ORIGINAL ARTICLE

OPEN ACCESS

Prevalence of type-2 Diabetes Mellitus and Prediabetes using HbA1c in OGDCL Employees

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Received: June 07. 2023 Revised: September 06, 2023
Accepted: November 16. 2023 Published: January 05, 2024
DOI: https://doi.org/10.70394/jhbsmdc.v3i2.26

Abstract

Objectives: A screening survey using glycosylated hemoglobin (HbA1c) as the screening tool, was conducted amid OGDCL employees across Pakistan to evaluate the occurrence of pre-diabetes and type 2 diabetes.

Methodology: This study included employees aged ≥ 40 years working at OGDCL's Head Office and various Oil Fields across Pakistan, all of whom subjected to HbA1c testing. Data collected were analyzed using SPSS version 26. Categorical variables were summarized as frequencies and percentages, with data presented graphically using bar charts. Chi-square tests were used to compare characteristics across three groups: non-diabetes, pre-diabetes, and diabetes. A significance level of $p \leq 0.05$ indicated significance, while $p \leq 0.01$ was considered highly significant.

Results: A total of 8689 participants were recruited in our study. Out of which 66.26% were non- diabetic and the prevalence of pre-diabetes and diabetes was found to be 12.3% and 21.5% respectively. In our study 34.7% of the participants had family history of diabetes. In diabetic people percentage (54%) of having family history of diabetes was high as compared to the non-diabetics (29%) and pre-diabetics (32.1%) individuals which created a substantial variance between the three groups. (p=0.001) Majority 94.8% of the study participants never smoked, 3.3% were current smokers and 1.9% had history of smoking. The prevalence of current smokers was high (6.1%) in pre-diabetes as compared to the diabetes (2.0%) and non-diabetes (3.2%). A strong significant association was observed between smoking and pre-diabetes. (p=0.0001) In our study prevalence of hypertension among pre-diabetes and diabetes was 21% and 20% respectively. (p=0.738) The majority 57.8% of the participants in our study was overweight and the prevalence of obese was 10.7%. (p=0.001)

Conclusions: In OGDCL, there is much higher incidence of type 2 diabetes and pre-diabetes as was previously thought. Comprehensive approaches are required to be established to integrate screening, prevention and treatment of type 2 diabetes both at primary and secondary health care levels, at Head Office and Oil Fields. This is necessary not only for intensification of the workout put but also to cut down the medical budget.

Key words: Type II Diabetes Mellitus, Prediabetes, HbA1c, Glycosylated Hemoglobin

Conflict of Interest: None **Funding Source**: None

Introduction

Diabetes mellitus (DM) is not just a disease but a worldwide public health concern. This has affected masses of people of all ages, gender, and racial and ethnic groups. It is a chronic illness that causes derangement of the metabolism of all macro nutrients, which later on result in chronic progression to failure in the smooth functioning of multiple organ systems in the body, including cardiovascular, visual and renal systems.

Patients that suffer from Diabetes Mellitus have a higher incidence of IHD, HTN and dyslipidemia as compared to non-DM patients. Vascular derangements are the most considered important offenders in producing pathologies in diabetic patients.

DM is considered as metabolic disorder linked to hyperglycemia, atherosclerosis, inflammation, hypercoagulability, dyslipidemia and insulin resistance. All of the mentioned pathologies lead to endothelial dysfunction in organ systems and associated complications. Endothelial damage is the fore most player behind vascular complications in DM.[1,2]

Vascular pathologies related to DM lead to development of macrovascular and microvascular complications. Microvascular complications (nephropathy, retinopathy, and neuropathy) and macrovascular complications (cardiovascular disease, stroke, and peripheral artery disease).[3]

The increased risk for Type 2 diabetes associated macrovascular and microvascular complications and cardiovascular disease is eminent factor which needs therapeutic attention for at a higher risk group and this demands early screening for disease. Later there could be approach to a change in life style and weight reduction. Increased body weight has been shown to be a strong predictor of the metabolic syndrome. This understanding of correlation of body weight with disease gives hope to the philosophy that treatment and prevention may seem therapeutic because it means that losing weight or stopping weight gain might decrease the hazard of a future appearance of a factor that is still not obvious.[4]

Diabetes mellitus (DM) is increasingly considered as a pandemic worldwide. Globally, DM is affecting health of more than 285 million people up till now. It is estimated that by end of 2030, it will reach to 438 million. This is particularly true for low resource countries, where there are limited health resources, hence becoming a huge public health problem in these countries. South Asian population is more predisposed to type 2 DM. The prevalence of DM has estimated to increase over 151% between year 2000 and 2030 in South Asian region. In year 2012, incidence of DM in adults in Pakistan was almost 6.6 million therefore being ranked the tenth largest country with this pathology. In Pakistani population, there is substantially high occurrence of diabetes leading to development of associated complications at relatively younger age.[5,6]

The worldwide prevalence and incidence of Intermediate hyperglycemia or borderline diabetes (a.k.a Pre-diabetes) is rising and it is estimated that by 2030 more than 470 million individuals will be prediabetic. The risk for Type 2 DM intensifies due to prediabetes, which results in the predisposition to different diabetes associated complications. However, literature specifies that Lifestyle alterations can aid in reducing or preventing diabetes progression by 40–70%. This outcome emphasizes the stipulation for early diagnosis of prediabetes and diabetes.[7]

Therefore, the current study, is aimed to explore both the prevalence and the causative factors of prediabetes and diabetes in OGDC so that strategies can be developed for early detection and improvement of prediabetes and to avert development of diabetes and its associated complications.

The specific objectives of our study were to estimate prediabetes and diabetes prevalence among the OGDCL employees across the country and compare the qualitative characteristics of divided three study groups of participants.

Methodology

After approval from ethical review committee of institute, an observational and cross section study was conducted on eight thousand six hundred and eighty-nine employees aged ≥ 40 years, of OGDC working at Head Office and different Oil Fields all over Pakistan and was completed in 2 months. Three subgroups were made after HBA1c based diagnosed prediabetics, diabetics and nondiabetics. Non-probability convenience sampling was done. Written consent form was verbally explained and consent taken. The standard collection technique was used for Specimen's collection. A 2 ml of venous blood sample was obtained by a nurse practitioner, and transferred in a vacutainer with EDTA, labelled with the employee identification number and then shifted to the haematology lab for the analysis of glycated haemoglobin (HbA1c). Participants were weighed and interviewed for family and smoking history. Hypertension was defined as systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg.[8]

World Health Organization (WHO) defines obesity as BMI ≥ 30 kg/m^2 and overweight as 25–29.9 kg/m^2.9

Data was be analyzed by SPSS version 26, mean and standard error of mean was calculated for quantitative variables and parameters was analyzed, using student "t" test followed by ANOVA and "p" value of <0.05 was be taken as significant.

Results

Eight thousand six hundred and eighty-nine, apparently healthy individuals of 40 years and above participated in the study. All participants were male. No female participated in the study. The Participants belonged to different geographical areas of Pakistan. Table I describes demographic details of the study participants. After compilation data was collectively analyzed as well as in subgroups separately. Table 1 presents baseline characteristics of the study participants by their diabetes status and for total population. A total of 8689 participants were recruited in the study. Out of which, 1866(21.5%) were diabetics, 1066 (12.3%) were prediabetics, and 5757 (66.2%) were nondiabetics. Among diabetics 54% had family history of DM, while 32% prediabetic also had family history of DM.

Table I: Demographics of participants.					
Characteristics	Group			Total	P-value[1]
	Non- diabetic	Pre-diabetic	Diabetic		
Frequency (%)	5757(66.2)	1066(12.3)	1866(21.5)	8689(100)	-----
Family History	1669(29.0)	342(32.1)	1007(54.0)	3018(34.7)	0.0001**
Smoking					
Never	5474(95.1)	980(91.9)	1779(95.3)	8504(94.8)	0.0001**
Current	185(3.2)	65(6.1)	38(2.0)	288(3.3)	
Ex-Smoker	98(1.7)	21(2.0)	49(2.6)	168(1.9)	
Hypertension	1151(20.0)	224(21.0)	373(20.0)	1748(20.1)	0.738
Weight					
Normal	1842(32)	300(28.1)	597(32)	2739(31.5)	0.001**
Overweight	3339(58.0)	617(57.9)	1064(57)	5020(57.8)	
Obese	576(10.0)	149(14.0)	205(11.0)	930(10.7)	

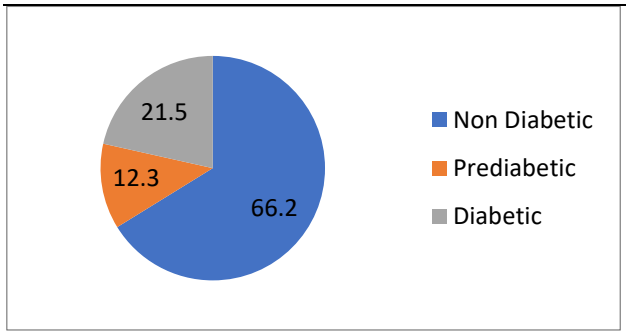

Figure 1: Prevalence of Diabetes and pre-diabetes.

Discussion

Worldwide, Diabetes mellitus is considered to be an imperative public health issue. It is a perpetually progressive global health crisis in the 21st century and approximately more than 300 million individuals may be impacted by diabetes in the year 2025. It may lead to devastating complications if remain undiagnosed and treated at early stages. This contemporary study was carried out to investigate the determinants and prevalence of pre diabetes among employees of OGDC.

In current study, status of diabetes as well as prediabetes was precisely defined by using HbA1c cutoff levels. Therefore, according to American Diabetes Association 2016, nondiabetics have HbA1c less than 5.7 there are cluster of %, prediabetes have greater than 5.7% but less than 6.5% values, and diabetics have greater than or equal to 6.5%.[10]

The prevalence of diabetes and prediabetes in our study, was 21.5% and 12.3% respectively which is hazardously high showing that similar results are expected in urban areas and in office workers of Pakistan. Office employees spend most of their duty hours, using computers, contributing in screen-based recreation therefore spend most of their duty timings while being seated. There are cluster of studies done in recent past reporting the predisposition of DM with sedentary jobs and life styles. Therefore, while at work taking frequent steps and walk or standing and moving the joints can be beneficial in reducing the risk of development of DM by growing surge of energy utilization.[11]

Among diabetics 54% had family history of DM, while 32% prediabetic also had family history of DM. The relationship of diabetics and nondiabetics with family history is highly significant in both groups which is similar to the already established finding that incidence of diabetes is pretty much higher among individuals having diabetic first-degree relative than that of individuals without a positive family history. Fundamentally, hereditary factors interplay a decisive role in the development and progression of diabetes and hence there is a desire of understanding the causes of this disease and introducing the probable pre-emptive avoidable measures.

The finding implies that the type II diabetes risk attributed to family history is supported by distinct etiology affecting the family member and is also superimposed by the presence of diverse metabolic derangements reliant on the affected family member.

In our recent study, significant relation of hypertension was not found with our studied sub groups. All three subgroups have same percentage of hypertensive patients. Among 5757 of nondiabetics 20% were hypertensive. Among 1066 prediabetics 21% were hypertensive and among 1866 diabetics 20% were hypertensive. Hypertension and T2DM as reviewed by no of research studies are meticulously connected to each other, but the effective causative link bridging the two conditions is unclear. There exist common pathophysiological mechanisms which help prove the coexistence among Hypertension and T2DM. Insulin resistance, increased blood insulin levels leading to increased oxidative stress, and underlying inflammation.[14,15]

Insulin resistance leads to elevated insulin levels in blood which predisposes to hypertension development in normotensive nondiabetic individuals. Hyperinsulinemia, produces augmented sympathetic output by the nervous system, increases the activity of renin-angiotensin-aldosterone system in the kidney, and increases sodium

reabsorption by the renal tubules. Furthermore, endothelial dysfunction by increased oxidative stress leading to inflammatory response predisposes to endothelial dysfunction, decreased vascular responsiveness, increased resistance in the peripheral vasculature and metabolic derangements specifically in glucose and lipid metabolism. This changing carbohydrate and lipid metabolism finally leads to hypertension and DM.[16]

In our study most of subjects were unaware of their disease status, not able to document the first onset of hypertension or diabetes. Research studies have now documented that there is increased risk hypertension in inherently susceptible T2D but, no such correlation is found among predisposed hypertensives and T2D. The scientists have distinguished momentous pleiotropy in the connection between hypertension and the development of T2D.[17] However the biggest limitation of our study is only males were enrolled in study due to fact that majority of workers in OGDC are males.

Smoking can not only aggravate the diabetes complications such as macro- or micro-vascular disease, but has also been shown to deteriorate glucose metabolism in normal subjects and thereby may provoke the onset of type 2 diabetes. In our study most of the population was non smoker, among 8689 subjects 95% never smoked. Among 66% of nondiabetics 4.9% had history of smoking. In 1066 of prediabetics 8% have history of smoking. This significant p Value strongly supports previous research work showing relationship of type 2 diabetes with smoking. The exact mechanism for why smoking increases the risk of diabetes and worsens glucose homeostasis has not been fully explained, but the available evidence shows that smoking increases insulin resistance. Another effect of early onset of diabetes in smokers is that smoking increases inflammation and oxidative stress which damages β-cell function.[18,19] The use of e-cigarettes is increasing in our young generation day by day and research studies showed that use of cigarette and e-cigarettes have been shown to be associated with prediabetes and increased HbA1c levels in adults without a history of diabetes.[20]

In our study prediabetic and diabetics subjects almost 58% were overweight, showing a significant p value of 0.001. Obesity is a key underlying etiological factor for initiation of diabetes. Obesity is increasing worldwide and millions of youths and adults are imposed to risk of metabolic diseases including hypertension, dyslipidemia, liver steatosis and abnormal blood glucose regulation. In obesity, there is chronic tissue inflammation in liver, muscle, adipose tissue and pancreatic beta cells leading to abnormal CHO metabolism and hyperglycemia. The epidemic of obesity related diabetes is a big problem in recent decades and needs to educate changes in lifestyle. Changing our lifestyle including diet and physical activity, can help prevent or decrease the prevalence of development of these diseases.[21,22]

Conclusion

Diabetes mellitus is a worldwide public health problem affecting millions of people and prevalence is dangerously rising in Pakistan. The prevalence of type 2 diabetes and pre-diabetes is much higher than previously thought

Recommendations

It is therefore essential to identify prediabetics and there is a need to educate about lifestyle modifications, targeting nutrition, exercise and weight loss which contribute to health by reducing body weight, blood pressure and blood glucose levels.

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Authors Contribution:

[1]Substantial contributions to the conception or design of the work;
[3,4]The acquisition, analysis, or interpretation of data for the work;
[1,2,3,4]Final approval of the version to be published
[2,3]Drafting the work or revising it critically for important intellectual content.