

# Effect of diet and exercise on improvement of anthropometric variables and BSL in prediabetic study subjects of urban slum area

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## Abstract

**Introduction:** Subjects with IGT and IFG have an increased risk of type-2 diabetes therefore form an important target group for interventions aimed at preventing diabetes. Approximately one third of the individuals with either IFG or IGT and two third of individuals with both will develop diabetes within six years. Present study was planned to focus attention on prediabetes and to see the effect of the intervention measures such as diet change and increasing level of physical activity to control the blood sugar level in prediabetics. **Materials and Methods:** The present hospital based interventional study was conducted in urban slum area. The outpatient department attendees of the Urban Health Centre, comprises the study population for the present study. If blood sugar levels fits in the definition of pre-diabetes (either IFG or IGT or both) then subjects were assigned to the groups, either in the intervention group or control group by randomization. Subjects in the intervention group were advised regarding diet change and exercise. All the subjects in both the groups were followed-up for 9 months. **Results:** Total 288 study subjects undergo investigation for pre-diabetes, out of which 104 (36.11%) found to have pre-diabetes. So prevalence of pre-diabetes was 36.11%. Majority of the participants i.e. 34 were in the age group of 40 to 49 yrs. Majority of the participants had completed their education up to graduation (39 %) and post-graduation (17 %). Anthropometric variables like BMI and waist hip ratio were not found significant before intervention but after intervention there is significant variation in anthropometric variables between control and intervention groups. Similarly fasting and post prandial blood sugar level among control and intervention groups were found to be significant after intervention. **Conclusion:** The study shows that intervention measures like diet change and exercise are effective to decrease and maintain the blood sugar levels among prediabetics by decreasing and maintaining their bodyweight.

**Keywords:** diet, exercise, intervention, prediabetic.

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## INTRODUCTION

The prevalence of diabetes is rapidly rising all over the globe at an alarming rate. Over the past 30 yr, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle aged people. It is important to note that the rise in prevalence is seen in all six inhabited continents of the globe. Although there is an increase in the prevalence of type-1 diabetes also, the major driver of the epidemic is the more common form of diabetes, namely type-2 diabetes, which accounts for more than 90 per cent of all diabetes cases. The number of people suffering from type-2 diabetes and related conditions has skyrocketed

over the past fifty years. And more and more peoples have blood sugar levels that, while not high enough to qualify as diabetes, are too high for good health. This condition goes by the name prediabetes. Prediabetes is either impaired fasting glucose or impaired glucose tolerance or both. Impaired glucose tolerance and impaired fasting glucose is an intermediate category between normoglycemia and overt diabetes and it can be identified by an oral glucose tolerance test<sup>1</sup>. Impaired fasting glucose is defined as the blood sugar level between 5.6 and 7.0 mmol/L (100 and 126 mg/dL). Impaired glucose tolerance is defined as plasma glucose levels between 7.8 and 11.1 mmol/L (140 and 200 mg/dL) 2 h after a 75-g oral glucose load.<sup>2</sup> Nowhere is the diabetes epidemic more pronounced in India as the World Health Organization (WHO) reports show that 32 million people had diabetes in the year 2000<sup>3</sup>. The International Diabetes Federation (IDF) estimates the total number of diabetic subjects to be around 40.9 million in India in 2006 and this is further set to rise to 69.9 million by the year 2025<sup>4</sup>. Subjects with IGT and IFG have an increased risk of type-2 diabetes therefore form an important target group for interventions aimed at preventing diabetes. Approximately one third of the individuals with either IFG or IGT and two third of individuals with both will develop diabetes within six years<sup>5</sup>. Present study was planned to focus attention on prediabetes and to see the effect of the intervention measures such as diet change and increasing level of physical activity to control the blood sugar level in prediabetics.

## MATERIALS AND METHODS

The present hospital based interventional study was conducted in Urban Health Centre, Bandra, Mumbai which is attached to the Sir J.J. Group of Hospitals, Byculla, Mumbai. Study was conducted from October 2007 to November 2008. The outpatient department attendees of the Urban Health Centre, Bandra comprises the study population for the present study. Among the outpatient department attendees, subjects with the following risk factors (inclusion criteria) were included in the study.

### Inclusion Criteria

Age 20 years and above, Any one criteria of the following -Family H/O Diabetes Mellitus, K/C/O Hyper-tension, H/O Gestational Diabetes, H/O Large Baby, Apparently Overweight/ Obese.

### Exclusion Criteria

1. K/C/O Diabetes Mellitus
2. Pregnancy
3. H/O An episode of Acute Myocardial Ischemia

In the first step of data collection we identified the at risk subjects among the outpatient attendees. These at risk

subjects were called on next morning with 12-hr fasting. After informed consent blood sample (about 4 ml) was taken for **fasting** blood glucose, lipid profile and hemoglobin, then those subjects were given 75 gms of anhydrous glucose powder mixed in one glass of water. Second blood sample was taken after two hours for post-load blood sugar estimation (Oral Glucose Tolerance Test). Subjects were called on next day for reports of blood tests. If blood sugar levels fits in the definition of pre-diabetes (either IFG or IGT or Both) subjects were assigned to the groups, either in the intervention group or control group by randomization which was done with the help of computer programme; then pre-coded questionnaire was filled up by face to face interview after taking informed consent and height, weight, waist circumference, hip circumference and blood pressure were measured. Subjects in the intervention group were advised regarding diet change and exercise. All the subjects in both the groups were followed-up for 9 months. In the Intervention group tailored diet plan for each individual was given with the help of dietitian and in the Control group, general guidelines regarding diet were given. The second form of intervention was exercise. Subjects in the Interventional group were advised to do brisk walking for 10 min/day to start with and it was gradually increased to 30 min./day and for at least 5 days/week. Control group had not been advised regarding exercise.

## RESULTS

Total 288 study subjects undergo investigation for prediabetes, out of which 104 (36.11%) found to have prediabetes. So prevalence of pre-diabetes was 36.11%. But 4 study subjects lost to follow up so total study subjects included for intervention were 100. They were divided equally into control and intervention group (each group 50). Majority of the participants i.e. 34 were in the age group of 40 to 49 yrs (17 participants in each group) followed by 28 in the age group of 30 to 39 yrs (15 in the control and 13 in the intervention group). Sex distribution of the participants shows that 49 % were males and 51% were females. Among the study participants 82 % had education up to or above high school level. Majority of the participants had completed their education up to graduation (39 %) and post-graduation (17 %). Distribution of participants according to their occupation shows that majority of the participants were doing office jobs (48 %) which was followed by housewives (29%). Distribution of participants according to their per capita income shows that majority of the participants i.e. 44 in control group and 42 in intervention group had PCI of Rs. 3000 or more i.e. in total 86 (86 %). (Table 1)

**Table 1: Demographic characteristics of study subjects (n=100)**

Characteristics	Control group(n=50)	Intervention group(n=50)	Total
<b>Age group(yrs)</b>			
20-29 yrs	9(52.9%)	8(47.1%)	17
30-39 yrs	15(53.6%)	13(46.4%)	28
40-49 yrs	17(50%)	17(50%)	34
50-59 yrs	7(41.2%)	10(58.8%)	17
60 and above	2(50%)	2(50%)	4
<b>Sex</b>			
Male	25(51%)	24(49%)	49
Female	25(49%)	26(51%)	51
<b>Education</b>			
Illiterate	0	2(100%)	2
Primary and middle	7(43.75%)	9(56.25%)	16
High school and HSC	14(53.85%)	12(46.15%)	26
Graduate	21(53.9%)	18(46.1%)	39
Post graduate and above	8(47.1%)	9(52.9%)	17
<b>Occupation</b>			
Unskilled	4(50%)	4(50%)	8
Skilled	2(20%)	8(80%)	10
Office job	26(54.2%)	22(45.8%)	48
Housewife	15(51.7%)	14(48.3%)	29
Unemployed	3(60%)	2(40%)	5
<b>Per Capita income(PCI)</b>			
< 1000 Rs	0	1(100%)	1
1000-1999 Rs	1(25%)	3(75%)	4
2000 -2999 Rs	5(55.6%)	4(44.4%)	9
3000 Rs and above	44(51.2%)	42(48.8%)	86

Anthropometric variables like BMI and waist hip ratio were not found significant before intervention but after intervention there is significant variation in anthropometric variables between control and intervention groups. (**Table 2**).

**Table 2: Before and after intervention anthropometric characteristics of study subjects**

Anthropometric characteristic	Control group(n=50)	Intervention group(n=50)	t test value
<b>Before intervention</b>			
B.M.I.	26.48	27.24	t= -1.9285(NS)
Waist to hip ratio	0.94	0.94	t=0.6064 (NS)
<b>After intervention</b>			
B.M.I.	25.8	25.31	t=2.0531(S)
Waist to hip ratio	0.93	0.91	t =3.3333(S)

Similarly fasting and post prandial blood sugar level among control and intervention groups were found to be significant after intervention (**Table 3**).

**Table 3: Before and after intervention blood sugar level of study subjects**

Blood sugar levels (mg/dl)	Control group(n=50)	Intervention group(n=50)	t test value
<b>Before intervention</b>			
Fasting blood sugar level	111.66	110.34	t= 0.7129 (NS)
Post prandial blood sugar level	162.52	160.44	t=0.4427 (NS)
<b>After intervention</b>			
Fasting blood sugar level	101.62	86.74	t=6.4515(S)
Post prandial blood sugar level	151.86	140.12	t =4.2157(S)

## DISCUSSION

Present study was planned to highlight the importance of intervention measures (diet change and exercise) among

prediabetics for improving blood sugar level. In the present study the prevalence of prediabetes was 36 .11%. As this was hospital based study prevalence rate may be

more from the prevalence of community based study. The National Urban Diabetes Survey (NUDS) (2001), a population based study which was conducted in six metropolitan cities across India suggested that there was 14 % prevalence of prediabetes<sup>6</sup>. V. Mohan studied the changing prevalence of IGT in Chennai which was 2 % in 1988 and 9% in 2006<sup>7</sup>. As compared to our study, a lower prevalence of 11.2% was found in the Amrita Diabetes and Endocrine Population Survey (ADEPS)<sup>8</sup> , which was a community-based cross-sectional survey done in urban areas of Ernakulam district in Kerala. A study in a developing rural area of Andhra Pradesh reported the prevalence of pre-diabetes to be 15.5% which was lower as compared to our results <sup>9</sup>. Prevalence of prediabetes from our study shows that it is more as compared to result of previous studies in India, so it indicates that prevalence of prediabetes is increasing in India as time passes on. The present study indicated that mean body mass index of the participants from both the groups had decreased from the baseline mean body mass index but the difference was of much more magnitude in the intervention group. After the intervention, difference between the groups was statistically significant. Various studies previously shown that on the virtue of lifestyle intervention by decreasing the body mass index, incidence of diabetes from prediabetes has been decreased. In Diabetes Prevention Programme Research Group , effect of intervention measures on the prevention of progression of glucose intolerance to diabetes was studied; it was found that the average weight loss was 0.1, 2.1, and 5.6 kg in the placebo, metformin, and lifestyle- intervention groups, respectively (P<0.001). The lifestyle intervention was particularly effective, with one case of diabetes prevented per seven persons treated for three years <sup>10</sup>. Gregory A *et al* <sup>11</sup>when studied progression from newly acquired impaired fasting glucose to Type 2 Diabetes, they found that each kilogram per squared meter of BMI increased risk of progression by 3–4%. Similarly waist to hip ratio was also found to be significantly reduced in both the group after intervention. These results indicated that the interventional measures used were effective to reduce the central obesity which has a direct relation with the prevalence of prediabetes. From various studies conducted previously it was shown that there is direct relation of the central obesity with the prevalence of diabetes and prediabetes and it has also shown that by decreasing central obesity incidence of diabetes from hyperglycemic states was decreased. Wilfred Y *et al* <sup>12</sup>studied the changes in body size and shape and the risk of diabetes in the Diabetes Prevention Program. It was found that anthropometric measurements like waist and hip circumference and waist to hip ratio decreased from baseline in the lifestyle intervention group. The study also

shows that intervention measures (diet change and exercise) were effective to decrease the mean fasting blood sugar and post-load blood glucose level. The Finnish Diabetes Prevention Study <sup>10</sup> found that a reduction in body weight achieved through an intensive diet and exercise program was associated with a 58% reduction in the risk of developing type 2 diabetes ( $P < 0.001$ ). Jaakko T<sup>13</sup> studied the effect of lifestyle intervention on the incidence of diabetes in the population with impaired glucose tolerance. Result of the study indicated that the risk of diabetes was reduced by 58 percent ( $P<0.001$ ) in the intervention group. The reduction in the incidence of diabetes was directly associated with changes in lifestyle.

## CONCLUSION

The study shows that intervention measures like diet change and exercise are effective to decrease and maintain the blood sugar levels among prediabetics by decreasing and maintaining their bodyweight. Thus there is a vital role for health education among risk group to decrease the blood sugar level and maintain that blood sugar level.

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