



## Prevalence of Pre-Diabetes and Diabetic status in Pre-Hypertensive Patients

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### Abstract

**Background:** *Diabetes and hypertension are something that coexist in patients. The prevalence of hypertension is 1.5-2 times more in those with diabetes than in those without diabetes, whereas almost 1/3 of the patients with hypertension develop diabetes later. In this study, pre-diabetes and diabetes in hypertensive patients and on coexisting risk factors were studied.*

**Methods:** *After diagnosed hypertension cases on treatment who gave written informed consent were studied for duration of disease, drug therapy, family history, manifestations of co-morbidities and investigated for fasting and post-prandial blood sugar, oral glucose tolerance, lipid profile, serum creatinine, uric acid and SGPT.*

**Results:** *Out of 100 recruited hypertensive patients 52 were females and 48 were males. 43% were diagnosed pre-diabetics whereas 16% were diabetics.*

**Conclusions:** *Prediabetes and diabetes are highly prevalent among individuals with known cases of hypertension and pre-hypertension.*

**Keywords:** *Pre-diabetes, Impaired glucose tolerance, Impaired fasting glucose, Diabetes, Hypertension, Pre-Hypertensive.*

### Introduction

Hypertension and diabetes, two of the major global risks for mortality, are on a rapid rise in developing nations.<sup>1</sup> In India, according to the 2011 estimates reported by the Indian council of medical research-India diabetes study, 62.4 and 77.2 million people have diabetes mellitus (DM) and pre-diabetes (PD), respectively.<sup>2</sup> It is predicted that by 2030, India's diabetes burden will be almost 87 million people.<sup>3</sup> Additionally, there is increasing prevalence of hypertension in the Indian population, especially in the urban areas.<sup>4</sup> Elevated blood pressure has been linked to ischemic heart disease, peripheral vascular diseases, stroke, myocardial infarction, and renal failure.<sup>5</sup> Hypertension and diabetes are two most

important risk factors for cardiovascular disease. Given the increasing rates of coronary artery disease among Indians, especially at a younger age, understanding and successfully managing hypertension and diabetes may hold the key to reducing cardiovascular mortality in India.<sup>6</sup>

Diabetes and hypertension are also known to coexist in patients. The prevalence of hypertension is 1.5-2 times more in those with diabetes than in those without diabetes, whereas almost 1/3 of the patients with hypertension develop diabetes later.<sup>7</sup> This coexistence presents an increased risk and can accelerate vascular complications.<sup>8,9</sup> Diabetes and hypertension are manageable health conditions and can be controlled by medicinal intervention, exercise, and

diet. Moreover, detection of progenitors pre-diabetes and pre-hypertension through periodic surveillance can allow for early intervention and delay disease progression. Although studies have been carried out over the past few years to estimate the prevalence of diabetes and hypertension, they were often small-scale and regional or carried out in a particular subset of the diverse Indian population.

In this research, we present the findings on prevalence of new cases of pre-diabetes and diabetes, diabetes in hypertensive patients and on coexisting risk factors. The objectives of the study were following.

- To determine the prevalence of pre-diabetes and diabetic status in hypertensive patients and its early detection.
- To study correlation of duration of hypertension leading to pre-diabetes and diabetic status
- To study the correlation of impaired plasma glucose levels with lipid profile, serum uric acid, SGPT and co-morbidities.

### Methods

This study is a transverse sectional study of patients attending OPD in a private Clinic in Kolkata, West Bengal (Eastern India). Patients who gave written informed consent were selected for this study (n=100).

### Inclusion Criteria

Patients more than 40 years of age who are diagnosed cases of hypertension and are taking treatment for the same.

### Exclusion Criteria

Patients less than 40 years of age, known cases of DM and secondary hypertension, pregnant ladies and patients on thiazide diuretics or beta blockers. Demographic details of patients, history of hypertension, drug therapy, family history and history of co-morbidities were noted. Patients were investigated for fasting and post-prandial plasma glucose, lipid profile, serum uric acid,

serum glutamate pyruvate transaminase (SGPT) and serum creatinine levels. In addition to this patients were subjected to oral glucose tolerance test (OGTT).

### Definitions

A patient whose diabetic status was not known and had OGTT (2 hours) levels between 140 mg/dl and less than 200 mg/dl or fasting plasma glucose levels between 100 and 125 mg/dl was defined as having ‘‘prediabetes.’ Patients without previously reported diabetes who had OGTT (2 hours) levels more than 200 mg/dl were considered as new cases of diabetes mellitus (DM).

### Statistical Analysis

Categorical data is presented as percentages and continuous data as mean and standard deviations. Significance of difference in parameters was calculated by Karl Pearson’s Chi Square test at 95% confidence interval ( $p < 0.05$ ). EpiInfo version 7.0 (public domain software package from centers for disease control and prevention was used for calculating the Chi Square test (with Yates’ correction where applicable).

### Results

Out of 100 recruited hypertensive patients 52 were females and 48 were male patients. When these patients were screened for pre-diabetes and diabetes, 43% were diagnosed as prediabetics where as 16% were diabetics. Amongst those who were detected to be prediabetic, 58% were females and 42% were male. In diabetic patients 44% were female and 56% were male. The demographic details of demography and investigations of patients are given in Table 1. The details of diabetics are in Table 2 and those of prediabetics in Table 3.

**Table1:** Hypertensives-demographic profile and blood parameters

Duration of hypertension (years)		<1 year	1-5 year	>5 year
	21-40	11	2	1
Age	41-60	22	27	17
	>60	4	7	9
Gender	Female	20	18	14
	Male	17	18	13
Family	No	34	33	26
History of hypertension	Yes	3	3	1
Serum	Normal	18	23	16
Triglycerides	Increased	19	13	11
Serum	Normal	25	24	21
cholesterol	Increased	12	12	6
	Normal	30	25	19
Serum LDL	Increased	7	11	8
Serum	Normal	34	33	25
creatinine	Increased	3	3	2
Serumuric	Normal	32	27	19
acid	Increased	5	9	8

**Table 2:** Serum parameters normal and raised fasting plasma glucose

Fasting plasma glucose (mg/dl)		<100	<125	>125
	No	50	29	15
Family history	Yes	2	4	0
of diabetes mellitus				
Serum	Normal	49	29	14
creatinine	Increased	3	4	1
	Normal	39	25	10
Serum LDL	Increased	13	8	5
Serum	Normal	36	22	12
cholesterol	Increased	16	11	3
Serum	Normal	33	16	8
triglycerides	Increased	19	17	7
Serumuric	Normal	39	25	14
acid	Increased	13	8	1

**Table 3:** Serum parameters -normal and raised plasma glucose after 2 hour OGTT

2 hours OGTT plasma glucose (mg/dl)		<140	<200	>200
Serum LDL	Normal	39	26	9
	Increased	13	8	5
Serum	Normal	48	33	11
creatinine	Increased	4	1	3
Serum	Normal	37	22	11
cholesterol	Increased	15	12	3
Serum	Normal	29	20	8
triglycerides	Increased	23	14	6
Serumuric	Normal	36	29	13
acid	Increased	16	5	1

## Discussion

Among the high blood pressure patients of UNTH, the ore-diabetic status was 25 percent. It comes within the range that had been forwarded by

Govindarajan et al. 2 Prevalence rate of hypertension for about 43 percent had been found in urban areas of India. 4 Furthermore, Milla and Grant had claimed that 25 percent of the total population

were at the risk of relative insulin resistance that often leads to type 2 Diabetes Mellitus. In Kolkata, a prevalence rate of 3.5 percent was reported among primary health care patients while 40 percent women had polycystic ovarian syndrome. Despite a whopping 18 percent of Indian adults being aware of the occurrences of prediabetes, only 4 percent were aware of it. During this study, awareness had not been examined and it was found that lack of knowledge regarding prediabetes in an individual makes it mandatory that screening must be done. Impaired fasting glucose (IFG) was more prevalent among the patients 15%, than impaired glucose tolerance (IGT) (5%). This does not, however, align with the findings of the report by Shobha et al. where 9.7 percent of IFG and 15.6 percent of IGT was prevalent among Indians who aged between 40 to 74 years. This article had also found that the prevalence combined rate of both IFG and IGT in India was 14.7 among adults of 45-74 years, and 30.7 percent among women and men from 40-49 and 50-59 years.

While detecting early dysregulation, IGT tends to be more sensitive as compared to the IFG. This is reflective of hepatic gluconeogenesis and also a slow uptake of glucose from the blood of the adipose tissue and skeletal muscles after a meal. It has independent association with traditional microvascular complications of diabetes. However, it is noteworthy that not all IGT patients would progress to diabetes as it is a reversible and dynamic state. While some revert towards normoglycaemia, a majority of the patients would continue in the same state. 6 patients out of the entire sample had both IGT and IFG impaired.

Eleven patients were impaired with IGT in this study, among whom 5 had IGT alone while 6 had both IGT and IFG. These eleven patients were at an increased threat of a progression towards Type 2 Diabetes Mellitus and develops cardiovascular disorders. 14 percent of the patients had unreported about Diabetes Mellitus. Hence, it underscores the importance of regular screening of the hypertensive patients for checking DM. The mean HOMA-IR (homeostasis model assessment for insulin

resistance) of the patients, (5.1+4.5) is in the upper range of values reported for PD (4.3-5.2) with some definitely in the DM range, 8.3-9.5, as a result of the unreported DM subjects. The HOMA-IR of the total sample exceeded the range of values which is usually reported for Indians i.e., 2.1-2.7. In comparison to this, the occurrence of PD amongst the patients had not exceeded the value range. However, the percentage of underreported cases was indeed high. The reasons behind unreporting included lack of affordability of health services and also ignorance. There does not exist any relationship between laboratory parameters and anthropometric parameters which was evident from the following. This holds back from predicting PD based on the knowledge of former parameters. As for the patients, they held not much differences amongst themselves in their Body Mass Index (BMI). But they were different in case of the waist circumference and the waist to hip ratio. The differences in the later parameters reflect in considerably ascended fasting and 2-hour post prandial plasma glucose of the patients. This depicts that BMI is not a good index for detecting obesity in this group of patients. Among hypertensive patients, normal fasting insulin level showcase the observation that majority of the patients could secrete insulin which was enough for them to be kept in normoglycaemic state, even in the absence of insulin resistance as revealed by the normal index. The study has identified that the importance of screening for PD especially among hypertensive patients of the study locality.

### Conclusion

Prediabetes and diabetes are extremely popular among people with known cases of hypertension. The threat of both diabetes and prediabetes increased in long standing hypertension. According to this study, it has highlighted the importance of screening for prediabetes and diabetes especially among hypertensive patients of the study locality so that treatment measures can be started early on these patients and further complications can be prevented by the disease.

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