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ORIGINAL ARTICLE **OPEN ACCESS**

A Cross-Sectional Study on The Impact of Socio-Demographic Parameters on Prediabetes and Diabetes

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ABSTRACT
Diabetes mellitus is a leading cause of death and disability worldwide. The global prevalence of diabetes mellitus is rapidly increasing as a result of population aging, urbanization, and associated lifestyle changes. To identify the influence of the selected parameters in predicting the early onset of diabetes and associated complications in the selected population using a cross-sectional study for 2 years. A total of 632 population were included in the study. Various sociodemographic parameters are correlated with stages of glycemia to assess the correlation of blood glucose levels with gender, age, marital status, body mass index, employment, location, education, alcohol and smoking habits, food habits, and sleeping patterns. It was observed that strong correlation id there with sociodemographic parameters with prediabetes and diabetes significantly at Pearson correlation in multivariate analysis.
***Keywords**: Diabetes, Prediabetes, Prevalence, Sociodemographic.*

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INTRODUCTION

Prediabetes is a condition where a person's blood sugar level is higher than normal but not high enough for a diabetes diagnosis. This condition is usually asymptomatic and can be detected through impaired fasting glucose (IFG), impaired glucose tolerance (IGT) or both. People with prediabetes are at a greater risk of developing type 2 diabetes and micro vascular problems like retinopathy, nephropathy, and neuropathy. However, there is no consensus among international professional organizations about whether clinical identification and intervention for prediabetes is necessary. Nonetheless, it is important to target prediabetes since lifestyle alterations can reduce the risk of developing diabetes by 40 to 70% in prediabetic patients. During the pathophysiological course of type 2 diabetes (T2D), several metabolic imbalances occur. There is increasing evidence that metabolic dysfunction far precedes clinical manifestations [1]. Thus, knowing and understanding metabolic imbalances is crucial to unraveling new strategies and molecules (biomarkers) for the early-stage prediction of the disease's non-clinical phase [2]. Theevelopmentt and progression of type 2 diabetes is a complex process that involves a combination of genetic, epigenetic, lifestyle, demographic, socioeconomic, therapeutic, and environmental factors. However, due to the variability in the way these factors are reported across different studies, it has been challenging to establish a uniform definition of the condition and to adjust for all relevant factors in research. Prediabetes, diabetes, and diabetic complications are interconnected through the progression of the disease, the impact of high blood sugar levels on various organ systems, and the importance of proactive management to prevent or delay the onset of complications. Early detection, lifestyle modifications, and proper medical management are key to minimizing the risk of complications and improving overall health outcomes for individuals with prediabetes and diabetes [3-5].

Hence, the present study interventions must be made with considerable involvement of lifestyle, and it should be considered that not all patients will respond in the same manner. Individuals with a high risk of diabetic progression will present compensatory metabolic mechanisms, translated into correlations that will therefore show potential predictive value to differentiate between progressors/non-progressors in selected T2D patients [6, 7].

MATERIAL AND METHODS

Study duration

2 years

Study design

A prospective cross-sectional study

Patients were interviewed using a semi-structured pre-designed consent form with sections eliciting information on personal, demographic, clinical, lab reports, etc. Information was sought from the patient or his attendant/ relative.

The required data was obtained from the medical records databases were searched to retrieve the records of patients who were diagnosed with prediabetes and diabetes and persistent progression in diabetes and who were under various diabetic complications and drug therapy.

Inclusion Criteria

All patients with a provisional diagnosis of diabetes mellitus with type 2 diabetes mellitus, blood glucose levels between 70 to 300 mg/dL, in-patient and outpatients are also to be included in the study.

Exclusion Criteria

Age below 20 years and above 70 were not included in the study. Type 1 diabetic patients, pancreatic abnormalities, pregnant women, breastfeeding women, and COVID-19-positive subjects were excluded from the study. Patients who had incomplete medical records or died from causes other than cancer were excluded from the study group.

Statistical Analysis:

Data were entered in an Excel spreadsheet for Windows and analyzed using GraphPad Prism 9. Data was distributed according to the parameters selected; Categorical variables were presented as percentages (%). The correlations of the selected factors were analyzed using multivariate analysis, correlation matrix with Pearson r correlation at 95% confidence interval and p-value was calculated using two-tailed. The considered p-value is at $p > 0.05$.

METHODS

Type 2 diabetes is a chronic metabolic disorder characterized by high blood sugar levels due to the body's inability to effectively use insulin. Biomarkers are measurable substances or indicators that can provide insights into a disease's presence, progression, and severity.

RESULTS AND DISCUSSION

Diabetes mellitus is a chronic metabolic condition that increases the risk of illness and premature death. Type 2 diabetes accounts for over 90% of all cases of diabetes [8-10]. The severity of clinical conditions can be viewed as a progression of the underlying disease process, where increasing severity and the associated complications require more complex treatment and greater use of clinical resources. It is important to assess the severity of diabetes because it helps identify people who require more targeted and intensive therapies for risk stratification and to reduce adverse outcomes; allows healthcare resources to be allocated towards those at greatest risk of harm; and provides a useful way to benchmark clinical services. Clinicians currently use glycated haemoglobin (HbA1c) levels primarily as a proxy for diabetes severity and to make management recommendations [11-14].

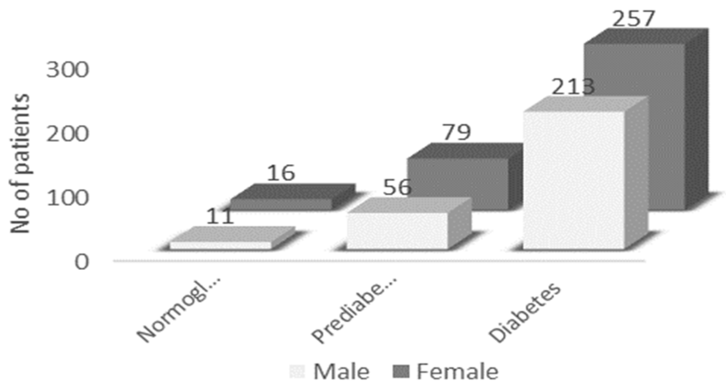

Figure 1: Distribution of subjects by Gender vs. Stage of Glycemia

Gender vs. Stage of Glycemia: There is no strong association between gender (male and female) to the incidence of normoglycemia and prediabetes but there was a significant association is there in diabetic conditions. The female population was found to be more among the population. The same was observed in women, diabetes mellitus appears to be less controlled considering each metabolic parameter, especially given the fact that they tend to have lower insulin sensitivity than their male counterparts, resulting in greater use of insulin units to maintain optimal glycemic values and compliance with therapeutic goals. These differences in glucose homeostasis between the two genders are to be found above all in the pre-diabetic state where there is a reduced fasting glycemia, especially while women are more prone to develop a reduced glucose tolerance in response to a meal or glucose load [15, 16]. A pooled women-to-men RRR showed a 13% greater risk of all-cause mortality associated with diabetes in women than in men [17-19].
Age vs. Stage of Glycemia: There is a strong association between age and the stage of glycemia in all the selected age groups. The age of 40-50 years was found to be more in the among population. The Southall and Brent Revisited (SABRE) study (***n*** = 1007) that observed South Asian men 40–69 years of age living in North and West London for 19 years until 2011 reported a 35% incidence of DM. The peak in diabetes prevalence occurs earlier in men (65–69 years of age) than in women (70–79 years of age) and male predominance is, therefore, specifically observed in middle-aged populations (35–69 years of age).The present study resulted that the incidence of diabetes was found to be more in female (55.70%) compare to that of men (44.30%) as shown in figure 2.

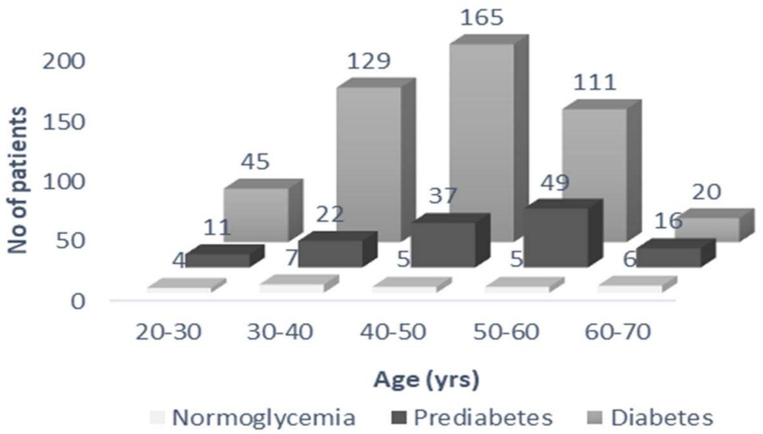

Figure 2: Distribution of subjects by Age vs. Stage of Glycemia

Marital status vs. Stage of Glycemia: There is a strong association between marital status (married, unmarried, and widower) and the stage of glycemia (prediabetes and diabetes) and not with normoglycemia. The married persons are found to be more in the among population. In diabetes research in the United States, socioeconomic status has been strongly related to mortality when divorced/separated and widowed statuses were combined into one covariate [20]. Similarly, single status was related to diabetes morbidity among African American women and diabetes mortality in African American men without separating divorced/separated from widowed status [21, 22]. In the present study, it was observed that 74.37% were diabetics and 32.75% were found at 40 – 45 years of age total population as shown in figure 3.

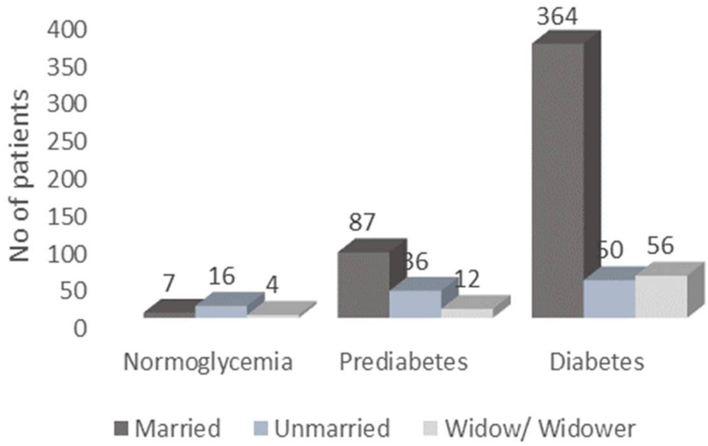

Figure 3: Distribution of subjects by Marriage status vs. Stage of Glycemia

BMI vs. Stage of Glycemia: The population was divided from underweight to obese. The overweight population is found to be more and there is a strong correlation between BMI and prediabetes and incidence of diabetes but not with normoglycemia. The study found that overweight subjects have an average relative risk of 3-fold, while obese subjects have a 7-fold risk compared to individuals with normal BMI. The meta-analysis considered studies covering both sexes and a wide age range of 18 to 80 years [23]. Another study by Tirosh et al. examined the BMI of 37,674 male Israeli conscripts aged 17 and found that the risk of incident diabetes was 2.76 times higher in the highest BMI decile compared to the lowest. However, this increased risk became nonsignificant after adjusting for adult BMI [24, 25]. The present study supported by previous study outcomes that the incidence of diabetes was more 50.16% with high BMI (25–29.99 kg/m2) (figure 4).

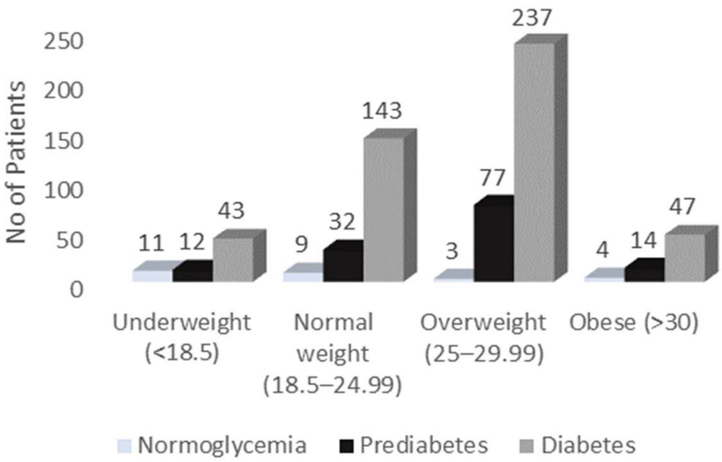

Figure 4: Distribution of subjects by BMI vs. Stage of Glycemia

Employment vs. Stage of Glycemia: The population is divided into retired, employed, and unemployed; the employed persons are more among. There was a strong correlation between employment and the stage of glycemia. An increase in the unemployment rate decreases diabetes prevalence. This may be due to an increasingly serviced or sedentary lifestyle (including watching TV; sitting at work and other sitting; and increased mechanization and driving) in the employed population [26]. Secondly, a reduction in unemployment (or an increase in average income) would result in higher levels of spending on discretionary foods (high caloric with poor nutritional value), which may result in an increase in the prevalence of diabetes. Conversely, an increase in unemployment (or reduction in net income) may reduce the proportion of income spent on these discretionary foods [27]. In the present study, 60.60% populations were found to be diabetes and 33.86% unemployed, indicating that work stress may be the reason for the incidence of diabetes in the selected population and was a correlation is there between prediabetes, diabetes the employment status shown in figure 5.

Figure 5: Distribution of subjects by Employment vs. Stage of Glycemia

Location vs Stage of Glycemia: The urban population is more than rural. There is no correlation between the location and normoglycemia and prediabetes and there was a strong correlation with diabetes. The Prevalence of Diabetes in India Study reported a diabetes prevalence of 4.3% in India, with rates of 5.9% in urban areas and 2.7% in rural areas [28]. This may be the only other study that was conducted throughout India and was based on a nationally representative sample. An earlier multicentred study in India reported a diabetes prevalence of 2.1% in urban and 1.5% in rural areas [29, 30]. The National Urban Diabetes Survey by Ramachandran et al. reported prevalence rates of 12% for diabetes and 14% for impaired glucose tolerance in urban India [31]. These studies indicate that the incidence is higher in urban people might be due to their sedentary habits, the same was proven in the study that the incidence is higher in urban people at 68.83% and 31.17 in rural people and the correlation of living places is with diabetes condition as shown in figure 6.

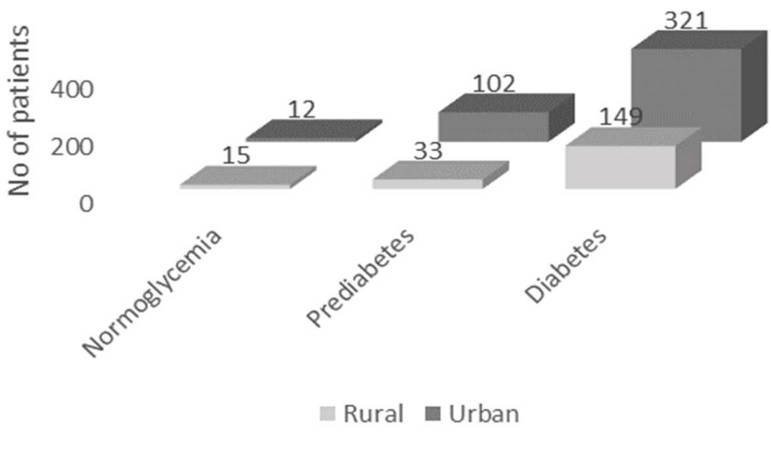

Figure 6: Distribution of subjects by Location vs Stage of Glycemia

Education Status vs. Stage of Glycemia: the population was distributed at different grades of education and illiterates. The graduates are more among all and there is a strong correlation between the stage of glycemia to educational status. The educational attainment may act as a fundamental cause of disease by utilizing resources such as knowledge that strongly influence people's ability to reduce risks that may prevent or delay diabetes or better control the disease once it occurs [32, 33]. Figure 7 explains that 34.65% of people who did a bachelor's were suffering from diabetes among the population and was lowest in primary school patients at 3.64%.

Alcohol consumption vs. Stage of Glycemia: There is no significant correlation between them, and alcoholics were found to be more among the population. Chronic use of alcohol is a potential risk factor that causes insulin resistance and pancreatic β-cell dysfunction which is a prerequisite for the development of diabetes. However, alcohol consumption in diabetes has been controversial, and more detailed information on the diabetogenic impact of alcohol seems warranted.

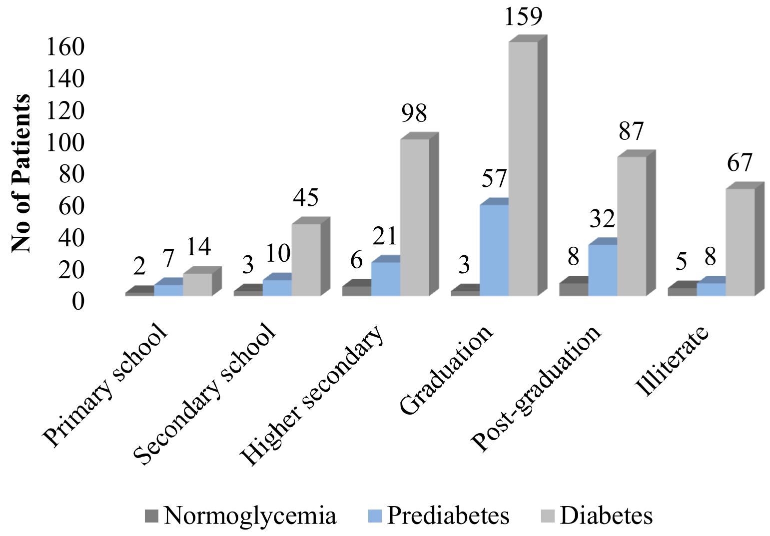

Figure 7: Distribution of subjects by Education status vs. Stage of Glycemia

Diabetes, especially T2DM, causes dysregulation of various metabolic processes, which includes a defect in the insulin-mediated glucose function of adipocytes, and an impaired insulin action in the liver [34, 35]. The incidence was found to be higher in alcoholics at 63.61% and non-alcoholics at 36.39% and there was no correlation between the drinking habits and the incidence of diabetes as shown in figure 8.

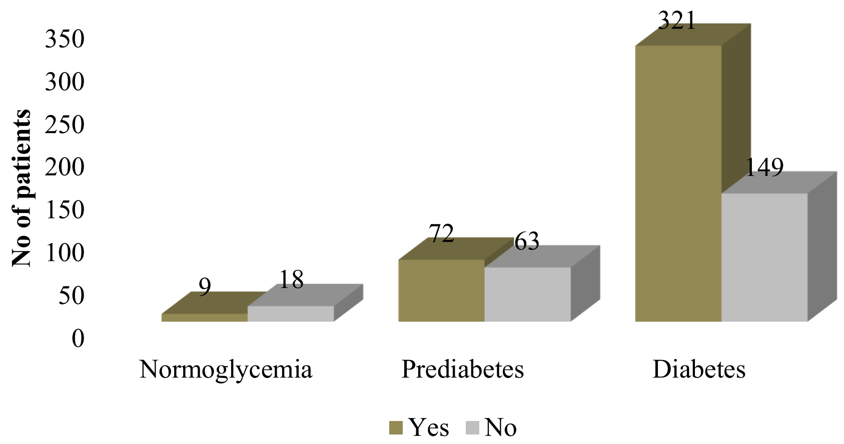

Figure 8: Distribution of subjects by Alcohol consumption vs. Stage of Glycemia

Smoking vs. Stage of Glycemia: Smoking also does not have a significant correlation with the stage of glycemia and smokers are more likely in the selected population. In persons with established diabetes, euglycemic hyperinsulinemic clamp analyses revealed that total body glucose disposal was reduced in smokers compared to those who did not smoke. Ostgren and colleagues studied nearly 260 Swedish men and found that current cigarette smokers had lower β cell function, as measured by the homeostatic model assessment method (HOMA-β), compared to never-smokers [36]. Smokers are at 58.07% & non-smokers are 41.93% of the population there no correlation is between smoking habits and diabetes incidence, but it might the one of the reasons for the progression of diabetic complications as shown in figure 9.

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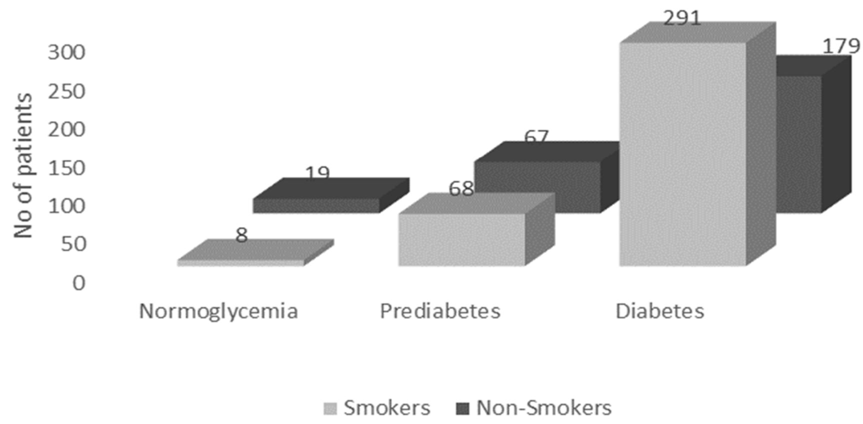

Figure 9: Distribution of subjects by Smoking vs. Stage of Glycemia

Food Habits vs. Stage of Glycemia: Non-veg people are more than veg in the selected population and there was no significant correlation between normoglycemia and weak correlation with prediabetes and diabetes. In the present study, 60.28% were non-vegetarians, and 39.72% were vegetarians among the selected population as shown in figure 10. A Western diet is typically low in these foods and high in animal protein, saturated fat, and refined carbohydrates. As countries develop a more Westernized diet, their rates of diabetes increase [37, 38]. A diet that differs from typical Western foods is a vegetarian one, and vegetarians in the US have a lower prevalence of diabetes than omnivores (consuming both plant and animal foods) [39-42]. In addition, the adoption of a vegetarian diet is more beneficial in improving diabetes symptoms than traditional medication in some studies [43].

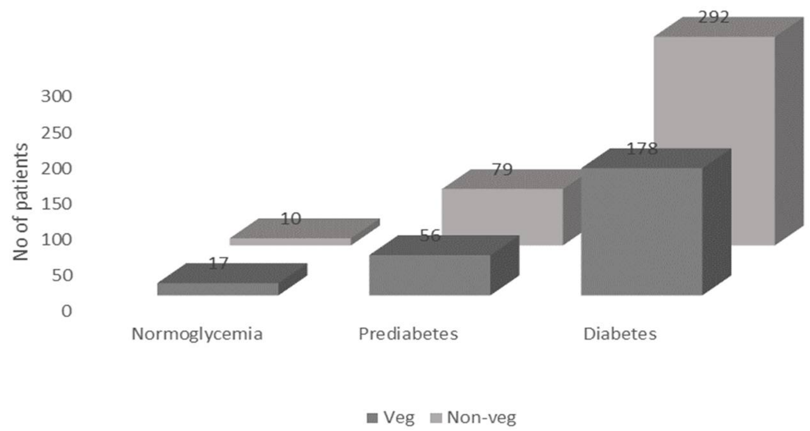

Figure 10: Distribution of subjects by Food Habits vs. Stage of Glycemia

Sleeping Time vs. Stage of Glycemia: the population was distributed according to 5 to 8hr of sleeping, 5-7 hrs sleeping habits people are more among. It was observed that no correlation between sleeping hours and normoglycemia, but a significant correlation is there with prediabetes and diabetic conditions. The timing of sleep is a rough marker of the circadian phase. Both poor sleep habits and sleep disorders are highly prevalent among adults with type 2 diabetes. Sleep restriction may affect blood sugar levels due to its effects on insulin, cortisol, and oxidative stress. In present study assessed the sleeping patterns according to the sleeping time less than 5 hrs to more than 8 hrs and was observed that incidence is more in less than 5-7 hrs sleeping time 47.62% as shown in figure 11. There was a strong correlation is also there between sleeping time and diabetes.

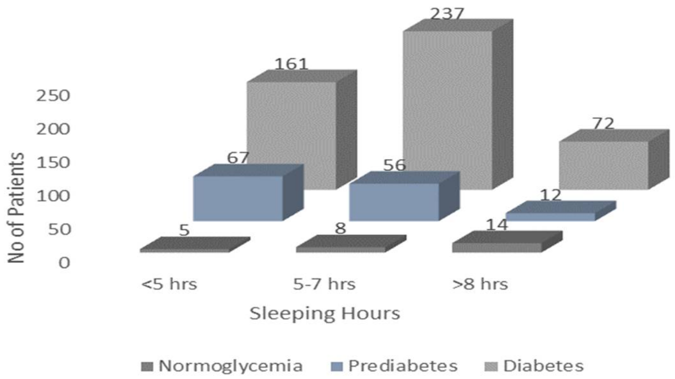

Figure 11: Distribution of subjects by Sleeping time vs. Stage of Glycemia

Table 1: Correlation of stage of glycemia with the various parameters of study population (n=362)

Gender	Normoglycemia	Prediabetes	Diabetes
Gender			
P (two-tailed)	0.0736	0.0586	0.0217
Significance	ns	ns	*
r value	0.9933	0.9958	0.9994
Age			
P (two-tailed)	0.0032	0.0006	<0.0001
Significance	**	***	****
r value	0.9535	0.9798	0.9981
Marital status			
P (two-tailed)	0.3973	0.0150	0.0033
Significance	ns	*	**
r value	0.6027	0.9850	0.9967
BMI			
P (two-tailed)	0.1288	0.0006	<0.0001
Significance	ns	***	****
r value	0.7687	0.9938	0.9997
Employment			
P (two-tailed)	0.0280	0.0090	0.0012
Significance	*	**	**
r value	0.9720	0.9910	0.9988
Location			
P (two-tailed)	0.4890	0.0934	0.0083
Significance	ns	ns	**
r value	0.7192	0.9893	0.9999
Education			
P (two-tailed)	0.0013	<0.0001	<0.0001
Significance	**	****	****
r value	0.9454	0.9903	0.9994
Alcohol Consumption			
P (two-tailed)	0.6138	0.2072	0.0792
Significance	ns	ns	ns
r value	0.5702	0.9475	0.9923
Smoking habits			
P (two-tailed)	0.5647	0.1654	0.0757
Significance	ns	ns	ns
r value	0.6317	0.9665	0.9929
Food Habits			
P (two-tailed)	0.4866	0.0352	0.0353
Significance	ns	*	*
r value	0.7219	0.9985	0.9985
Sleeping patterns			
P (two-tailed)	0.2548	0.0289	0.0018
Significance	ns	*	**
r value	0.7452	0.9711	0.9982

CONCLUSIONS

Prediabetes is a major but silent incubator of future morbidity. The voice to acknowledge its ever-increasing burden needs to grow louder to be heard by doctors and patients alike. Carefully selected pharmacological treatment should be initiated early in addition to lifestyle modification to circumvent the vicious circle of pathophysiological processes leading to various complications of prediabetes and progression to diabetes. In the same vein, patient education and counselling are needed to emphasize the importance of accepting pharmacological treatment or considering surgical procedures to treat prediabetes. Education campaigns addressing the high costs and reduced quality of life associated with managing prediabetes and diabetes complications should target both people with prediabetes and healthcare providers.

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