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# Prevalence And Risk Factors of Pre-Diabetes And Diabetes Mellitus In A Remote Village of Eastern India

Tapas Kumar[1], Adwitiya Das[2*]
[1](Assissant Professor, Department Of General Medicine, IQ City College And Hospital, Durgapur, India)
[2](Demonstrator, Department Of Community Medicine, Medical College Kolkata, India)

***Abstract:*** *Diabetes mellitus is a modern day epidemic, silently affecting both rural and urban population. This cross-sectional study done over a period of five months following modified version of STEPS questionnaire on adult population aimed at finding the prevalence and risk factors of diabetes and pre-diabetes in a rural area of Eastern India. A high prevalence of diabetes and pre-diabetes was observed. Obesity, sedentary lifestyle, hypertension and family history of diabetes were found to be significantly associated with diabetes. There was significant positive correlation between HbA1c values and Body mass index.*

***Keywords :*** *Diabetes mellitus, Glycemic control, Risk factors, Morbidity*

## I. Introduction

Diabetes mellitus (DM) is quickly emerging as the 21st century epidemic. [1] Roughly, 20% of global burden of diabetes is in South East Asian Region (SEAR), which is likely to reach 228 million by the year 2025 from the current 84 million. India has the maximum prevalence of diabetes among all countries, and has been rightly called the "Diabetes capital". [2] Contrary to the earlier belief that it is as disease of the upper socio-economic status, recent studies have described high prevalence among people from lower socio-economic strata. Now, it has also encroached among rural populations and tribal areas. People in the rural and remote areas are even unaware of the free services or facilities being provided to them, leading to increased disease severity and greater occurrence of complications. [3, 4]

Diabetes is said to represent the tip of the iceberg, with a large number of asymptomatic people having either impaired glucose tolerance or insulin resistance. Insulin resistance predisposes to future diabetes, and is the cradle-bed of cardiovascular diseases. Early diagnosis and effective management of insulin resistance through individual and community-based approaches may be fruitful in prevention of adverse cardiovascular events.

Several factors might influence development of insulin resistance. Sedentary lifestyle, obesity, positive family history, high calorie diet and smoking are probable risk factors. [5] Preventive strategies aimed at high risk populations may be instrumental in managing the emerging epidemic of diabetes. [6] Most of the research about the complex inter-play of diabetes and its risk factors has been undertaken in urban, affluent societies. Studies focusing on risk factors of diabetes and insulin resistance among rural population of India who lack access to modern healthcare facilities, is, surprisingly sparse in the scientific literature. The present study aims to assess the prevalence and risk factors of impaired glucose tolerance and diabetes mellitus in Ghatampur, a remote village in rural areas of Singur Block, Hooghly district, West Bengal, India.

## II. Methodology

This study, undertaken from March to July 2013, was an epidemiological study through cross-sectional community-based survey of the selected sample population, which comprised of population aged 15-65 years of age, residing in a remote village called Ghatampur with a population of around 1400 in the Hooghly district of West Bengal. Total study duration was 5 months. The protocol was approved by the Institutional Ethics Committee and informed consent from the participants was mandatory for inclusion. Those who were unwilling to provide blood samples and those who were seriously ill or had recent history of hospitalisation due to any ailments were excluded from the study. The number of eligible people in the village who could be approached was 823. Out of them, 809 subjects gave informed consent, and 807 finally completed the full interview and gave biological samples necessary for the research.

Study subjects were assessed using a case record form, adapted from relevant sections of WHO STEPS questionnaire and modified for rapid survey among rural population, including information for socioeconomic status, physical activity (duration of work of >90, 60–90, 30–59, and <30 minutes per day as heavy, moderate, mild, and sedentary, respectively), diet, smoking (in pack-years), and alcohol (in number of drinks consumed of 60 ml after standardisation) use. After the interview, anthropometric assessment (height and weight) was done and classified as per WHO classification for BMI [7]. Blood pressure was taken after a 10-minute rest with standard cuffs for adults fitted with a mercury sphygmomanometer in sitting position. Blood pressure was taken thrice (in a gap of 10 minutes) and average value was considered. The JNC criteria 7 were used for

categorisation [8]. Twelve hour fasting and 2 hrs post–prandial blood glucose was assessed by peroxidase method and WHO cut-off was followed [9]. Data were analyzed using Microsoft excel and SPSS version 16.0. Firstly, the data was checked for normality and independence, following which, a bivariate analysis was done to ascertain the association between presence of impaired glucose tolerance or Diabetes mellitus with some independent variables. Only those found to be significant were entered into a multiple logistic model LINK FUNCTION= LOGISTIC) by ENTER method. Diagnostic tests were done after modeling to assess goodness-of-fit and assumptions regarding logistic regression. A p-value less than 0.05 was considered as statistically significant.

## III. Results

Out of 807 participants, 59.23% were male, and 33.21% were in the age group of 30-44 years. Most of the subjects were below poverty line. Table 1 shows the socio-demographic parameters of the participants. It was observed that 209 (25.9%) participants were suffering from diabetes. Pre-diabetes in the form of impaired fasting and/or impaired post-prandial glucose was observed in a significant proportion (387, 47.96%) of the study population (Table 2). The study population had a mean HbA1C of 6.14(1.08). 162 out of 209 diabetics had HbA1C above 7%, signifying inadequate glycemic control (not shown in table). In an attempt to find out probable risk factors of pre-diabetes and diabetes in the study population, it was observed that obesity, sedentary lifestyle, family history of DM and hypertension were significantly associated with diabetes or pre-diabetes (Table 3). There was significant positive correlation between BMI and HbA1c [Pearson's correlation coefficient: $r=0.78$, $p<0.05$].

**Tables Table 1:** Socio-Demographic Parameters Of The Study Population. (N=807)

| **Variable** | **Mean(SD)** | **N (%)** |
|---|---|---|
| Age (in completed years) | 42.59(15.63) | |
| <30 | | 182(22.55) |
| 30-44 | | 268(33.21) |
| 45-59 | | 204(25.28) |
| 60 & more | | 153(18.96) |
| Gender | | |
| Male | | 478(59.23) |
| Female | | 329(40.77) |
| Religion | | |
| Hindu | | 711(88.10) |
| Islam | | 96(11.90) |
| Marital status | | |
| Married | | 752(93.18) |
| Unmarried/widowed | | 55(6.82) |
| SE status | | |
| APL | | 16(1.98) |
| BPL | | 791(98.02) |
| Level of education | | |
| Below $10^{th}$ Std | | 379(46.96) |
| Up to $10^{th}$ Std | | 322(39.90) |
| >10 to <$12^{th}$ Std | | 7(0.87) |
| Up to $12^{th}$ Std | | 76(9.42) |
| Graduate & above | | 23(2.85) |
| Monthly family income | 2150.31(2250.43) | |
| Up to 2000 INR | | 344(42.63) |
| >2000 to 5000 INR | | 431(53.41) |
| >5000 INR | | 32(3.97) |

**Table 2:** Distribution of various cardiovascular risk factors in the study population (n=807)

| **Cardiovascular risk factor** | **Mean(SD)** | **Number (%)** |
|---|---|---|
| SBP | 128.63(7.06) | |
| Hypertension present | | 385(47.71) |
| Dyslipidemia present | | 249(30.86) |
| Diabetes present | | 209(25.90) |
| Pre-diabetes present | | 387(47.96) |
| HbA1c | 6.14(1.08) | |
| <7% | | 622(77.08) |
| ≥7% | | 185(22.92) |
| Waist Hip ratio above normal (Male) | | 216(45.19% of males) |
| Waist Hip ratio above normal (Female) | | 119(36.17% of females) |
| BMI($kg/m^2$) | 29.83(3.75) | |

**Table 3:** Covariates of increased risk of diabetes and impaired glucose tolerance in the study population (n=807)

| Covariate | DM/IGT present (596) | OR | AOR |
|---|---|---|---|
| Age | | | |
| <45 years (450) | 306 | **0.49(0.35-0.68)** | 0.82(0.05-2.84) |
| ≥45 years (357) | 290 | 1 | 1 |
| Gender | | | |
| Male(478) | 355 | 1.05(0.77-1.45) | |
| Female(329) | 241 | 1 | |
| Obesity | | | |
| Present (357) | 307 | **3.42(2.40-4.88)** | **2.16(1.38-3.75)** |
| Absent (450) | 289 | 1 | 1 |
| Sedentary worker | | | |
| Yes (272) | 233 | **2.83(1.93-4.16)** | **1.13(1.02-2.96)** |
| No (535) | 363 | 1 | 1 |
| Smoking | | | |
| Yes (103) | 88 | **2.26(1.28-4.01)** | 1.79(0.88-4.04) |
| No (704) | 508 | 1 | 1 |
| Alcoholism | | | |
| Yes (76) | 61 | 1.49(0.83-2.68) | |
| No (731) | 535 | 1 | |
| Known family h/o DM | | | |
| Yes (243) | 199 | **1.90(1.31-2.76)** | **1.46(1.13-2.85)** |
| No (564) | 397 | 1 | 1 |
| Hypertension | | | |
| Yes (385) | 306 | **1.76(1.28-2.43)** | **1.33(1.09-5.48)** |
| No (422) | 290 | 1 | 1 |
| Dyslipidemia | | | |
| Yes (249) | 193 | 1.32(0.93-1.88) | |
| No (558) | 403 | 1 | |

## IV. Discussion

Our Our study showed that DM and pre-diabetes were prevalent in a large proportion of the study population. Pre-diabetes was present in greater number of study subjects than DM, suggesting that clinically detectable diabetes represents only a small percentage of the huge number of individuals with insulin resistance. Inadequate glycemic control in the study population was consistent with the probable lack of awareness, and scarcity of health care facilities in the village. It was found that after adjusting for age, gender and other variables, obesity, sedentary lifestyle, family history of diabetes and hypertension were significantly associated with pre-diabetes and diabetes in the study population. Significant positive correlation was also observed between HbA1c and BMI, further pointing towards the close association between hyperglycemia and obesity.

Findings from the present study corroborated with as well as differed from previous studies from different parts of India and the world. It is well known that prevalence of DM is increasing not only in urban India but also in rural areas. Rural India has relatively high prevalence of DM ranging from about 2.0% to 10.0% [10]. Our study reported overall prevalence of DM to be 25.9%, which is way higher than other studies. Pre-diabetes was found in about 14% individuals in an urban India based study [11]. However, the present study found a higher prevalence of 47.96%. This is again, far less than the prevalence found by Kapoor et al, who reported it to be nearly 90% in sub-Himalayan population [12]. The ignorance about diabetes risk factors and diet rich in carbohydrate, along with other ethnic factors may be responsible for such high prevalence in the study population. However, searching for causes of high prevalence was not part of the study protocol. It was observed that after adjusting for age and gender, obesity, sedentary lifestyle, hypertension and family history of DM were associated with occurrence of DM in the study population. Obesity, mainly central obesity has long been considered a risk factor for DM and other cardiovascular diseases. It is observed that Asian Indians are more susceptible to adiposity (based on BMI), and central obesity, despite having a relatively low BMI [13]. We did not get any gender difference in prevalence of diabetes and pre-diabetes, though a South Indian study reported greater prevalence in females, which they ascribed to increased central obesity in females [14]. In our study, 306 individuals had co-existent DM and hypertension, pointing towards the close association between the two important cardiovascular risk factors. A French study reported hypertension in about one third of diabetic patients [15]. We could not document any relation between smoking and alcoholism, and DM. Researchers have different opinions regarding relation between smoking, alcoholism and diabetes risk. While alcohol was found positively associated with diabetes in a Manipur-based study, both smoking and alcoholism were not considered as significant risk factors of DM in a study from Haryana [16, 17]. In the present study, we did not include psychosocial stress in the final model for DM risk. However, in urban studies, stress has been shown to increase

risk of DM [18]. Sedentary lifestyle was found to be a significant association, which is in keeping with other studies [19]. Family history of DM, particularly in first degree relatives, might confer an increased risk of DM in the individual. This was observed in our study as well. Many other researchers have also emphasized on the genetic predisposition in type 2 DM [20].

In spite of limitations like small sample size and unicenter model, this study takes an important step towards exploring the inter-relationship of various predictors for Diabetes and impaired glucose tolerance.

## V. Conclusion

Our study demonstrated a high prevalence of diabetes in rural Bengal. Early identification of risk factors and significant associations of DM and pre-diabetes may be beneficial in all over cardiovascular risk reduction. Other studies from different parts of West Bengal and India may be helpful in identifying other risk factors of DM, and may thereby contribute in preventing the future occurrence of the disease

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