabetes is a chronic state of hyperglycemia which results in complications involving organs such as eyes, kidneys, nerves, heart, and blood vessels. Identifying the risk factors at an early stage can help in reducing the complications and co-morbidities of the disease. Hence, the study is carried out to assess the socio-demographic profile and associated risk factors of adult patients with diabetes mellitus.

**Methods:** It was a cross-sectional study carried out in the urban field practice area of M.K.C.G Medical College for a period of 2 years. Multistage simple random sampling was used to select 160 known diabetic cases. Data were collected using a pre-tested questionnaire and anthropometric measurements were taken. Data were analyzed in SPSS version 17 and appropriate statistical tests were used.

**Results:** The mean age of study participants was 53.94. About 41.88% and 21.25% were current tobacco and alcohol users, respectively. Inadequate fruit and vegetable consumption, mixed type diet, obesity in the form of increased body mass index, and waist hip ratio and sedentary life style were found to be the predisposing factors of the disease.

**Conclusion:** Early identification of at risk individuals and appropriate intervention to increase physical activity, bring about changes in dietary habits, maintenance of correct body weight could help to prevent or delay the onset of the disease to a great extent.

**Keywords:** Diabetes mellitus, Risk factors, Obesity, Waist hip ratio, Sedentary lifestyle.

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## INTRODUCTION

Diabetes mellitus is a state of chronic hyperglycemia which occurs due to an interaction of various causes such as environmental factors, genes, family history, and obesity. Chronic hyperglycemia results in future complication involving multiple organs of the body.

According to the WHO Global Report on Diabetes about 422 million adults were diabetics in 2014. The global prevalence of diabetes has nearly doubled rising from 4.7% to 8.5% in the adult population since 1980. The prevalence of diabetes has risen faster in low and middle income countries than in high income countries over a decade [1]. More than 80% of the diabetic population live in low and middle income countries in South-East Asian region [2]. As per the estimates of the International diabetes federation, globally 451 million (18–99 years) people are suffering from diabetes (with global prevalence: 8.8%) and by 2045, the world will have 693 million people suffering from diabetes [3].

Diabetes mellitus poses an exceptional burden not only in the form of disease, incapacity, and demise but also in shape of economic burden. Genetic predisposition blended with lifestyle changes associated with urbanization and globalization has contributed to the rapid upward push of the disease in India. The transition from a conventional to trendy way of life, intake of diets rich in fat and calories along with an excessive stage of mental strain has compounded the trouble further.

Knowledge of the factors responsible for making diabetes a public health crisis can help in reducing the morbidities and co-morbidities related to the disease. Further, the resulting healthcare and economic burden on both families and society can be reduced. Since there are limited studies pertaining to diabetes in this area there was a need to conduct a study to assess the risk factors of diabetes.

### Objective

The objective of the study was to assess the socio-demographic profile and associated risk factors of adult patients with diabetes mellitus.

## METHODS

The study was a cross-sectional study carried out in Ankuli which is the urban field practice area of MKCG Medical College, Berhampur for a period of 2 years from October 2017 to September 2019.

Taking the nation-wide prevalence of diabetes in urban areas as 11.2% [4]; allowable error as 5% and confidence interval as 95%, sample size was calculated [$n = Z^2 P (1 – P)/d^2$]. A total figure of 152 was calculated which was rounded off to 160.

Diagnosed cases of type 2 diabetes ≥18 years residing in Ankuli and those who gave informed consent were included in the study. Unwilling patients, patients with type 1 diabetes, pregnant and postnatal mothers, those who were absent on the day of interview, persons having acute illness, were excluded from the study.

Multistage simple random sampling was used to select the participants. Out of the total 41 streets in Ankuli, 20 streets were selected randomly. The houses of the street to be visited were selected randomly till the desired sample size of 8 participants per street was obtained. Each street was visited twice. In each visit, 4–5 participants were interviewed. The same procedure was used in selecting the households from all the 20 streets, until the desired sample size was achieved. Within each household, one adult aged ≥18 years who is a known case

of Diabetes was enrolled for the study purpose. If there were more than one known diabetic in the family, then one participant was selected by lottery method. If there was no one in the house or the person did not meet the inclusion criteria, the next house selected randomly was visited till the desired sample size was achieved.

Data were collected using a pre-tested questionnaire and anthropometric measurements were taken. Data were analyzed using SPSS version 17. Student's t-test and Chi-square tests were used for continuous and categorical variables. Ethical permission was taken from Institutional Ethics committee.

## RESULTS

The mean age was found to be 53.94±7.9. Majority 99 (61.88%) of the participants belonged to the age group of 41–60 and 93 (58.12%) were males. About 127 (80%) of the study population were in Class III and IV socioeconomic status (Table 1).

In the present study, 67 (41.88%) and 34 (21.25%) were found to be using tobacco and alcohol. Tobacco and alcohol use was found to be higher among males. Higher proportion of males 42 (26.25%) had physical activity in low levels whereas higher proportion of females 30 (18.75%) had physical activity in moderate levels. Sedentary activity was seen in 67 (41.88%) participants.

Majority, that is, 133 (83.13%) participants had either no family history of diabetes or they were unaware of it (Table 2).

Only 47 (29.38%) participants had normal body mass index (BMI). The percentage of males 34 (36.55%) who were obese was greater than that of the females 19 (28.35%). This difference was found to be significant (Table 2).

≥5 servings of fruits and vegetable consumption was seen in 23 (14.38%) and 46 (28.75%) diabetics, respectively. Only 25 (15.62%) males and 21 (13.13%) females consumed vegetables more than 5 servings per day. This difference was not significant statistically ($\chi^2$=0.378, p=0.12). About 137 (85.62%) of study participants had fruit consumption <5 servings per day. Only 18 (11.25%) males and 5 (3.13%) of females had more than five servings of fruit per day. Statistically significant association was found between consumption of adequate serving of fruits and diabetes. ($\chi^2$=4.476, p=0.03) (Table 2).

The mean height of males and females was 164.17±6.9 cm and 155.89±4.8 cm, respectively. The mean weight of males was 76.32±11.77 kg and females was 67.33±11.42 kg which was more than the weight of reference man and woman. The mean BMI of males and females was 28.41±4.7 and 27.76±4.9, respectively. The mean waist hip ratio (WHR) of males was 0.90±0.084. However, the WHR of females was 0.87±0.087 (Table 3).

Out of total study, population 87 (54.38%) took mixed type of diet and 73 (45.62%) were vegetarians. Consumption of mixed type of diet was seen higher in males 62 (38.75%) compared to females 25 (15.63%) whereas higher number of females 42 (26.25%) were vegetarians compared to males 31 (19.37%). This difference was statistically significant ($\chi^2$=17.7, p<0.05) (Fig. 1).

Palm oil was used as the cooking media by 89 (55.62%) of the participants followed by refined oil 64 (40%). Mustard oil, ghee, and coconut oil were used by the rest 7 (4.38%). Palm oil was used more in females (58.21%). Refined oil use was seen more in males (40.86%) [$\chi^2$=0.68, p=0.708] (Fig. 2).

## DISCUSSION

Diabetes is a multifactorial disease. It is strongly associated with behaviors such as consumption of tobacco and alcohol, physical inactivity, and unhealthy diet [5].

**Table 1: Demographic characteristics of study population**

| Variables | Number (160) | Percentage |
|---|---|---|
| Age Group | | |
| 18–40 | 10 | 6.24 |
| 41–60 | 99 | 61.88 |
| >60 | 51 | 31.88 |
| Gender | | |
| Male | 93 | 58.12 |
| Female | 67 | 41.88 |
| Socio-economic Status* | | |
| I | 8 | 5.0 |
| II | 15 | 9.38 |
| III | 65 | 40.62 |
| IV | 62 | 38.75 |
| V | 10 | 6.25 |

*Modified BG Prasad Scale

**Table 2: Distribution of risk factors of study population**

| Variables | Male (93) (%) | Female (67) (%) | Total (160) (%) | p-value |
|---|---|---|---|---|
| Current tobacco use | | | | |
| Yes | 49 (30.62) | 18 (11.25) | 67 (41.88) | <0.05 |
| No | 44 (27.50) | 49 (30.63) | 93 (58.12) | |
| Current alcohol use | | | | |
| Yes | 29 (18.12) | 5 (7.46) | 34 (21.25) | <0.05 |
| No | 64 (40.0) | 62 (38.75) | 126 (78.75) | |
| Physical activity | | | | |
| Low/Sedentary | 42 (26.25) | 25 (15.63) | 67 (41.88) | <0.05 |
| Moderate | 24 (15.0) | 30 (18.75) | 54 (33.75) | |
| Heavy | 27 (16.87) | 12 (7.50) | 39 (24.37) | |
| Family history | | | | |
| Yes | 17 (10.62) | 10 (6.25) | 27 (16.87) | 0.57 |
| No/Unknown | 76 (47.50) | 57 (35.63) | 133 (83.13) | |
| BMI | | | | |
| Normal | 19 (11.87) | 28 (17.50) | 47 (29.38) | <0.05 |
| Pre-obese | 40 (25.0) | 20 (12.50) | 60 (37.50) | |
| Obesity I | 25 (15.62) | 9 (5.63) | 34 (21.25) | |
| Obesity II | 7 (4.38) | 9 (5.63) | 16 (10.0) | |
| Obesity III | 2 (1.25) | 1 (0.62) | 3 (1.87) | |
| Fruit Intake | | | | |
| <5 | 75 (46.87) | 62 (38.75) | 137 (85.62) | <0.05 |
| ≥5 | 18 (11.25) | 5 (3.13) | 23 (14.38) | |
| Vegetable Intake | | | | |
| <5 | 68 (42.50) | 46 (28.75) | 114 (71.25) | 0.12 |
| ≥5 | 25 (15.62) | 21 (13.13) | 46 (28.75) | |

**Table 3: Distribution of study population according to anthropometric measurements**

| Variable | Male | Female | t value | p-value |
|---|---|---|---|---|
| Height | 164.17±6.9 | 155.89±4.8 | 8.4 | <0.001 |
| Weight | 76.32±11.77 | 67.33±11.42 | 4.8 | <0.001 |
| Waist circumference | 84.38±7.6 | 79.51±6.7 | 4.1 | <0.001 |
| Hip circumference | 92.97±7.9 | 90.83±7.2 | 1.7 | 0.084 |
| Waist hip ratio | 0.90±0.084 | 0.87±0.087 | 1.7 | 0.090 |
| BMI* | 28.41±4.7 | 27.76±4.9 | 0.851 | 0.396 |

*WHO Classification

In the WHO-ICMR National NCD risk factor surveillance study [6] and Indian diabetic risk scoring system [7], age was found to be an important predisposing factor for development of Type 2 diabetes. The prevalence rises with increasing age. In our study, majority of the diabetics were in the age group of 41–60 years. As per the study conducted by Rana *et al.* [8] on diabetic patients in a tertiary care hospital of central Gujarat majority of the diabetics were more than 50 years of age.

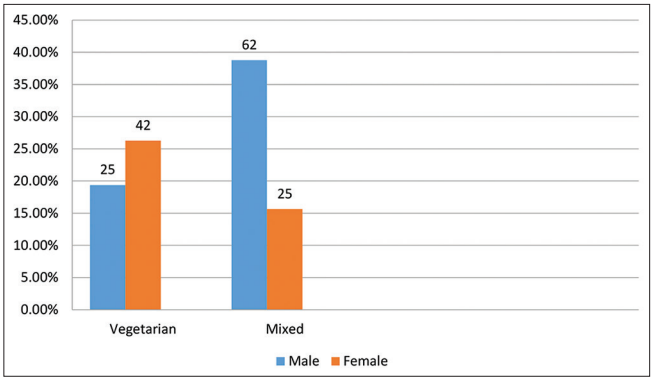


**Fig. 1: Distribution of study population according to the type of diet (n=160)**

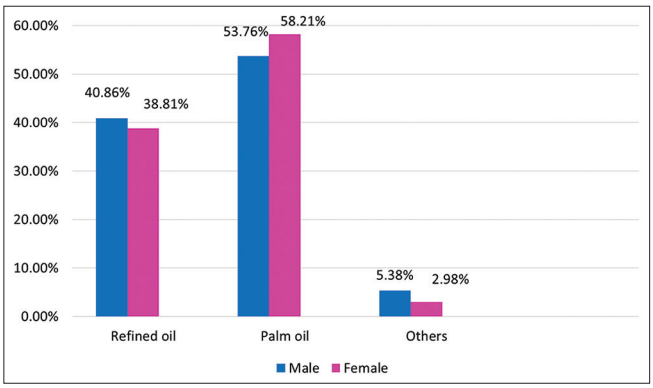


**Fig. 2: Distribution of study population on the basis of oil consumption (n=160)**

Nearly 42% of the study population were tobacco users. However, it was more among males as compared to females**.** Use of tobacco products leads increased chances of central obesity which in turn causes insulin resistance. Cigarette smoking along with smokeless tobacco and betel chewing is another leading preventable cause of diabetes [9-12]. In a study by Borah and Goswami [13]**,** 46% of the study population were consuming tobacco which is very similar to our study. In another study by Mathur *et al.* [14] in Rajasthan 33.7% of the study population were found to be smokers. As per the study by Kumar *et al.* [15], the use of tobacco among diabetics was high (83.8%) and was significantly associated with it.

Heavy alcohol intake has many metabolic side-effects such as excess caloric consumption, obesity, increased triglycerides, and abnormality in carbohydrate metabolism [16]. As per the study by Tripathy *et al.* [17], 10.4% of the diabetics were alcoholic. Around 12.6% were alcoholic and 87.4% were nonalcoholic in a study by Niti *et al.* [18].

Physical inactivity, sedentary life style leads to overweight and obesity which further contributes to an early onset of diabetes. Physical inactivity leads to energy imbalance and increase in body mass particularly body fat and insulin resistance. Over time, these factors act together and greatly increase the risk for diabetes mellitus [19]. As per the NUD survey by Ramachandran *et al.* [20] in Chennai, the prevalence of diabetes was significantly lower in study participants with high levels of physical activity. According to a large community based survey in North India by Tripathy *et al.* [17], only 3% of the diabetics were having physical activity above minimal recommended levels.

The odd's of having diabetes for offspring is more in a single affected parent compared with no parental history of diabetes and it doubles if both the parents are affected [21]. The 80% concordance in monozygotic twins compared to 50% lesser in dizygotic twins gives a strong evidence for the genetic factor in development of diabetes mellitus [22]. According to the study in a tertiary care hospital in Assam by Borah and Goswami [13]**,** 17% of the study subjects were having positive family history which is very similar to the results of our study. The Chennai Urban Population Survey [23] reported that the prevalence of diabetes was higher in subjects who had a positive family history (18.2%) as compared to those without (10.6%). Around 64.7% and 54.2% of the study participants had a family history of diabetes in studies conducted by Dev *et al.* [24] and Valliyot *et al.* [25], respectively.

Overweight and obesity poses risk for the development of diabetes and the prevalence of diabetes increases with increase in trends for overweight and obesity. The duration and degree of obesity both are related to diabetes. Waist circumference and WHR which signifies central or visceral obesity are more powerful determinant for developing diabetes compared to the BMI [9,26]. Weight loss improves insulin sensitivity and thus reduces the risk of diabetes [27].

According to a study done by Kavitha and Ramadas [28] in type 2 diabetes patients in Tamil Nadu the mean height of male and female subjects was 166.39±6.53 cm and 159.93±8.09 cm. The mean weight of males was 74.03 kg and in females it was 66.9 kg. The mean BMI of the male and female type 2 diabetic subjects was 26.73±2.12 and 26.01±2.10, respectively. The findings were quite similar to the findings of our study. However, in another study by Rana *et al.* [8] among diabetic patients the mean BMI of males was 23.8 which was very less as compared to our study but that of females was 27.1 which is similar to our study findings. As per the study by Niti *et al.* [18] among diabetics in Punjab, 83.2% were obese. In another study by Kumar *et al.* [15] in adult residents in rural Khammam 64.9% were overweight with BMI >25 which is similar to our findings.

High intake of dietary fiber results in reduced blood glucose and insulin levels in people with diabetes [29]. Evidences from randomized controlled trials suggest that increased intake of whole grain cereals, vegetables, and fruits have a protective effect on diabetes [30].

Increased fruit and vegetable intake results in improved weight control reduced HbA1c and a decreased risk of diabetes [31]. In the present study, only 31.5% females consumed more than 5 servings of vegetables per day. Majority of the study population did not consume adequate servings of fruits and vegetables. In a large community based study in North India by Tripathy *et al.* [17], only 9.2% of the diabetics were having ≥5 servings of fruits and vegetables per day.

Numerous studies have shown that vegetarian dietary pattern results in the lower risk of diabetes. However due to "Nutrition Transition" following urbanization a decrease in whole plant food content of the Indian Vegetarian Dietary pattern was seen. It has been replaced by food items such as processed, fried foods, and refined carbohydrates. This led to development of obesity and diabetes. As per a cohort study by Mari-Sachis *et al.* [32], development of diabetes was found to be associated with meat consumption.

Results similar to our study were reported by Kumar *et al.* [15], in which 51.2% of the diabetics took non-vegetarian diet and 48.8% vegetarian diet. In contrast to the present study, a study by Niti *et al.* [18] reported higher prevalence of diabetes in subjects with vegetarian diet (82.1%). A study by Liu *et al.* [33] found that there is a reduced risk of diabetes in people with high intake of green leafy or dark yellow vegetables.

A high intake of saturated fatty acids, that is, palm oil and coconut oil has been associated with increased risk of developing diabetes. Unsaturated fatty acids especially omega 3 polyunsaturated fatty acids seem to be protective. Majority of the participants consumed palm oil which is a saturated fat.

In a study by Basu *et al.* [34] in Hugly District of West Bengal 79.6% and 20.4% of study population consumed unsaturated oils and saturated

oils, respectively. The findings were different from our study. This may be because of increased awareness about the demerits of using saturated oil among the study population compared to the present study.

## CONCLUSION

The present study identified that factors such as age, tobacco use, inadequate fruit and vegetable consumption, mixed type diet, obesity in the form of increased BMI and WHR, and sedentary life style were the predisposing factors for diabetes. A larger proportion of participants were having higher WHR (43.75%) compared with the participants with increased BMI (33.14%) which shows central obesity is an important determining factor for the risk of development of diabetes than generalized obesity.

### Recommendation

Identification of at risk individuals at an early stage and appropriate lifestyle interventions such as adequate physical activity, healthy dietary habits, and maintenance of correct body weight could help to prevent or delay the onset of the disease. Strengthening the existing NPCDCS program and participation of various organizations including NGOs for formulating and implementing cost-effective tools to prevent and control the risk factors and the disease is the felt need and can aid the cases to adopt appropriate health care practices.

## AUTHORS CONTRIBUTION

Dr S Palai: Designing and conducting the study; data collection, analysis and interpretation, drafting the article.

Dr N Karmee: Contributed in designing and conducting the study, proofreading.

Dr S Das: Contributed in designing and conducting the study, proofreading.

Dr DM Satapathy: Contributed in the concept and design of the study.

## CONFLICT OF INTERESTS

Nil.

## AUTHORS FUNDING

Nil.

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