Original Research Article

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Prevalence of prediabetes in apparently healthy population of Tehsil Kangra and adjoining areas

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ABSTRACT

Background: More than 50% of the diabetes mellitus (DM) subjects in India remain unaware of their diabetic status. The aim of the study was to screen and identify apparently healthy individuals for impaired glucose tolerance in Tehsil Kangra and adjoining areas of Himachal Pradesh, India.

Methods: Cross sectional study with 80 apparently healthy subjects in the age group of 30 to 70 years were taken. Anthropometric parameters viz. weight, height and waist circumference of subjects were measured. Whole blood sample was used for estimation of glycosylated hemoglobin (HbA1c) and serum sample for fasting blood sugar (FBS) and some lipid parameters.

Results: The prevalence of prediabetes in apparently healthy population was found to be 25%. Additionally, a significant increase was observed in the FBS levels in prediabetics as compared to healthy subjects. However, no significant change was observed in the mean body mass index (BMI), mean body surface area (BSA), waist to height ratio (WHtR) and lipid parameters between prediabetics and healthy subjects.

Conclusions: The burden of prediabetes in apparently healthy subjects of Tehsil Kangra and adjoining areas was found to be 25% and this urgently calls for mass awareness and screening programmes to identify and overcome DM.

Keywords: Diabetes mellitus, Fasting blood sugar, Glycosylated hemoglobin, Prediabetes, Prevalence

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder defined by chronic hyperglycaemia with deranged fat, carbohydrate and protein metabolism that results from improper secretion or action of insulin. DM is a modernday pandemic and according to World Health Organisation (WHO) it will become the seventh most common cause of mortality worldwide by the year 2030. Moreover, the prevalence of diabetes is expected to rise to 10% by 2030. As far as the Indian scenario is concerned, approximately 72 million cases already exist in India and this number is expected to rise to 151 million by 2045 unless preventive measures are taken.

DM is traditionally known as a "silent disease," exhibiting no symptoms until it progresses to severe target organ damage. Unfortunately, more than 50% of the diabetic subjects in India remain unaware of their diabetic status, that further adds to the disease burden. There are two main types of DM viz. type I diabetes mellitus (T1DM) that results from the inability of the pancreas to produce enough insulin and the cause is unknown. Type-2 diabetes mellitus (T2DM) occurs due to insulin resistance in which the peripheral cells fail to respond to insulin properly and as the disease progresses, failure to produce insulin may also occur. The highest prevalence of T2DM is typically reported within urban settings rather than rural areas as urbanisation has led to

'westernised lifestyle' with unhealthy food choices and reduced levels of physical activity. Additionally, T2DM accounts for more than 90% of the DM cases worldwide. 8

The term prediabetes is an intermediary phase used to define a person with fasting blood glucose levels between 100-126 mg/dl of blood or whose postprandial blood glucose is 140-200 mg/dl. Studies on Indian population suggest that approximately 40-55% of the people with prediabetes will develop T2DM over a period of 3-5 years if no preventive measures are taken. The American Diabetes Association (ADA) has set a lower cut off range for impaired fasting glucose that falls between 100 mg/dl to 125 mg/dl. Moreover, ADA has also introduced glycosylated hemoglobin (HbA1c) to diagnose prediabetes for levels of ranging from 5.7% - 6.4% to avoid underestimation of the prevalence of diabetes and prediabetes. 9,11

The Government of India has already initiated a National Diabetes Control Programme. For such programmes to be successful, mass awareness and screening programmes are necessary to first identify and trace the prediabetics that are prone to develop diabetes to overcome the burden of diabetes in India. Therefore, active and opportunistic screening efforts are to be done for case detection.

Keeping in mind the above mentioned facts, the present study was designed to screen and identify apparently healthy individuals for impaired glucose tolerance thereby estimating the burden of prediabetes in Tehsil Kangra and adjoining areas of Kangra, Himachal Pradesh, India. The information subsequent to this study will add to the knowledge of the present preventive health care system in management of DM.

METHODS

After obtaining clearance from the Institutional Ethics Committee, the study was conceded from June 2017 to August 2018 in the Department of Anatomy and Biochemistry, Dr Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh, India.

Sample population

Sampling population consisted of 80 apparently healthy subjects in the age group of 30 to 70 years of Tehsil Kangra and adjoining areas. All the healthy subjects were randomly selected from Dr Rajendra Prasad Government Medical College, Kangra at Tanda, and Civil Hospital, Kangra, Himachal Pradesh, India. The subjects included healthy attendants of patients not on any treatment and healthy staff that were willing to be a part of the study. Written informed consent was taken from all the subjects. In accordance with the ADA guidelines apparently healthy subjects with fasting blood sugar (FBS) in the range between 100 mg/dl to 125 mg/dl and HbA1c in the range of 5.7% to 6.4% were labelled as prediabetics.

Data was recorded on a predesigned questionnaire and was collected for the following variables viz. age, gender, address, family history and any treatment history. Blood pressure was recorded to eliminate undiagnosed hypertensives. Anthropometric measurements viz. weight was recorded using standard digital weighing machine; height was measured by flexible measuring tape against a vertical wall and waist circumference was recorded at the level of umbilicus with flexible measuring tape. Body surface area (BSA), body mass index (BMI) and waist to height ratio (WHtR) of the subjects were calculated using the formula available on www.medcalc.com.

For biochemical estimations, approximately 6 ml of fasting venous blood sample was collected from the subjects [3 ml in ethylene diamine tetra acetic acid (EDTA) and 3 ml in plain vial]. Whole blood sample was utilized for HbA1c measurement based on boronate affinity assay using Nyco card (Alere Technologies AS, Oslo, Norway) reader. Serum samples were analyzed for FBS, cholesterol, triglycerides (TG) and high density lipoproteins (HDL) by XL 300 (Erba, Mannheim, Germany) automated chemistry analyzer using commercially available kits (Transasia Bio-Medicals Ltd., Baddi, India).

Statistical analysis

The data was presented as frequency, percentage and mean±standard deviation (SD) wherever applicable. Data was analyzed using Statistical Package for Social Sciences (SPSS) software version 21. Student t-test was used to compare continuous variables. Values with p<0.05 calculated at 95% confidence interval were considered statistically significant.

RESULTS

In the present study, out of 80 apparently healthy subjects, 45 were males and 35 were females (Table 1). The mean waist circumference for the study population was 89.42 cm \pm 9.59. The mean waist circumference for males was 88.59 cm \pm 10.13 and in case of females was 90.49 cm \pm 8.88 (Table 1). The mean BMI, BSA and WHtR in the study population was 24.01 kg/m² \pm 3.77, 1.66 m² \pm 0.90 and 0.55 \pm 0.66 respectively (Table 1). The mean HbA1c, FBS, cholesterol, TG and HDL levels in the study population were 5.37% \pm 0.46, 90.21 mg/dl \pm 16.72, 182.47 mg/dl \pm 43.53, 152.96 mg/dl \pm 91.44 and 53.81 mg/dl \pm 12.96 respectively (Table 1).

The mean FBS in the healthy study population was $85.32 \, \mathrm{mg/dl} \pm 14.62$. The subjects having FBS > $100 \, \mathrm{mg/dl}$ and $\leq 125 \, \mathrm{mg/dl}$ and HbA1c >5.6% and $\leq 6.4\%$ were labelled as prediabetes and the number was 20 (Table 2). Therefore, the percentage of prediabetics was 25% in the apparently healthy study population (Figure 1). Most of the cases of prediabetes were seen in the age group of 46-56 years (Table 2). The mean waist circumference in those having prediabetes was $91.95 \, \mathrm{cm} \pm 8.88$ (Table 2).

The mean BMI, mean BSA and mean WHtR in those having prediabetes was $24.20 \text{ kg/m}^2 \pm 3.49$, $1.72 \text{ m}^2 \pm 0.20$ and 0.56 ± 0.05 respectively (Table 2). The mean FBS,

mean cholesterol and HDL in those having prediabetes was 104.89 mg/dl ± 14.02 , 199.65 mg/dl ± 51.96 and 55.18 mg/dl ± 12.21 respectively (Table 2).

Table 1. Characteristics of the study population.

Variable	Total (N=80)	Male (N=45)	Female (N=35)	P value #
Age (years)				
Min-Max	30-70	30-64	30-70	0.302
Mean±SD	45.89±9.35	46.84±9.18	44.66±9.55	
Sex				
Male : Female	45:35	NA	NA	
Waist circumference				
Min-Max	66-113	66-108	71-113	0.384
Mean±SD	89.42±9.59	88.59±10.13	90.49±8.88	
BMI		•		
Min-Max	15.49-33.77	15.49-29.75	18.88-33.77	0.034
Mean±SD	24.01±3.77	23.23±3.55	25.02±3.85	0.034
BSA				
Min-Max	1.23-2.13	1.31-2.13	1.23-1.86	0.000
Mean±SD	1.66±0.90	1.73±0.19	1.56±0.13	0.000
Waist to height ratio				
Min-Max	0.39-0.73	0.39-0.65	0.45-0.73	0.000
Mean±SD	0.55±0.66	0.53±0.05	0.59±0.06	
HbA1c				
Min-Max	4.2-6.2	4.2-6.2	4.6-6.1	0.476
Mean±SD	5.37±0.46	5.33±0.49	5.41±0.42	
Fasting blood sugar				
Min-Max	60-128	60-123	61-128	0.617
Mean±SD	90.21±16.72	89.38±16.88	91.28±16.69	
Cholesterol				
Min-Max	41-314	41-314	89-277	0.803
Mean±SD	182.47±43.53	183.56±43.03	181.09±44.74	
Triglycerides				
Min-Max	50-544	50-296	52-544	0.542
Mean±SD	152.96±91.44	147.42±60.02	160.09±121.1	0.542
HDL				
Min-Max	29-122	36-122	29-83.6	0.382
Mean±SD	53.81±12.96	54.93±14.16	52.36±11.27	

 $NA = Not \ applicable; \#\ Compared\ between\ males\ and\ females;\ Data\ expressed\ as\ mean \pm SD$

Table 2. Characteristics of subjects in prediabetic and healthy group.

Variable	Pre-diabetic (N=20)	Healthy (N=60)	P value #
Age (years)	49.60±8.00	44.65±9.50	0.040
Sex (male:female)	12:8	33:27	0.896
Waist circumference	91.95±8.88	88.57±9.74	0.174
BMI	24.20±3.49	23.95±3.88	0.802
BSA	1.72±0.20	1.64±0.18	0.077
Waist to height ratio	0.56 ± 0.05	0.55±0.07	0.867
Fasting blood sugar	104.89±14.02	85.32±14.62	0.000
Cholesterol	199.65±51.96	176.75±39.17	0.041
Triglycerides	142.95±47.97	156.30±102.02	0.575
HDL	55.18±12.21	53.35±13.27	0.588

Compared between prediabetic and healthy; Data expressed as mean±SD.

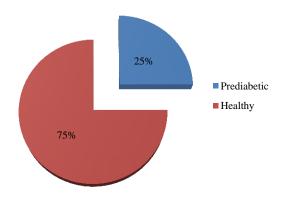


Figure 1: Prevalence of pre-diabetes in study population.

DISCUSSION

The present study exhibited a prevalence of 25% prediabetes among the healthy population of the Tehsil Kangra and adjoining areas as per the ADA guidelines. The findings of the present study are in line with the results of the Delhi Urban Diabetes Survey (DUDS) done by Madhu et al, published in May 2018 that showed a prevalence of prediabetes as 21% as per WHO criteria and 39.5% as per ADA criteria. 12 In a study carried out by Pandey et al, on paramedic students of Kanpur region, both boys and girls, aged between 17 and 19 years the prevalence of prediabetes was reported to be 32.1%.¹³ Anjana et al, in the phase III of Indian Council of Medical Research-India Diabetes study in the North Eastern states of India from 2012 to 2015 found the incidence of prediabetes from 6% in Mizoram to 14.7% in Tripura. 14

Two large-scale national surveys conducted in China in the year 2007 and 2010 revealed that the prevalence of prediabetes increased from 16.0% to 50.9% in rural areas. ¹⁵ The prevalence of prediabetes in the present study is thus comparable to data from other parts of the country and other countries of the region. The findings of this study are a clarion call to the preventive health system to vigorously spread the message of preventing diabetes by adopting healthy active life style.

CONCLUSION

The burden of prediabetes in apparently healthy subjects of Tehsil Kangra and adjoining areas was found to be 25% and if they would not have been the part of present study they would have remained ignorant about their prediabetes status. This is a major problem India is facing that majority of population is unaware of its diabetic status that further adds to the burden of DM. This urgently calls for mass awareness and screening programmes to identify and overcome the burden due to diabetes in India.

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