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RESEARCH ARTICLE

Prevalence of Diabetes and Its Risk Factors in Semi-Urban Populations

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Abstract: ***Background***: Diabetes mellitus is an under category non-communicable disease that is growing at astronomical rate with a huge prevalence of less developed and middle-income countries. Special risk of this is the semi-urban populations because they are altering their lifestyles, their accessibility of medical services is limited, and their diet is changing. ***Purposes***: The study was to establish the incidence of diabetes mellitus and risk factors that are relatable to the incidence of diabetes mellitus among adults in a semi-urban community. ***Materials and Methods***: A cross sectional survey was done on 500 adults aged 20 years and above living in a semi-urban community in a sample of 500. The data was gathered through pretested questionnaire that comprised of sociodemographic variables, lifestyle variables and medical history. The WHO requirements were applied in diagnosing diabetes by measuring the level of fasting blood glucose. The chi-square and logistic regression were used to statistically analyze the data helping to attract significant predictors. ***Results***: The overall prevalence rate of diabetes was 14.8 whereby the males had a higher rate (16.2) than the females (13.5). It has proven to be among the largest risk factors: age (above 40 years old) ($p < 0.001$), family history of diabetes ($p = 0.002$), overweight/obesity ($p = 0.001$), physical inactivity ($p = 0.004$), high waist circumference ($p = 0.01$). There were also high risks of high refined carbohydrate and low fruits and vegetables dietary habits. ***Inference***: The results have shown that diabetes prevalence in semi-urban population is rather quite and predetermined by lifestyle factors which can be modified. The major response components of the health interventions are the components of health education, promoting physical activities and changes in eating habits that are needed to lower the level of burden of diabetes among these transitioning communities.

Keywords: Diabetes mellitus; Prevalence; Risk factors; Semi-urban population; Lifestyle modification; Non-communicable diseases; Cross-sectional study.

INTRODUCTION

Diabetes mellitus (DM) refers to a complicated, persistent metabolic disease that is associated with the increase in blood glucose due to the impairment of insulin release, insulin action, or both. It is among the major non-communicable diseases (NCDs) globally, presenting a great challenge to the health systems of the people because it is chronic, has long-term complications, and healthcare costs associated with it are expensive. There are three major forms of the disease namely type 1, type 2, and gestational diabetes mellitus where type 2 diabetes is recorded to be over 90 percent of all diabetic cases throughout the world [1].

The incidence of diabetes in the world has increased exponentially in the recent decades. The International Diabetes Federation (IDF) Diabetes Atlas 2021 estimates that there are 537 million adults (20-79 years) living with diabetes today, and it is likely to grow to 643 million in 2030 and 783 million in 2045. The highest growth would be in low- and middle-income nations, where urbanization and lifestyle shift are increasing successively, exposing the populations to the dangers of obesity, lack of exercise, and bad eating habits [2].

With a longstanding reputation of being the diabetes capital of the world, India has been facing an alarming rate of diabetes prevalence in the past couple of years. According to the ICMR-INDIAB study, it is estimated that approximately 101 million adults in India have diabetes with almost 136 million having prediabetes. It is not only metropolitan cities that have been hit by the burden and has slowly extended to smaller towns and semi-urban areas. This is a change in a trend of epidemiology as people living in semi-urban areas are changing their lifestyles to that of the urban areas, including eating foods that contain high-calories, sedentary occupation and reduced physical activity, yet lacked proper healthcare facilities and awareness of the preventive measures [3].

The semi urban communities occupy a special location between the rural and urban setting. They must deal with two issues where they are at risk of being affected by the lifestyle and have little access to quality healthcare services. The established dieting habits and the increased

intake of processed food products coupled with lack of physical exercises and uncommon doctor visits is contributing to an increased trend in diabetes and other metabolism related illnesses. In addition, the situation is aggravated by the ignorance on the symptoms of the disease, diagnosing it in time, and follow-up treatment [4].

The determination of the prevalence of diabetes and the risk factors in semi-urban regions is of paramount importance due to a number of reasons. To begin with, it aids in estimating the scale of the issue in a communal context. Second, it allows establishing the modifiable risk factors that may include obesity, sedentary lifestyle, and unhealthy diet early on. Third, it gives an evidence base to the public health interventions to prevent diabetes and alleviate its complications via health education, lifestyle modification programs, and community-based screening programs [5].

Despite the fact that a number of studies have evaluated the level of diabetes among urban and rural populations, a relatively low number have evaluated semi-urban populations which are the rapidly expanding population of a number of developing regions. Absence of the epidemiological data on the region makes it hard to implement the effective strategies to prevent and control diabetes [6].

Therefore, the current study was aimed at establishing the prevalence of diabetes mellitus, as well as identifying the risk factors of the condition against the background of semi-urban population of adults. It is believed that the findings will be useful in such aspects as getting to know the emerging diabetes burden within these transitioning communities and informing the development of specific health policies and prevention strategies [7].

MATERIALS AND METHODS

Study Design and Setting

To determine the prevalence of diabetes mellitus and the risk factors of the disorder among adults living in a semi-urban community, a community-based cross-sectional study was designed. The research was conducted in the period of January -June 2025 in a semi urban locality located close to Andhra Pradesh, which is one of the typical transitional regions between countryside and urban settings. The area was chosen due to its diversity in socio-economic features and ease of accessibility by the community in terms of conducting screening [8].

Study Population

The population of the study sample was adult residents aged 20 years and above but had resided in the chosen semi-urban area at least one year. Severely ill people, pregnant women and those who could not bring their consent were excluded of the study [9].

Sample Size Determination

The sample size was estimated using the prevalence of diabetes according to the past community-based research studies, which were performed in the past and prevailed to be 12, a 95% interval, and a 3% error. The sample size of 500 participants was identified as the minimum. Participants were selected through a multistage random sampling to ensure they were selected proportionately in various wards in the semi-urban region [10].

Data Collection Materials and Methods

The data were gathered with the help of a pre-tested and designed questionnaire via a face-to-face interview. The questionnaire was divided into four parts [11]:

- Sociodemographic information - age, sexuality, education, profession, earnings, and marital status.
- Habitual factors - dietary, physical activity, smoking, alcohol, and sleep.
- Medical history- Family history of diabetes, hypertension or cardiovascular disease.
- Anthropometric and clinical data height, weight, waist circumference, and blood pressure [12].

Anthropometric Measurements

The measurement of weight was done using a digital weighing machine of accurate mass with the subjects being lightly dressed and shoeless. A stadiometer was used to measure height to nearest 0.1 cm. Body Mass Index (BMI) was computed as weight (kg)/height 2 (m^2) and classified based on WHO standards. A non-stretchable tape was used to measure the waist circumference halfway between the lowest rib and the iliac crest [13].

Biochemical Analysis

Blood samples were taken off as venous samples and an overnight fast of at least 8 hours was observed. It estimated the Fasting Blood Glucose (FBG) levels through the glucose oxidase-peroxidase technique in a standardized biochemical analyzer. The participants fell into the following categories [14]:

- Normal: FBG < 100 mg/dL
- Prediabetes: FBG 100–125 mg/dL
- Diabetes: FBG ≥ 126 mg/dL

According to the World Health Organization (WHO, 2020) criteria of diagnosis.

Data Quality Control

All the instruments were calibrated on a daily basis and data collectors were trained on the standard methods of interviewing and measurements. The questionnaire was tested on 30 people in a locality and required adjustments were done, in accordance to their opinions, to have clarity and reliability [15].

Ethical Considerations

The Institutional Ethics Committee gave ethical approval to the study before this study was conducted. All the

participants gave informed consent in writing. Those people diagnosed with an abnormally high level of glucose in the bloodstream were advised and sent to local health facilities where they were to undergo additional testing and treatment [16].

Statistical Analysis

The SPSS version 25.0 was used to enter and analyze data. The data were summarised using descriptive statistics which included mean, standard deviation and percentages. Chi-square test was also utilized to evaluate the relationship between categorical variables, and binary logistic regression analysis to determine independent risk factors of diabetes [17]. The p-value that was taken as statistically significant was below 0.05 (Figure 1).

Figure 1: Research Methodology

RESULTS

Sociodemographic Characteristics

The number of participants amounted to 500 (260 males (52%) and 240 females (48%)). The average age of the samples was 44.6 /12.3 years. Most (58%) of them were aged between 31 and 50 years old and 72 percent were married. In the area of education, 40 percent were secondary school graduates and 18 percent were graduates. In the aspect of occupation, 36% were sedentary, 42% were manual workers and 22% percent were homemakers.

Prevalence of Diabetes

The general incidence of diabetes in the population of the study was 14.8 (n = 74).

- One-point seven six was found to have prediabetes (n = 88).
- This prevalence was a little higher in males (16.2%) than it was in females (13.3%).
- The prevalence of diabetes rose with age of participants, with the highest rate of 26.8 percent among elderly participants with age over 50 years, and minimum rate of 4.5 percent among participants who were below 30 years old.

Lifestyle and Clinical Characteristics

These were 39 percent overweight individuals (BMI 2529.9 kg/m 2) and 21 percent obese (BMI 30kg/m 2) among the participants of the study. Forty four percent of the subjects reported physical inactivity. Twenty-eight percent of the participants reported a family history of diabetes. Hypertension was observed in 22.5 per cent of the people, and central obesity was observed in 35.4 per cent (waist circumference more than 90 cm in men and more than 80 cm in women).

Relationship between Risk Factors and Diabetes

The statistical analysis revealed that there is a significant correlation between the prevalence of diabetes and most risk factors. The significant predictors were age over 40 years, the family history of diabetes, overweight/obesity, physical inactivity, and hypertension ($p < 0.05$) (Table 1, Figure 2).

Table 1. Association of Risk Factors with Diabetes Mellitus in Semi-Urban Population (n = 500)

Risk Factor	Category	Diabetic (n=74)	Non-Diabetic (n=426)	p-value
Age (years)	< 40	12 (6.2%)	182 (93.8%)	< 0.001*
	≥ 40	62 (23.1%)	206 (76.9%)	
Gender	Male	42 (16.2%)	218 (83.8%)	0.21
	Female	32 (13.3%)	208 (86.7%)	
BMI (kg/m²)	< 25	11 (5.8%)	180 (94.2%)	< 0.001*
	≥ 25	63 (23.9%)	200 (76.1%)	
Physical Activity	Active	18 (7.8%)	212 (92.2%)	0.002*
	Inactive	56 (20.4%)	218 (79.6%)	
Family History of Diabetes	Present	32 (22.9%)	108 (77.1%)	0.001*
	Absent	42 (11.7%)	318 (88.3%)	
Hypertension	Present	26 (23.2%)	86 (76.8%)	0.004*
	Absent	48 (12.4%)	340 (87.6%)	
Waist Circumference	Normal	19 (8.5%)	204 (91.5%)	0.01*
	High	55 (22.0%)	222 (78.0%)	

*Significant at $p < 0.05$

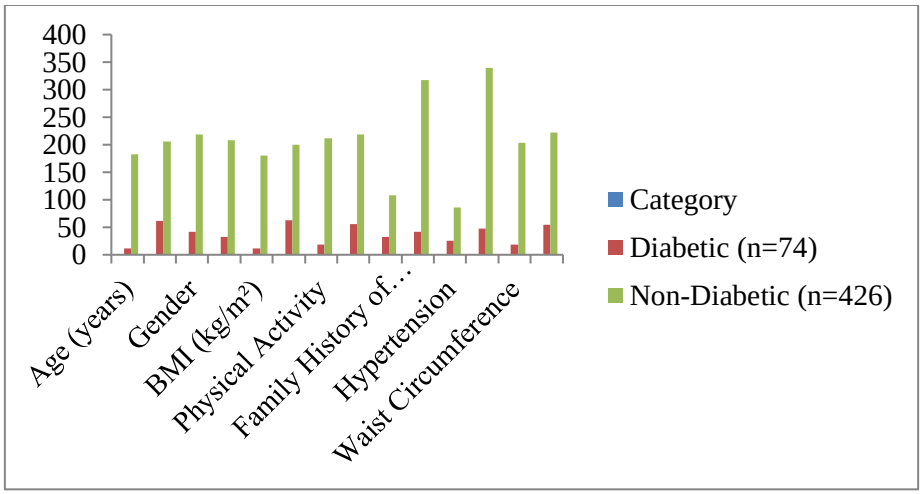

Figure 2: Graphical presentation of Risk Factors with Diabetes Mellitus in Semi-Urban Population

Multivariate Logistic Regression Analysis

On multivariate analysis, independent predictors of diabetes were:

- Age ≥ 40 years (OR = 2.8, 95% CI: 1.6–4.9, $p < 0.001$)
- Family history of diabetes (OR = 2.3, 95% CI: 1.3–4.1, $p = 0.002$)
- BMI ≥ 25 kg/m² (OR = 2.7, 95% CI: 1.5–4.8, $p = 0.001$)
- Physical inactivity (OR = 1.9, 95% CI: 1.1–3.3, $p = 0.02$

DISCUSSION

The current research evaluated the incidence of diabetes mellitus and the risk factors of the same in adults living in a semi-urban population. The results showed the prevalence of diabetes of 14.8 which shows that there is a moderate high burden of disease in the study area. This pre-eminence is comparable to other Indian articles carried out in semi-urban and urbanizing areas where prevalence rates have been between 12-18%. These figures indicate the epidemiological transition of semi-

urban communities as a result of modernization, change in diet and sedentary lifestyles [18].

The recorded increased prevalence in males (16.2%) as opposed to female (13.3) is in tandem with other earlier studies by Anjana et al. (2019) and Kumar et al. (2021), which revealed gender disparities due to occupational stress, dietary habits, and central obesity in men. Nevertheless, in certain areas, women have demonstrated equal or even greater prevalence perhaps because of hormonal fluctuations and rising obesity, the indication is that gender-specific trends may be region-specific [19].

There was a positive, but strong correlation between age and diabetes with a significant increase in prevalence in individuals, who are above 40 years. This observation substantiates the biological concept that insulin sensitivity and pancreatic 8-cells drop as age advances, which subjects older adults to hyperglycemia. This age effect has been reported in other studies in Tamil Nadu, Maharashtra, and Kerala, as well as this supports the claim that age is one of the most reliable risk factors of diabetes in a wide variety of people [20].

In this study, obesity and overweight were significantly related with diabetes ($p < 0.001$). The risk of diabetes was almost three times more in persons who had BMI 25 kg/m 2 and above, as it is aligned with the statements of the WHO Global Diabetes Report (2021) that obesity is one of the primary modifiable determinants. The elevated adiposity causes insulin resistance, disturbed lipid metabolism, and inflammation of low grade, which are associated with the pathogenesis of type 2 diabetes. This semi-urban population has a very high number of overweight people (60%), which stresses the importance of specific lifestyle intervention programs [21].

Another significant risk factor was physical inactivity ($p = 0.002$) that supports the findings of Ramachandran et al. (2017) who proved that in transitional populations, sedentary lifestyle is a significant risk factor of developing diabetes. The fast mechanization, office-related employment, and decreased outdoor activities in the semi-urban regions have contributed to the decrease in the energy consumption, which predisposes people to the development of the metabolic disorders [22].

The family history of diabetes also played a significant role in the occurrence of the disease ($p = 0.001$). This relationship is probably caused by genetic predisposition and common environmental and lifestyle factors. It is documented that people who have a diabetic relative in the first-degree of the family have a two to threefold increased level of risk of developing diabetes as per both national and international studies [23].

Moreover, hypertension and central obesity were also highly related to diabetes in this study, which also represents the clustering of metabolic risk factors that is commonly observed in metabolic syndrome. These results coincide with those of the Indian Council of Medical Research (ICMR) -INDIAB study that reported a high rate of co-morbidity of diabetes, hypertension, and obesity among semi-urban populations. This clustering shows that there is need to implement a unitary screening and management programs which should treat a number of risk factors simultaneously [24].

Although the prevalence in this study is not significantly high compared to that of the large metropolitan areas, it remains very high in comparison to the rates that had been reported among the rural population before. Such gradient reflects the semi-urban nature of such communities, where the change of the lifestyle has not been covered by the adequate level of the health education or prevention strategies [25].

The article mentions the importance of community-based health education on diet, physical activity, and frequent screening as a problem that needs to be addressed immediately. Timely diagnosis of the issue through the use of fasting blood glucose and promotion of healthy lifestyles may reduce the burden of diabetes and its complications significantly. The reversal of the escalating trend would help in empowering the primary healthcare facilities, and providing awareness campaigns that are unique to the semi-urban communities [26].

Despite a great insight that the research will make, there are certain limitations that have to be mentioned. Being a cross-sectional type, it cannot provide causal relations between the risk factors and diabetes. Self reported lifestyle information is also prone to recall bias. Moreover, the fasting glucose was the only test that was conducted and the oral glucose tolerance test or the HbA1c level would have provided a more accurate diagnostic measure. Despite these limitations, the study findings contribute very much to the body of information on the incidence of the burden of diabetes in semi-urban populations [27].

Although the research has a significant insight to be made, some limitations have to be mentioned. As a cross-sectional type, it is not able to give causal relationships amongst the risk factors and diabetes. Lifestyle information that is self reported can also be prone to recall bias. Further, only fasting glucose was tested; the oral glucose tolerance test or the level of HbA1c would have given a better diagnostic accuracy. Irrespective of these weaknesses, the results of the study play a significant role in the knowledge of the burden of diabetes among semi-urban populations [28].

CONCLUSION

The prevalence of diabetes mellitus in adults residing in semi-urban communities is rather low but moderate (14.8) as an indicator of the raised non-communicable disease burden in the transitional communities. Advancing age, family history of diabetes, obesity,

physical inactivity, and hypertension were identified to be the key risk factors. These findings substantiate the importance of the community-based preventive interventions directed at the encouragement of healthy diets, physical activities, and early screening of the high-incidence groups. Community health education and primary healthcare intervention measures should also be ameliorated in the semi-urban communities as this can be deemed crucial towards the prevention of the rising trend of diabetes and associated complications. The research should adopt longitudinal and interventional studies in future to establish causal and effect relations and whether the prevention measures developed are effective in semi-urban populations.

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