

Screening of Prediabetics for Intervention Study in Coimbatore

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Abstract

Prediabetes an asymptomatic intermediate state of hyperglycemia with blood glycemc parameters above normal but below the diabetes threshold with high probability of developing diabetes. Hence, main aim of the study was to screen the prediabetics using IDRS (Indian Diabetic Risk Score). Around 948 healthy volunteers (office administrators, employees, trainees and authorities) between the age of 25-60 years were selected from a Central Government funded center and from five private industries for screening the prediabetic subjects. From the 948 participants screened, 540 (57%) were males and 408 (43%) were females. About 35% male and 36.3% female subjects, were having an IDRS of ≥ 60 and were categorized as subjects with high risk vulnerabilities. From the high risk vulnerabilities group, about 120 (35.6%) subjects (64 male and 56 female) who had fasting blood glucose level ranging between 100-125 mg/dl were identified as prediabetics. The study revealed that the prediabetics can be screened in a simple and effective way for large populations.

Keywords: Diabetes, Hypoglycemia, Indian Diabetic Risk Score, Prediabetes

1. Introduction

Currently, prediabetes is a term covering two possible heterogeneous condition by the presence of Impaired Fasting Glucose (IFG) and/or Impaired Glucose Tolerance (IGT) that has not yet reached the thresholds for diagnosable Type II diabetes. Prediabetes raises the risk of Type II diabetes by 3- to 10-fold¹. The prevalence of prediabetes is estimated to be over 330 million people worldwide and expected to raise to at least 470 million in 2030². Worldwide, the number of people with IGT is estimated to be 280 million; by 2030, it is expected to be 398 million. Continuous rather than dichotomous risk scores are more useful for predicting the risk of developing diabetes. Hence the present study was carried out to screen the prediabetics for further food based intervention.

2. Materials and Methods

2.1 Selection of Area for Screening the Prediabetics

Before developing Type II diabetes, majority have “prediabetes” in which the blood sugar levels are higher without symptoms. Hence healthy volunteers (office administrators, employees, trainees and authorities) between the age of 25-60 years were selected from a Central Government funded center and from five private industries for screening the prediabetic subjects.

The study was registered in the Clinical Trial Registry of India (CTRI), Indian Council of Medical Research (ICMR). CTRI registration number is CTRI/2013/06/003759. The methodology of the present study was presented before the Institutional Human

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Ethical Committee (IHEC) of Avinashilingam University and the approval number AUW/IHEC-2013 AP-01 was obtained to conduct the clinical trial.

2.2 Screening using Indian Diabetic Risk Score (IDRS)

The study design, duration of the study and expected outcome of the study was explained and oriented to all the 948 participants by a formal meeting in their work premises itself. This was arranged with the support of the authorities of concerned industries and informed written consent was obtained from all the participants before the start of the study.

IDRS is a simple, very low-cost screening tool developed by Mohan *et al.* (2005)³ having multiple potential applications in clinical and epidemiological settings in India and was used to identify the prediabetics in the study. The screening of prediabetics was done using the Indian Diabetic Risk Score (Table 1).

Table 1. Indian diabetes risk score*

Criteria Assessed	
Age (Yrs)	Std. Points
<35	0
35-49	20
≥50	30
Waist circumference (cm)	
<80(female), <90 (male)	0
80-89 (female), 90 -99 (male)	10
≥90(female), ≥100 (male)	20
Physical activity	
Vigorous regular exercise or manual work at home/work	0
Moderate regular exercise or physical activity at home/work	10
Mild regular exercise or physical activity at home/work	20
No exercise and sedentary activities at home/work	30
Family history of diabetes	
No diabetes in parents	0
One parent diabetic	10
Both parents diabetic	20

*Mohan *et al.*, (2005)³

Subjects with an IDRS risk points <30 were categorized as low risk, between 30 and 50 points as medium risk and those with ≥60 points are high risk for developing diabetes.

3. Results and Discussion

3.1 Age and Sex Wise Distribution of the Selected Participants

Figure 1 reveals the age and gender wise distribution of the 948 selected population screened using IDRS.

Of the 948 participants screened, 540 (57%) were males and 408 (43%) were females.

A study by Sosale *et al.*, (2014)⁴ confirms that the newly diagnosed diabetics were from a younger age between 31-40 years (35%) and almost equal (40%) population was from the age group of 41-50 years. Younger age of onset implies that the most productive years of life is utilized and has a greater chance of rising complications. Both environmental and genetic factors might explain the younger onset of age along with high prevalence of diabetes in the Indian population. Hence the participants aged 25 years onwards were screened to identify the prediabetics.

From the 540 male subjects, most (35.4%) of the selected subjects were in the age group between 31-40 years followed by 30.6% in 41-50 years of age. Only a minimum of 2% of these selected male subjects were more than 60 years of age. Among the 408 female subjects screened, a higher percentage (47.1%) were in the age between 31-40 years and 31.1% were less than 30 years of age. Around 17.6% and 4.2% were in the age group of 41-50 years and 51-60 years respectively.

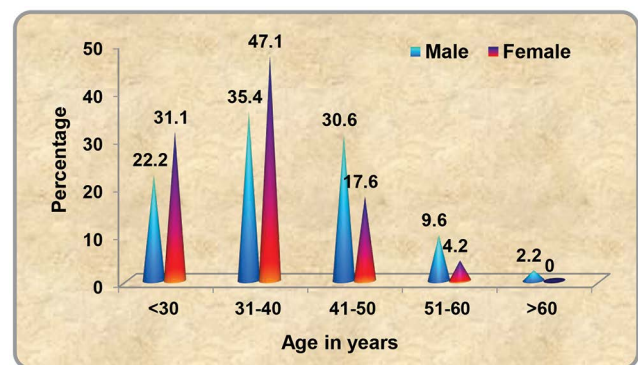


Figure 1. Age and sex wise distribution of the participants.

3.2 BMI Classification of Participants

Table 2 portrays the classification of screened subjects according to their BMI.

According to American Diabetes Association (2014)⁶ “lower BMI cut off points, specifically 24 kg/m² in South Asians and 25 kg/m² in Chinese, denote increased diabetes risk in some racial and ethnic groups”.

It is noticed from the above Table 2, among the 540 male subjects, 56.3% of them were considered to be normal having BMI ranging from 18.5-24.99. Very few (9.6%) of male subjects were underweight. Almost 28.7% of the subjects were in preobese category with the BMI of ≥ 25 and are considered to be overweight. 3.5% were under mild obese class I category, 1.1% in moderate obese class I and only 0.2% each in moderate obese class II and obese class III categories.

Among the 549 female subjects, 41.2% were in normal BMI range between 18.5-24.99. Only 6.9% of the females were underweight (whose BMI was < 18.49). Among these subjects, 36.5% were under the pre obese category, 10% falls under mild obese class I category, 2.9% were under moderate obese class I category, 1.5% under mild obese class II category and 1% was under moderate obese class II category.

Table 2. BMI classification of the participants

BMI Classification*		Male		Female		Total	
		Number	Per cent	Number	Per cent	Number	Per cent
<18.49	Underweight	52	9.6	28	6.9	80	8.4
18.5 – 24.9	Normal	304	56.3	168	41.2	472	49.8
25.0-29.9	Pre obese	155	28.7	149	36.5	304	32.1
30.0- 32.49	Mild Obese class I	19	3.5	41	10.0	60	6.3
32.5-34.9	Moderate Obese class I	6	1.1	12	2.9	18	1.9
35.0- 37.49	Mild Obese class II	2	0.4	6	1.5	8	0.8
37.5-39.9	Moderate Obese class II	1	0.2	4	1.0	5	0.5
≥ 40.0	Obese class III	1	0.2	0	0.0	1	0.1
TOTAL		540	100.0	408	100.0	948	100

*WHO (2004)⁵

3.3 Waist Circumference of the Selected Participants

Classification of screened subjects according to waist circumference is presented in Table 3.

Among the South Asians, in both men and women, the waist circumference cut-point was consistently lower than in whites which is 102 cm for men or 88 cm for women. Based on findings of Bodicoat *et al.*, (2014)⁸ it was recommended a waist circumference threshold of 90 cm for men and 77 cm for women in South Asians.

With regard to waist circumference, a higher percentage (63.5) of the male subjects were in normal range with < 90 cm whereas 37.7% of female subjects were having their waist circumference of 80-89 cm and were categorized under risk category. About 27.5% of the female subjects were having ≥ 90 cm as their waist circumference in turn increases the metabolic rate.

3.4 Physical Activity Status of the Selected Participants

Distribution of screened subjects according to their physical activity status is given in Table 4. ICMR-INDIAB-5 study by Anjana *et al.*, (2014)⁹ revealed that “among

Table 3. Waist circumference of the selected participants

Waist circumference* (cm)	Male		Waist circumference* (cm)	Female	
	Number	Per cent		Number	Per cent
<90	343	63.5	<80	142	34.8
90-99	138	25.6	80-89	154	37.7
≥100	59	10.9	≥90	112	27.5
Total	173	100	Total	159	100

*WHO (2008)⁷**Table 4.** Physical activity status of the selected participants

Physical activity	Male		Female		Total	
	Number	Percent	Number	Percent	Number	Percent
Vigorous exercise or manual work at home/work site	0	0.0	1	0.2	1	0.1
Moderate exercise or physical activity at home/work site	15	2.8	6	1.5	21	2.2
Mild exercise or physical activity at home/work site	86	15.9	37	9.1	123	13.0
No exercise and sedentary activities at home/worksite	439	81.3	364	89.2	803	84.7
Total	540	100	408	100.0	948	100.0

14227 individuals studied, 54.4% (n = 7737) were inactive while 31.9% (n = 4537) were active and 13.7% (n = 1953) were highly active. The region-wise prevalence of physical inactivity was as follows: Chandigarh-66.8%, Tamil Nadu-60.0%, Maharashtra- 55.2% and Jharkhand-34.9%. When extrapolated to the whole country, the estimated number of inactive individuals in India would be 392 million⁸. The present study findings may also bear same results that higher percent of both male and female (81.3 and 89.2%) subjects were not doing exercise.

About 15.9% of male and 9.1% of female belong to mild physical activity category where as 2.8 and 1.5% of the male and female subjects respectively were doing moderate exercise or strenuous work category.

It was heartening to know that about 81.3% of male and 89.2% of female subjects were not exercising and they belonged to sedentary activity which was one of the important risk factor for developing diabetes.

3.5 Family History of the Selected Participants

Table 5 shows the screened subjects according to their

family history of diabetes

With regard to the family history, 126 (23.3%) males and 122 (29.9%) of females were having positive history of diabetes in one of the parent and 3.9% male and 4.2% female respectively in both parents. Almost similar finding was revealed by Kumar et al., (2014)¹⁰ who reported 32% of the screened subjects with single parental history and 6% in both parents.

3.6 Classification of Screened Subjects as per IDRS

Details of the screened participants (N-948) for the clinical trial are presented in Table 6.

About 35% male and 36.3% female subject, were having an IDRS risk score of ≥ 60 and were categorized as subjects with high risk vulnerabilities. Higher percentages (62.6%) of the subjects were in the medium risk and only 1.9% of subjects were in low risk category.

All the subjects with high risk vulnerabilities were further tested for their Fasting Blood Glucose (FBG) level to confirm prediabetic status. The fasting blood glucose was analysed from capillary blood after 12 hours fasting

Table 5. Family history of diabetes

Family history	Male		Female		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
No genetic history	393	72.8	269	65.9	662	69.8
Single parent	126	23.3	122	29.9	248	26.2
Both parents	21	3.9	17	4.2	38	4.0
Total	540	100	408	100	948	100.0

Table 6. Classification of screened subjects as per IDRS

Sex	Low risk vulnerabilities		Medium risk vulnerabilities		High risk vulnerabilities		Total	
	No	%	No	%	No	%	No	%
Male	14	2.6	337	62.4	189	35	540	57
Female	4	1	256	62.7	148	36.3	408	43
Total	18	1.9	593	62.6	337	35.5	948	100

with Accucheck active glucometer (Roche Diagnostics, Germany) and the blood glucose values were recorded. Breakfast was provided for all the participants involved in FBG screening.

3.7 Distribution of Screened Subjects as per Blood Glucose Level

Table 7 reveals the distribution of screened subjects as per blood glucose level.

From the high risk vulnerabilities group, around 60.8% of the subjects were having desirable blood glucose level of <100 mg/dl. About 120 (35.6%) subjects (64 male and 56 female) had fasting blood glucose level ranging between 100-125 mg/dl and identified as prediabetics as per American Diabetes Association (2013)⁶. Around 12 subjects who were not diagnosed before as diabetics were also identified during the screening and advised to monitor

Table 7. Distribution of screened subjects as per blood glucose level

Sex	Normal subjects		Prediabetics		Diabetics		Total
	No	%	No	%	No	%	No
Male	113	59.7	64	33.8	12	6.34	189
Female	92	62.2	56	37.8	0	0	148
Total	205	60.8	120	35.6	12	3.6	337

their blood glucose level further with a diabetologist and confirm their status. Among the 120 prediabetics identified, based on the willingness and ready to give written consent, 90 prediabetics (male 53 and female 37) were selected from various venue to participate in the clinical trial.

4. Conclusion

The study revealed that prediabetics can be screened in a simple and effective way for large populations. Specially designed interventions along with changes in modifiable risk factors will reduce the incidence of prediabetics.

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