

# Assessment of Body Mass Index in Prediabetics

Satabdi Saha<sup>1,\*</sup>, Vijayadas<sup>2</sup>, Preethi BL<sup>2</sup>, Pramila Kalra<sup>2</sup>

## ABSTRACT

Pre-diabetes is a stage in which blood glucose levels are higher than normal but not high enough to call as diabetes. The aim of study was to determine the association of body mass index with pre-diabetes. A sample of 50 subjects, 25 prediabetics and 25 normal healthy individuals between the ages 20-50 years participated in our study. Anthropometric measurements, educational level and HbA1C level of participants were recorded. Statistical analysis was done using SPSS 20. All parameters were summarized using mean and standard deviation. Students *t*-test was used to compare mean differences in all the parameters between the two groups. A *p*-value  $\leq 0.05$  were considered significant. The mean BMI of the normal subjects and prediabetics were  $23.07 \pm 2.19$  and  $27.84 \pm 1.88$  Kg/m<sup>2</sup> respectively. Our study showed that pre-diabetic subjects had a higher BMI level compared to normal healthy subjects. Proper maintenance of body weight as per height is of utmost importance to lead a normal healthy life and controlling BMI can also prevent the progression of diabetes from prediabetes.

**Key words:** Body Mass index, Prediabetes, HbA1C, Obesity, Oxidative Stress.

## INTRODUCTION

Type 2 of DM (T2DM) is one of the most important public health crises which has taken the form of global pandemic, because of its association with increased morbidity and mortality. Around 29 – 93% individuals with prediabetes develop diabetes in the subsequent years.<sup>[1]</sup> New Figures for diabetes prevalence in India showed that 77.4 million people are on threshold for diabetes, with pre-diabetes.<sup>[2]</sup> It is also surprising that half of the adults with prediabetes are under the age of 50 years. Impaired fasting glucose or pre-diabetes increases the risk of atherosclerosis, oxidative damage of organs, cardiovascular disease.<sup>[3]</sup> In the British Whitehall II study done by Tabak AG *et al.* it had been found that that people with diabetes had increased blood glucose level 13 years before the diagnosis of type 2 diabetes.<sup>[4]</sup> Insulin sensitivity was also found to be reduced with a higher insulin level throughout the 13 years observation period of Whitehall II study. These findings indicate that insulin resistance and beta cell dysfunction start years before the development of diabetes, during the period of prediabetes.<sup>[4-6]</sup> Multiple factors can be responsible for insulin resistance like obesity, inflammation, mitochondrial dysfunction, genetic predisposition, aging, oxidative stress and so on.<sup>[7,8]</sup> Our study was done to assess the relationship of body mass index to pre-diabetic condition.

## MATERIALS AND METHODS

### Study Participants

Twenty Five prediabetics attending the endocrinology outpatient department of MS Ramaiah Medical College and Hospital were recruited for the study after getting the informed consent. Twenty Five age, sex and education matched healthy controls were enrolled for the study. The study was conducted from January 2015 to April 2016.

### Procedure

Testing procedures were explained and consent was obtained from the subjects. Detailed history was taken. A thorough general physical examination and systemic examination was done. The subjects were divided into the two groups based on their serum HbA1C level. Serum HbA1C level was estimated by High Performance Liquid Chromatography (HPLC).

Anthropometric measurement was done. Height was measured using Height measuring stand-Bioplus. Weight was measured using standardized weighing machine. BMI was calculated.

### Statistical Analysis of Data

The parameters were tested for normal distribution. Parametric data were described in terms of mean and standard deviation (mean  $\pm$  SD). ANOVA was used to analyze the differences in mean between the groups. *P*-values less than 0.05 were considered significant. Statistical analyses were done using SPSS version 17.0.

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## RESULTS

The study was conducted on 25 normal subjects and 25 prediabetics. The participants were between the age group of 20-50 years. The mean age of normal subjects and prediabetics were  $26.85 \pm 5.66$  and  $31 \pm 3.75$  years respectively. Two-way ANOVA was used to adjust for the effect of age and it was found that age did not have any significant influence on any of the parameters. The mean HbA1C levels in control group and cases were  $5.14 \pm 0.24$  and  $6.03 \pm 0.23$  % respectively. Age, height, weight, HbA1C levels are summarized in Table 1.

In controls, 15 were female and 10 were male. In cases, 13 females, 12 males were there. The gender distribution in the study groups was comparable ( $P = 0.687$ ). The study population was described as normal weight, overweight and obese based on their BMI level (Table 2).

The mean BMI of the normal subjects and prediabetics were  $23.07 \pm 2.19$  and  $27.84 \pm 1.88$  Kg/m<sup>2</sup> respectively as shown in Table 3 and Figure 1 and the difference was statistically significant.

## DISCUSSION

Prediabetes and type 2 DM are the two major global health emergencies of the 21<sup>st</sup> century. Each year more and more people live with these conditions which can lead to life-changing complications. Obesity or increase in BMI is associated with increase in blood glucose level in diabetics.<sup>[9-11]</sup> The same factor can contribute to the development of prediabetes. In this study prediabetics had significantly higher BMI.

**Table 1: Basic parameters in study groups.**

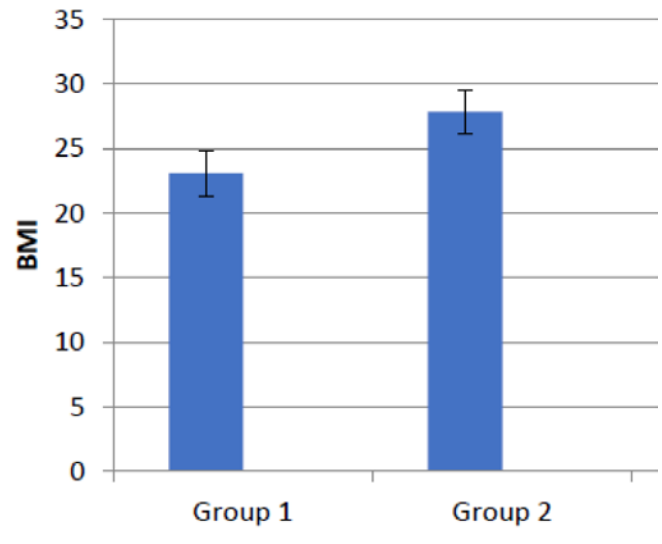
Parameters	Controls n=25		Cases n=25		P-Value
	Mean	SD	Mean	SD	
Age (Years)	26.85	5.66	31	3.75	> 0.05
Height (cm)	157.32	6.98	157.52	7.57	> 0.05
Weight (Kg)	57.52	9.69	69.38	8.80	0.003
HbA1C%	5.14	0.24	6.03	0.23	<0.001

**Table 2: Gender distribution and BMI status of the study groups.**

Parameters	Controls		Cases	
	Number	%	Number	%
Sex				
Male	10	40	12	48
Female	15	60	13	52
BMI Categories				
Normal	20	80	1	04
Overweight	4	16	17	68
Obese	1	04	7	28

**Table 3: Comparison of BMI between controls and cases.**

Parameters	Controls n=25		Cases n=25		P-Value
	Mean	SD	Mean	SD	
BMI	23.07	2.19	27.84	1.88	< 0.05



**Figure 1: BMI of controls (Group1) and Cases (Group 2).**

Bosi *et al.* and Chin and Lin reported the association between BMI and pre-diabetes.<sup>[12,13]</sup> Other studies also found the positive relationship between BMI and pre-diabetes.<sup>[2,14]</sup> But, in study conducted by Lee *et al.* and Gupta *et al.*, there was no significant correlation between pre-diabetes and BMI.<sup>[15,16]</sup>

In our study a significant correlation was found between increase in BMI and prediabetes. Prediabetic people had a significantly higher BMI compared to healthy individuals.

American Diabetes Association recommended testing for prediabetes in all adults who are overweight (BMI  $\geq 25$ kg/m<sup>2</sup> or  $\geq 23$ kg/m<sup>2</sup> in Asian Americans) and if the result is normal repeat testing at a minimum of three-year intervals.<sup>[17]</sup>

The present study may be limited by impending risk factors which were not considered for in the analysis. Dietary habits and life style could be some limitations of our study.

## CONCLUSION

Based on our finding, it is possible that increase in BMI is associated with increased risk of pre-diabetes. Therefore blood glucose level should be monitored regularly in people with increase in BMI.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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