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Assessment of Sociodemographic Status, Self-awareness, and Risk Factors Affecting Patients with Prediabetes in Bangladesh: Cross-sectional Study

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Abstract

Background: Poor glycemic control and high diabetes and prediabetes incidence are influenced by socioeconomic disparity. Raising awareness and ensuring that people with prediabetes are receiving medication, maintaining their glycemic control, and getting the proper care they need despite their socioeconomic situation are crucial in the fight against diabetes. This study aims to assess the sociodemographic status, self-awareness, and risk factors associated with prediabetes in Bangladesh.

Methods: A cross-sectional survey was carried out among 500 participants aged >18 years to evaluate and summarize their demographic data, socioeconomic status, and responses to various questionnaires about their conditions related to prediabetes and their awareness of this condition.

Results: Analysis of factors revealed that 41% and 39% of the participants had first- and second-degree relatives with diabetes, respectively. Meanwhile, 36% of the participants maintain physical activities, 30% prefer sweetened beverages, and 29% have high blood pressure. The participants were aware of different statements related to diabetes, such as how lifestyle modification and awareness can help people with prediabetes.

Conclusions: This study provided insights into the underlying factors related to prediabetes and enabled us to identify the prediabetes conditions unknown to people in Bangladesh.

Keywords: awareness, Bangladesh, cross-sectional study, prediabetics, risk factors

INTRODUCTION

Diabetes is a noncommunicable, chronic metabolic disorder caused by either insufficient insulin production from the pancreas or the body's inability to regulate blood glucose levels and excessive urine production from the kidneys. Increased blood glucose levels cause severe long-term damage to the nerves that control the heart, blood vessels, and kidneys, resulting in cardiovascular dysfunctions.[1] The most prevalent kind of diabetes is diabetes mellitus or type 2 diabetes mellitus (T2DM), which often affects adults and develops when the body stops producing adequate insulin or becomes resistant to it.[2]

The prevalence of diabetes, including types 1 and 2, is expected to rise by 54%, exceeding 54.9 million Americans by 2030; annual diabetes-related deaths and total medical and societal costs will surge by 38% to 385,800 and 53% to more than $622 billion, respectively.[3] Diabetes affects 90 million people in Southeast Asia and 537 million people worldwide, the majority of whom reside in low and lower-middle-income countries (LMICs). By 2045, this number will continue to increase to 151.5 million.[1] Diabetes is responsible for 1.5 million deaths annually, and this number increases at an alarming rate every year. The substantial rise in diabetes incidence in LMICs is caused by the epidemiological change that has resulted in the consumption of westernized meals, poor lifestyle decisions, less exercise, altered leisure activity patterns, long workdays, and decreased sleep.[2]

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Prediabetes is a condition characterized by blood sugar levels that are higher than normal but not yet high enough to be diagnosed as T2DM.[4,5] According to the Department of Health and Human Services of the USA and the American Diabetes Association, "prediabetes" is a term used for people with conditions who have blood glucose levels that are higher than normal but are not yet diabetic.[6] Several factors, including a combination of genetic, lifestyle, and metabolic influences e.g., insulin resistance, obesity, physical inactivity, poor diet, age, ethnicity, gestational diabetes, hormonal factors, and sleep disorders, contribute to the development of prediabetes.[7]

Addressing the prevalence of prediabetes is globally paramount because it represents a critical opportunity to intervene and prevent the progression to T2DM, thereby mitigating the associated health and economic burdens.[6] In Bangladesh, research on prediabetes becomes crucial because the prevalence of diabetes is soaring gradually due to urbanization, sedentary lifestyles, and dietary changes.[8,9] The findings will help curb the impending diabetes epidemic, improve public health outcomes, and alleviate the strain on the country's healthcare system.[9]

The first step in motivating people with prediabetes to adopt a healthy lifestyle is identifying them and letting them know about their elevated risk for T2DM. Despite its increasing trend, the level of prediabetes knowledge remains low. According to the Centers for Disease Control and Prevention statistics from 2017 to 2020, more than 80% of individuals with the disease are not aware of it.[10] This situation might be a barrier to promoting engagement rates. Patients who are ignorant of their illness could lack the motivation to participate in risk-reduction measures because the willingness to act depends on the perceived necessity for action.[11] Evidence-based lifestyle programs advocate that individuals with prediabetes can prevent the progression to T2DM by making dietary changes, engaging in moderate amounts of physical activity, and losing a substantial amount of weight.[12]

Knowledge of the interplay among genetic, environmental, and lifestyle factors is lacking.[13] The precise molecular mechanisms underlying the transition from prediabetes to overt diabetes are also unknown, impending the development of targeted therapeutic interventions.[14] Further research is needed to explore the cultural and socioeconomic factors influencing prediabetes in diverse populations and to develop tailored strategies for prevention and early intervention.[15]

The prespecified hypotheses of prediabetes include investigating the effect of a structured exercise regimen on improving insulin sensitivity and reducing the progression from prediabetes to diabetes in a diverse population.[16] Scientists hypothesize that dietary interventions focusing on specific nutrient profiles can mitigate metabolic abnormalities associated with prediabetes, potentially providing insights into personalized dietary strategies for at-risk individuals.[17–19] Prediabetes is preventable if efforts are directed to raising consciousness and facilitating its management, mitigation, and monitoring.[20] Although many studies have explored prediabetes prevalence, data are lacking on the knowledge and awareness of prediabetes risk factors to evaluate how much people know about this condition.[18,21] Thus, the present work aims to summarize the demographic data of the participants and their responses to various questionnaires about their situations related to prediabetes and their awareness of this condition.

METHODS

This hospital-based survey was conducted at the Dhaka Medical College Hospital, SIBL Foundation Hospital and three more hospitals in Dhaka, Bangladesh from November 2022 to March 2023. A total of 500 participants were selected by simple random sampling and lottery method.[22] The sample size was calculated using Masood *et al.*'s method[23] and an online calculator (http://www.raosoft.com/samplesize.html), with a confidence interval of 95% and a margin of error 5%. Despite the extremely low chances, bias may occur during sample selection. Using an appropriate sample calculation method can prevent the formation of bias.

Some criteria were carefully followed during the whole study period, such as age >18 years, capability to understand English or Bengali, willingness to participate in this study, and the following symptoms for prediabetes patients: blood sugar level from 140 mg/dl to 199 mg/dl (7.8–11.0 mmol/L), increased thirst, frequent urination, excess hunger, fatigue, and blurred vision.

Some participants were excluded from the study because of their inability to match the above criteria. Prior to the study, a written consent form was obtained from all the participants. The Department of Pharmacy of Atish Dipankar University of Science and Technology approved and coordinated this study under the reference number ADUST-EC/2022/35.

The questionnaire was designed by following previously published articles[23–27] and was composed of four segments: (a) demographic characteristics of respondents, (b) general knowledge of participants regarding prediabetes, (c) awareness and risk factors of prediabetes, and (d) symptoms of prediabetes. It was first prepared in English and then translated to Bengali to facilitate understanding among the participants. The questionnaire was validated by a panel of experts such as endocrinologists, clinical pharmacists, social science graduates, university professors with expertise in relevant fields, and healthcare professionals. A pretest was conducted among a small number of participants to determine whether they face any problems in

understanding the questionnaire, but no such difficulties were observed. Different medical terms were elucidated in face-to-face interviews with the participants.

Five dedicated pharmacy graduates and physicians volunteered to collect data. They underwent a 1-month training course on prediabetes screening and risk assessment and were trained on the research questionnaire. They also took part in various seminars on prediabetes as arranged by different medical institutions. The volunteers maintained the above-mentioned four steps for data collection. First, the participants were asked to complete a questionnaire related to sociodemographic and anthropometric information. The purpose of the research was then explained, and their confidentiality was ensured. Any types of doubts or questions from the participants were clarified by the authors and trained volunteers. Immediately after the completion of the interview, the questionnaires were collected. Statistical data analysis were performed using Statistical Package for Social Sciences (SPSS software, Inc., Chicago, USA) version 22.0, and Cronbach's alpha was analyzed.

RESULTS

A total of 500 respondents were interviewed. Among them, 40% are male (N = 300), and 60% are female (N = 200). The age of respondents ranged from 20–60 years old. The response rate for this study is 100%. Gender, body weight, employment, educational qualification, economic situation, and other sociodemographic variables impact diabetes development. Family history, a genetic component, also plays an essential role.[28]

According to the results, 11.16% of the participants are moderately obese, 22% are overweight, 56.4% are normal weight, 7.6% are underweight, and 2.4% are severely underweight. In addition, 39% of the participants have business backgrounds, 41% are service holders, and 14% have other occupations. With regard to the distribution of economic classes, 12% of the respondents belong to higher class, 18% to higher middle class, 50% to middle class, and 20% to lower middle class. Approximately 41% of the respondents have first-degree relatives with diabetes, 39% have second-degree relatives with diabetes, and 12% have both (Table1).

The analysis of the questionnaire indicated sufficient face validity. Further, the questionnaire also indicated having internal and test-retest reliability. Among the 500 participants, only 150 prefer beverages, which is surprising because of the popularity of these sugary drinks. When asked if fruits, vegetables, and nuts are part of their daily consumption, 42% of the participants said they eat these daily. A significant percentage of respondents, 58%, said they do not eat fruits, vegetables, and nuts. In terms of physical exercise, 320 participants (64%) said that they do not perform any activities, leaving only 180 participants (36%) who physically exercise. People who do not eat fruits and vegetables and do not maintain physical activity are at great risk of developing T2DM.[29] Meanwhile, fewer participants have said that they have high blood pressure, feel stress in their lives, and have gestational diabetes, all of which are T2DM symptoms.[1] Observing the presence of darkened spots in the body, which is common in patients with diabetes, is mandatory for people with prediabetes.[30] According to the analysis, 130 people said they do not observe this condition, and 370 people said this practice is unknown to them, probably because they are unaware of this being a symptom of diabetes (Table 2). The results proved that the majority of individuals in the country do not consume sufficient amounts of healthy food and do not engage in physical exercise, placing them at a high risk of developing diabetes.

Lifestyle, obesity, and other variables all contribute to the development of diabetes, and good awareness and use of information could help in diabetes prevention. Proper awareness of diabetes may assist in preventing diabetes and controlling blood sugar levels in the body.[31]

TABLE 1. Sociodemographic characteristics of the participants

Variables	N (%)
Gender	
Female	300 (60.0)
Male	200 (40.0)
Weight (BMI kg/m^2)	
Very severely underweight (less than 15)	0 (0.0)
Severely underweight (15.0 to 16.0)	12 (2.4)
Underweight (16.0–18.5)	38 (7.6)
Normal weight (18.5–25)	282 (56.4)
Overweight (25–30)	110 (22.0)
Moderately obese (30–35)	58 (11.2)
Family occupation	
Business	195 (39.0)
Service holder	205 (41.0)
Others	70 (14.0)
No comment	30 (6.0)
Educational qualification	
Uneducated	9 (1.8)
Primary (1–5)	161 (32.2)
Higher (6–12, Honors and more)	330 (66.0)
Economic status	
Higher class	60 (12.0)
Higher middle class	90 (18.0)
Middle class	250 (50.0)
Lower middle class	100 (20.0)
Family diabetes history	
The first degree of relatives (parent, sibling)	205 (41.0)
The second degree of relatives (aunt, uncle, grandparents)	195 (39.0)
Both first and second-degree	60 (12.0)
No history	40 (8.0)

According to the analysis, 84% of the participants strongly agree and agree that a healthy lifestyle could help them be free from diabetes. Another misconception about prediabetes is that only obese people will experience diabetes in the future; 42% of people agree with this idea, and 36% do not agree. A significant percentage (66%) of the participants do not agree with the statement that "diabetes can only be treated by taking drugs," showing that people are aware that physical activities and proper diet are needed along with medication. Among the participants, 88% are aware that diagnosing prediabetes is an effective way to increase patient awareness, and 64% strongly agree and agree that lifestyle modification is suitable for the treatment of prediabetes (Table 3). These findings revealed that a considerable proportion of the country's population lack adequate knowledge regarding diabetes development and management. Finally, diabetes warning signs and blood sugar levels should be frequently checked to prevent diabetes.[32]

According to the study, 42% of the participants experience blood sugar level between 140 and 199 mg/dl, and a significant portion of the participants (52%) do not know their blood glucose level. Among the respondents, 76.2% experience frequent urination. Increased thirst and excess hunger are reported by 61.8% and 78.4% of the participants, respectively. Fatigue and blurred vision occur in 70% and 66.8% of the participants, respectively (Table 4). The outcomes are disappointing because most of the respondents are unaware of their blood sugar levels, despite the fact that the majority of them have been warned about their blood sugar levels staying in the danger zone for developing diabetes.

TABLE 2. Response regarding the food habits, lifestyle, and health-related problems of the participants

Statements	Yes N (%)	No N (%)	Do not know N (%)
Do you prefer sweetened beverages?	150 (30.0)	350 (70.0)	
Do you eat fruits, vegetables, and nuts daily?	210 (42.0)	290 (58.0)	
Do you maintain any physical exercise?	180 (36.0)	320 (64.0)	
Do you smoke?	120 (24.0)	380 (76.0)	
Do you have high blood pressure?	145 (29.0)	355 (71.0)	
Do you feel any stress in your life?	143 (28.6)	357 (71.4)	
Do you have gestational diabetes?	20 (4.0)	480 (96.0)	
Do you have sleep apnea?	133 (26.6)	367 (73.4)	
Do you observe darkened skin on specific body parts like the neck, armpits, elbows, knees, and knuckles?		130 (26.0)	370 (74.0)

TABLE 3. Response regarding knowledge about prediabetes

Statements	Strongly agree N (%)	Agree N (%)	Do not know N (%)	Disagree N (%)	Strongly disagree N (%)
Only healthy lifestyle can help us to keep our bodies free from diabetes.	230 (46.0)	190 (38.0)	40 (8.0)	25 (5.0)	15 (3.0)
Only obese people will experience diabetes in future.	90 (18.0)	120 (24.0)	110 (22.0)	140 (28.0)	40 (8.0)
Symptoms of prediabetes can find at any age.	120 (24.0)	210 (42.0)	145 (29.0)	10 (2.0)	15 (3.0)
Diabetes can only be treated by taking drugs.	5 (1.0)	20 (4.0)	145 (29.0)	210 (42.0)	120 (24.0)
Diabetes is a curable condition.	40 (8.0)	60 (12.0)	210 (42.0)	160 (32.0)	30 (22.0)
Prediabetes is a significant public health issue.	220 (44.0)	240 (48.0)	30 (6.0)	6 (1.2%)	4 (0.8.0)
Diagnosing prediabetes is an effective way to increase patient awareness of their need for lifestyle modification.	230 (46.0)	210 (42.0)	30 (6.0)	18 (3.6%)	12 (2.4.0)
Evidence supports the effectiveness of treating prediabetes with lifestyle modification.	130 (26.0)	190 (38.0)	105 (21.0)	50 (10.0)	25 (5.0)
I am confident in my ability to manage prediabetes.	210 (42.0)	220 (44.0)	26 (9.2)	24 (4.8)	20 (4.0)

TABLE 4. Symptoms of prediabetes

Symptoms	Yes N (%)	No N (%)	Do not know N (%)
A blood sugar level from 140 to 199 mg/dl. (7.8–11.0 mmol/L)	210 (42.0)	30 (6.0)	260 (52.0)
Increased thirst	309 (61.8)	31 (6.2)	160 (32.0)
Frequent urination	381 (76.2)	13 (2.6)	106 (21.2)
Excess hunger	392 (78.4)	17 (3.4)	91 (18.2)
Fatigue	350 (70.0)	27 (5.4)	123 (24.6)
Blurred vision	334 (66.8)	85 (17.0)	81 (16.2)

DISCUSSION

Prediabetes, in which the hypoglycemia level lies between normal and diabetic levels, is a risk factor for diabetes. By analyzing the signs of prediabetes, we can estimate a patient's risk of developing diabetes, particularly T2DM.[33] This study aimed to determine the participants' degree of diabetes awareness and risk factors to estimate the general condition of the country's population.

Males continue to be at higher risk of diabetes than females, who accounted for the majority of the participants (60%). The correlation between diabetes and economic status is noteworthy: individuals with low incomes are more susceptible to the disease than those with high incomes.[1] In this study, 50% of the respondents belong to the middle class, and a significant proportion is from the lower middle class. These figures demonstrated that the country's population still has a high risk of developing diabetes.

Heredity is an important factor in diabetes, and genetic materials transfer the disease from one generation to another.[34] This process is a major concern because 80% of the participants have a family history of diabetes in their first and second degrees of relatives, which is a significant risk factor for diabetes. This study demonstrated that the majority of the population continues to be at risk of diabetes due to hereditary factors. Economic status and family history have a stronger influence on the development of prediabetes and diabetes than other sociodemographic factors. Nutrition and physical activity have crucial roles in the development of diabetes. Poor diet and physical inactivity contribute to obesity and diabetes.[35]

According to this study, 30% of the participants like sweetened beverages. Excessive sugar consumption increases the risk of gaining weight and developing T2DM by 26% compared with regular sugar consumption.[36] Fruits, vegetables, and nuts are crucial for maintaining proper physiological function in the body. However, 58% of the respondents do not consume these important foods on a regular basis, and 64% do not engage in regular physical activity, increasing their risk of developing prediabetes and diabetes.

According to the results, a significant number of people smoke and do not maintain normal blood pressure and mental stress. Giving up smoking and maintaining normal blood pressure and mental stress are crucial for preventing prediabetes and diabetes symptoms.[37,38] Most of the individuals have limited knowledge on prediabetes and diabetes. Though the majority believes that only a healthy lifestyle helps maintain our bodies free of diabetes (84%), some disagree with this assertion and 3% strongly disagree with it.

Obesity is an important contributory factor for diabetes, and obese people are likely to acquire the disease; however, it is not the sole risk factor. Approximately 66% of the participants contend that obesity is the only risk factor of diabetes, which is erroneous. Insulin-dependent diabetes may appear at any age, but non-insulin-dependent diabetes may arise when individuals become older. A significant proportion of the population (29%) is uninformed of the age at which prediabetes symptoms appear. This finding was concerning because so many individuals are indifferent about diabetes.

Diabetes may be managed by medications and lifestyle changes to maintain a healthy lifestyle.[34] Approximately 42% of the respondents think that diabetes is curable, and 29% believe it could only be treated with drugs. These findings implied a lack of information regarding diabetes care. Prediabetes is a serious public health concern because it is a precursor of diabetes. An encouraging result revealed that 48% and 44% of the respondents agree and strongly agree with the significant role of prediabetes. Only 21% of participants are uncertain of what they should do after being diagnosed with prediabetes, and 86% feel confident in their capacity to manage this condition.

Blood sugar levels should be checked on a regular basis after a specific length of time to diagnose prediabetes and diabetes. In this study, 52% of the individuals are uninformed of their blood sugar level, even though 42% of them have blood sugar levels ranging from 140 mg/dl to 199 mg/dl, which is indicative of prediabetes. Most of them experience the symptoms of prediabetes, such as increased thirst (61.8%), frequent urination (76.2%), excess hunger (78.4%), fatigue (70%), and blurred vision (66.8%).

This study found that people in the country are continuously at risk of developing diabetes and prediabetes, and the socioeconomic status of people promotes this situation. The risks of prediabetes and diabetes are not well understood by the people of this nation. The disease can be prevented by regularly checking blood sugar levels, leading a healthy lifestyle, and raising awareness of the condition.

This study had several limitations. While the validity and reliability of the questionnaire were acceptable, nonetheless further analysis of the data is suggested. Further, while our study benefits from the high number of samples, the limitation arises from the fact that it may not represent the pre diabetic patients Bangladesh population. The use of self-reported data may lead to reporting and social desirability bias. The cross-sectional limits its ability to establish causation between variables. While the validity and reliability of the questionnaire were acceptable, nonetheless further analysis of the data is suggested.

Further research may be conducted to determine the best strategy to improve people's consciousness and to provide the best guidelines for maintaining a healthy lifestyle while considering the country's socioeconomic status for prediabetes and diabetes prevention. The hospital is a very busy area, so data were rapidly collected in some cases. In addition, some participants responded late, which caused bias in this research.

CONCLUSIONS

Our study focused on the significant burden of prediabetes in Bangladesh, highlighting the urgency for targeted interventions and public health strategies. The findings underscore the need for increased awareness, early detection, and preventive measures to mitigate the progression of prediabetes to overt diabetes. In reducing the rising prevalence of prediabetes, modifiable risk factors such as unhealthy diet patterns and sedentary lifestyles must be addressed. Collaborative efforts among healthcare providers, policymakers, and community stakeholders are essential in implementing effective screening programs and eradicating the future burden of prediabetes and diabetes in Bangladesh.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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