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Assessment of risk of type 2 diabetes using the Indian Diabetes Risk Score in an urban slum of Pune, Maharashtra, India: a cross-sectional study

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ABSTRACT

Background: The urban poor is a group that is known to be vulnerable to adoption of a more urbanized lifestyle that places them at a higher risk for diabetes. Individuals who are unaware of their disease status are more prone to micro- and macrovascular complications. Hence, it is necessary to detect this large pool of undiagnosed participants with diabetes and offer them early therapy. The aim of this study was to use the Indian Diabetes Risk Score, developed by the Madras Diabetes Research Foundation (MDRF-IDRS), to assess the prevalence of people at high risk for developing diabetes, and the correlation with known risk factors.

Methods: A cross-sectional study was conducted in the field practice area of the urban health training centre of a private medical college in Pune, Maharashtra. A total of 425 participants aged 20 years and above were screened for risk factors, including age, waist circumference, family history of diabetes and physical activity. Random testing of the blood glucose level of participants with a high risk score was carried out using a glucometer. Statistical analysis of the data was performed by using the chi-squared test and logistic regression analysis.

Results: The prevalence of people at high risk of diabetes was 36.55%. Among high-risk participants on univariate analysis, primary education ($P = 0.004$), lower socioeconomic class ($P = 0.002$), less physical activity ($P < 0.001$) and high waist circumference ($P < 0.001$) were major contributing factors, while in the moderate-risk group, lower socioeconomic class and high waist circumference were the prominent risk factors for diabetes. Multivariate analysis showed that higher education, moderate to vigorous activity and high waist circumference were significantly associated with risk status. Out of 140 high-risk participants, 68 (49%) had a random capillary blood glucose level of 110 mg/dL or above.

Conclusion: As the prevalence of people at high risk for diabetes was high, lifestyle changes and awareness regarding risk factors is needed to take control of the diabetes in the study population.

Key words: diabetes, high-risk cases, prevalence, risk score, urban

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BACKGROUND

Epidemiological transitions in India in the 21st century have led to noncommunicable diseases becoming a major public health problem of growing magnitude. One of the important diseases in this respect is diabetes, which is considered a "disease of urbanization".[1–3]

While recognizing the increasing prevalence of type 2 diabetes in urban Indian adults, it is important to note that the prevalence of undiagnosed diabetes in the community is also high. In the Chennai Urban Rural Epidemiology Study (CURES), the prevalence of known diabetes was 6.1% in the population studied, and for undiagnosed diabetes was 9.1%. Many such studies have reported a high prevalence of undiagnosed cases.

Hence, it is necessary to detect this large pool of participants with undiagnosed diabetes in India and offer them early therapy. The Indian Diabetes Risk Score, developed by the Madras Diabetes Research Foundation (MDRF-IDRS; shortened to IDRS from here onwards), is based on a multiple logistic regression model, and is a cost-effective method for the detection of undiagnosed diabetes in the community.[4,5]

Nearly 32.5% of the population of Pune lives in slums. The annual growth in the slum population is much higher than the city's overall population growth rate: in 2001, the annual population growth rate of the city was 4.14%, whereas it was 6.06% for the slum population. The increase in the population of Pune city is largely due to the industrialization and urbanization in and around Pune city, which has attracted many migrants from other parts of the country, resulting in an increase in the number of slums and the slum population. Along with the increase in the number of slums, the health-related problems faced by the slum dwellers are also increasing.[6]

Few data on diabetes and associated risk factors are available from Pune and the surrounding area. Therefore, to enable predictions of the future prevalence of diabetes in urban slums in the Pune area, India, this study aimed to identify and grade individuals at risk for diabetes, in a community setting, using the IDRS and testing of random capillary blood glucose.

The objectives of the study were to:

- identify adults aged over 20 years at high risk for developing type 2 diabetes, using the IDRS;
- estimate the proportion of participants at high risk for developing type 2 diabetes in the study sample;
- determine the association of participants at high risk for developing diabetes with various risk factors, i.e. age, waist circumference, family history of diabetes, physical activity and sociodemographic variables.

METHODS

Study design

This was a community-based cross-sectional study conducted over one year, from September 2011 to August 2012.

Study area

There are a total of 14 wards and 564 slums in Pune city. The field practice area of the urban health training centre of a private medical college, Pune, provides services to three wards covering the approximate population of 60 000. Out of these three wards, three areas, namely Joshiwada, Ganjwewada and Mangwada, with populations of 349, 177 and 243 (total = 769) respectively, were randomly selected for the study.

Study population

The study population was individuals aged 20 years and above who were residents of the area. All adult men and women aged 20 years and above residing in the study area were included. Pregnant and lactating women up to 12 weeks postpartum were excluded, owing to the possibility of impaired glucose tolerance status in this group.[7]

Study methodology

Sample size

In a study done in India by Ramchandran et al. in 2008,[8] the prevalence of type 2 diabetes was 18.6%. The sample size was calculated at 438 by use of the formula $4pq/L^2$, where $p = 18.6$ and $q = 100 - p$, with an allowable error of 20%.

The number of study participants selected from each area was 199, 100 and 139 from Joshiwada, Ganjwewada and Mangwada respectively. As 13 study participants were not willing to take part, the total sample collected was 425.These 13 non-respondents declined to take part because of the need to earn their daily income or household duties.

All participants aged 20 years and over in each household were included in the study. House-to-house visits were conducted, covering the houses one after the other lane wise. The participants were fully informed regarding the purpose of the study. The patient information sheet was explained to each subject and written consent was obtained. Each interview began with a general discussion to build rapport with the participants and gain their confidence. Participants who could not be contacted on the first visit were contacted subsequently during weekends as per their convenience.

Clearance from the ethics committee of Bharati Vidyapeeth University Medical College, Pune, was obtained prior to initiation of the study.

During each house visit, data were collected using the World Health Organization (WHO) Stepwise approach to surveillance (STEPS),[9] which includes three steps for assessment of risk factors. The three steps are as follows:

- Step 1: a predesigned, pretested proforma was used to collect data from the study participants; this included information on sociodemographic characteristics, family history of diabetes and physical activity, etc.
- Step 2: anthropometric measurements were taken for all study participants. Measurements included height, weight, waist circumference and hip circumference.

Screening at steps 1 and 2 was done on the basis of the IDRS.[10,11]

- Step 3: biochemical testing, i.e. random capillary blood glucose was done for high-risk participants (IDRS ≥60) who were screened in steps 1 and 2.

The socioeconomic status of subjects was assessed according to a modified Prasad's Classification.[12]

Operational definitions used are listed next.

- High-risk cases of diabetes:[11] participants with IDRS ≥60 were considered at high risk of diabetes.
- Family history of diabetes:[13] if either or both of a subject's parents had diabetes, they were considered to have a positive family history.
- Physical activity:[9] levels were graded based on WHO STEPS definitions of sedentary, mildly, moderately or vigorously physically active.
- Waist circumference:[7] was measured to the nearest 0.1 cm at the midpoint between the tip of the iliac crest and the last costal margin in the back and at the umbilicus in the front, using a non-stretchable tape, at the end of normal expiration, with the subject standing erect in a relaxed position. Abdominal/central obesity was considered to be present when the waist circumference was ≥80 cm in women and ≥90 cm in men.
- Blood glucose:[14] estimation of random capillary blood glucose was done only for those found to be at high risk for diabetes (IDRS ≥60), using a standardized digital glucometer (Accu-Check, Roche diagnostics, Germany). Participants with known diabetes were not tested for blood sugar levels.
- Occupation:[15]
  - labourer: a person involved in occupation for cash or kind; this group included mostly unskilled labourers working for daily wages;
  - business: any well- or semi-established organized business owned by an individual, irrespective of its size and category, if it is meant for profit;
  - unemployed: a person who is able and wishes to work for cash or kind, but cannot get the work;
  - housewife: a person who cares for the home and family; she is alternatively referred to as a home-maker;
  - household worker: a person who is employed for remuneration whether in cash or kind, in any household through any agency or directly, on either a temporary or permanent, part-time or full-time basis, to do the household work, but not including any member of the family of an employer.
- Education:[11]
  - illiterate: a person, who can neither read nor write, or can only read but cannot write in any language;
  - primary: a person who has completed sixth standard;
  - secondary: a person who has studied from to fifth to tenth standard;
  - higher secondary and above: a person who has obtained a higher secondary school certificate from an educational board; a graduate (a person who has obtained a degree from any university); a postgraduate (a person who has obtained a postgraduate degree from any university); and a professional degree/diploma award (a person who has obtained any professional degree/diploma from any university).

Statistical analysis

The prevalence of diabetes among each of the high-risk groups, according to risk factors, was presented as a percentage. The chi squared test was used to establish whether there was an association between the risk of diabetes and each of the potential risk factors. Similarly, the odds of diabetes among the high-risk and moderate-risk groups were assessed for each risk factor, using univariate logistic regression. An adjusted analysis was performed using multivariate logistic regression. All statistical significance was assessed at the 5% significance level. All statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 19.

RESULTS

Out of 425 participants, 42 (9.88%) were diagnosed as having diabetes. The baseline characteristics of the remaining participants are shown in Table 1. Of these 383 participants, 140 (36.6%) had a high risk score (IDRS ≥60), the majority of participants (209; 54.6%) were in the moderate-risk category (IDRS 30–50) and 34 (8.9%) participants were found to be at low risk for diabetes (IDRS <30) (see Table 1). More women than men were at high risk (99; 40.4%). The majority (48; 56.5%) of illiterate participants were at high risk; 76 (60.8%) participants with higher secondary and above education were at moderate risk; and 14 (11.8 %) with secondary education were at low risk for diabetes. The association between low education status with high risk status was highly significant statistically ($P = 0.001$). Of the 140 high-risk participants, the largest group, i.e. 62, were in socioeconomic class 3, followed by 40 in classes 4 and 5. In addition to this, 89 (57.1%) participants in socioeconomic class 3 were at moderate risk and 17 (17.6%) participants in socioeconomic classes 4 and 5 were at low risk. The association between socioeconomic class and risk status was highly significant statistically ($P = 0.001$).

With respect to age, 94 (67.6%) participants aged ≥50 years were at high risk; 135 (73.0%) in the age group 35–49 years were at moderate risk and 30 (50.8%) in the age group 20–34 years were at low risk. The link between risk status and age group was highly significant statistically ($P < 0.001$). Only 24 (57.1%) high-risk participants, 16 (38%) moderate-risk participants and 2 (4.7%) low-risk participants had a family history of diabetes. The majority of participants were involved in sedentary to mild physical activity. In both sexes, a total of 197 (51.4%)

Table 1. Baseline characteristics of the participants included in the study

Characteristics	Total (%), *n* = 383	High risk (IDRS ≥60), *n* = 140 (36.6%)	Moderate risk (IDRS 30 to <60), *n* = 209 (54.6%)	Low risk (IDRS <30, *n* = 34 (8.9%)	Chi-squared *P* value
Sex					
Male	138 (36.1)	41 (29.7)	87 (63.1)	10 (7.2)	0.044[a]
Female	245 (63.9)	99 (40.4)	122 (49.8)	24 (9.8)	
Education					
Illiterate	85 (22.2)	48 (56.5)	35 (41.2)	2 (2.3)	
Primary	54 (14.1)	20 (37.0)	30 (55.6)	4 (7.4)	0.001[a]
Secondary	119 (31.1)	37 (31.1)	68.(57.1)	14 (11.8)	
Higher secondary and above	125 (32.6)	35 (28.0)	76 (60.8)	14 (11.2)	
Socioeconomic class					
Class 1	31 (8.1)	10 (32.3)	19 (61.3)	2 (6.4)	
Class 2	99 (25.8)	28 (28.3)	61 (61.6)	10 (10.1)	0.001[a]
Class 3	156 (40.7)	62 (39.7)	89 (57.1)	5 (3.2)	
Class 4 and 5	97 (25.3)	40 (41.2)	40 (41.2)	17 (17.5)	
Occupation					
Business	38 (9.9)	17 (44.7)	19 (50.0)	2 (5.3)	
Household worker	39 (10.2)	7 (17.9)	29 (74.4)	3 (7.7)	
Housewife	156 (40.7)	71 (45.5)	70 (44.9)	15 (9.6)	
Labourer	23 (6.0)	3 (13.0)	17 (73.9)	3 (13.0)	NA
Service	41 (10.7)	10 (24.4)	27 (65.9)	4 (9.8)	
Retired	19 (5.0)	12 (63.2)	7 (36.8)	0 (0)	
Others	67 (17.5)	20 (29.9)	40 (59.7)	7 (10.4)	
Age, years					
20–34	59 (15.4)	0 (0)	29 (49.2)	30 (50.8)	
35–49	185 (48.3)	46 (24.9)	135 (73.0)	4 (2.2)	<0.001[b]
≥50	139 (36.3)	94 (67.6)	45 (32.4)	0 (0)	
Family history of diabetes					
Yes	42 (11.0)	24 (57.1)	16 (38.1)	2 (4.8)	0.012[a]
No	341 (89.0)	116 (34.0)	193 (56.6)	32 (9.4)	
Physical activity					
Sedentary to mild	255 (66.6)	121 (47.5)	115 (45.1)	19 (7.5)	<0.001[b]
Moderate to vigorous	128 (33.4)	19 (14.8)	94 (73.4)	15 (11.7)	
Waist circumference, cm					
Men<90, women <80	186 (48.6)	30 (16.1)	126 (67.7)	30 (16.1)	<0.001[b]
Men ≥90, women ≥80	197 (51.4)	110 (55.8)	83 (42.1)	4 (2.0)	

IDRS: Madras Diabetes Research Foundation Indian Diabetes Risk Score; NA: not available.

[a]Significant at the $P < 0.05$ level.

[b]Highly significant at the $P < 0.001$ level.

had high waist circumference and more than half (110; 55.8%) were at high risk. Of those with low waist circumference, 126 (67.7%), were at moderate risk and 30 (16.1%) at low risk. The association between waist circumference and risk status was highly significant statistically ($P < 0.001$).

Univariate analysis for the high-risk group (see Table 2) showed that primary education (odds ratio [OR]: 9.60; 95% confidence interval [CI]: 2.05–44.90; $P = 0.004$) and socioeconomic class 4 and 5 (OR: 5.27; 95% CI: 1.80–15.41; $P = 0.002$) were significantly associated with risk status. Also, a highly significant association was found between physical activity (moderate to vigorous; OR: 0.20; 95% CI: 0.087–0.45) and high waist circumference, in both sexes (OR: 27.50; 95% CI: 8.98–84.17).

On univariate analysis for the moderate-risk group (see Table 3), socioeconomic class 3 (OR: 2.59; 95% CI: 1.07–6.23; $P = 0.033$) and high waist circumference (OR: 4.94; 95% CI: 1.67–14.54; $P = 0.004$) were found to be significantly associated with risk status. The association between socioeconomic class 4 and 5 (OR: 7.56; 95% CI: 2.60–21.93; $P < 0.001$) and risk status was highly significant.

On multiple logistic regression analysis for the high-risk and moderate-risk groups combined (see Table 4), it was found that higher education (higher secondary and above; OR: 0.21; 95% CI: 0.05–0.96; $P = 0.044$) and physical activity (moderate to vigorous; OR: 0.09; 95% CI: 0.02–0.49; $P = 0.005$) were significantly associated with risk status and there was a highly significant association between high waist circumference and risk status (OR: 47.45; 95% CI: 7.52–299.30; $P < 0.001$).

Table 2. Univariate logistic regression analysis of diabetes and associated risk factors among the high-risk group

Characteristics	Number (%) high risk (IDRS ≥60), *n* = 140 (36.6%)	Number (%) low risk (IDRS <30), *n* = 34 (8.9%)	Odds ratio	95% Confidence interval	*P* value
Sex					
Male	41 (29.3)	10 (29.4)	1	—	—
Female	99 (70.7)	24 (70.6)	1.01	0.44–2.29	0.988[a]
Education					
Illiterate	48 (34.3)	2 (5.9)	1	—	—
Primary	20 (14.3)	4 (11.8)	9.60	2.05–44.90	0.004[b]
Secondary	37 (26.4)	14 (41.2)	2.00	0.57–6.91	0.273[a]
Higher secondary and above	35 (25.0)	14 (41.2)	1.05	0.44–2.53	0.901[a]
Socioeconomic class					
Class 1	10 (7.1)	2 (5.9)	1	—	—
Class 2	28 (20.0)	10 (29.4)	2.12	0.42–10.74	0.362[a]
Class 3	62 (44.3)	5 (14.7)	1.19	0.47–2.98	0.071[a]
Class 4 and 5	40 (28.6)	17 (50.0)	5.27	1.80–15.41	0.002[b]
Family history of diabetes					
No	116 (82.9)	32 (94.1)	1	—	—
Yes	24 (17.1)	2 (5.9)	3.31	0.74–14.75	0.116[a]
Physical activity					
Sedentary to mild	121 (86.4)	19 (55.9)	1	—	—
Moderate to vigorous	19 (13.6)	15 (44.1)	0.20	0.09–0.45	<0.001[c]
Waist circumference, cm					
Men <90, women <80	30 (21.4)	30 (88.2)	1	—	—
Men ≥90, women ≥80	110 (78.6)	4 (11.8)	27.50	8.98–84.17	<0.001[c]

IDRS: Madras Diabetes Research Foundation Indian Diabetes Risk Score.

[a]Not significant.

[b]Significant at the $P < 0.05$ level.

[c]Highly significant at the $P < 0.001$ level.

Table 3. Univariate logistic regression analysis of diabetes and associated risk factors among the moderate-risk group

Characteristics	Number (%) moderate risk (IDRS 30 to <60), *n* = 209 (54.6%)	Number (%) low risk (IDRS <30), *n* = 34 (8.9%)	Odds ratio	95% Confidence interval	*P* value
Sex					
Male	87 (41.6)	10 (29.4)	1	—	—
Female	122 (58.4)	24 (70.6)	0.58	0.26–1.28	0.181[a]
Education					
Illiterate	35 (16.7)	2 (5.9)	1	—	—
Primary	30 (14.4)	4 (11.8)	3.22	0.69–14.95	0.135[a]
Secondary	68 (32.5)	14 (41.2)	1.38	0.42–4.53	0.594[a]
Higher secondary and above	76 (36.4)	14 (41.2)	0.89	0.39–2.01	0.788[a]
Socioeconomic class					
Class 1	19 (9.1)	2 (5.9)	1	—	—
Class 2	61 (29.2)	10 (29.4)	4.03	0.84–19.28	0.080[a]
Class 3	89 (42.6)	5 (14.7)	2.59	1.07–6.23	0.033[b]
Class 4 and 5	40 (19.1)	17 (50.0)	7.56	2.60–21.93	<0.001[c]
Family history of diabetes					
No	193 (92.3)	32 (94.1)	1	—	—
Yes	16 (7.7)	2 (5.9)	1.32	0.29–6.04	0.715[a]
Physical activity					
Sedentary to mild	115 (55.0)	19 (55.9)	1	—	—
Moderate to vigorous	94 (45.0)	15 (44.1)	1.03	0.49–2.14	0.926[a]
Waist circumference, cm					
Men <90, women <80	126 (60.3)	30 (88.2)	1	—	—
Men ≥90, women ≥80	83 (39.7)	4 (11.8)	4.94	1.67–14.54	0.004[b]

IDRS: Madras Diabetes Research Foundation Indian Diabetes Risk Score.

[a]Not significant.

[b]Significant at the $P < 0.05$ level.

[c]Highly significant at the $P < 0.001$ level.

Biochemical analysis showed that out of the total of 140 high-risk participants, 61 (43.6%) had a random capillary blood glucose level of 110–140 mg/dL, while 7 (5.0%) had a level of ≥140 mg/dL.

DISCUSSION

This study used the IDRS to identify individuals at risk for diabetes and determine the association of various risk factors with their risk status.

The proportion of individuals at high risk for diabetes was 36.55%. Similar findings were published by Gupta et al., who reported that 31.2% of the population in urban Pondicherry had a high risk score.[16] However, a study conducted by Mohan et al., in the metropolitan city of Chennai, found 43% of the population was in the high-risk category.[10] The difference in risk prevalence between the current study and the one in Chennai may be due to variance in lifestyles of the populations. The present study noted 54.6% of participants with moderate risk and 8.9% of participants with low risk, while Gupta et al. found 50.3% of participants at moderate risk and 18.5% at low risk for diabetes.[16] Pune is an evolving metropolitan city, owing to changes in physical activity and eating habits of the people, and the current study shows very few participants in the low-risk category compared to the high-risk category.

Similar to the present study, Arora et al. noted that more high-risk cases were women than men in urban Haryana, and there was a statistically significant association.[17] However, a study done by Misra et al. in an urban slum of Delhi showed no statistically significant association by sex.[3] Arora et al. also found a higher prevalence of risk in the lower middle class, though their results were not significant,[17] while in the present study there was a significant association between the lower socioeconomic classes and risk status. This suggests that diabetes is no longer a disease of the affluent, or a "rich

Table 4. Multivariate logistic regression analysis for the high- and moderate-risk groups against the low-risk group and associated risk factors

Characteristics	Odds ratio	95% Confidence interval	*P* value
Sex			
Male	1	—	—
Female	0.38	0.09–1.61	0.193[a]
Education			
Illiterate	1	—	—
Primary	0.60	0.019–19.71	0.777[a]
Secondary	0.65	0.09–4.96	0.684[a]
Higher secondary and above	0.21	0.05–0.96	0.044[b]
Socioeconomic class			
Class 1	1	—	—
Class 2	2.45	0.21–28.86	0.475[a]
Class 3	0.95	0.20–4.47	0.953[a]
Class 4 and 5	2.05	0.41–10.32	0.380[a]
Family history of diabetes			
No	1	—	—
Yes	12.42	0.93–165.80	0.057[a]
Physical activity			
Sedentary to mild	1	—	—
Moderate to vigorous	0.09	0.02–0.49	0.005[b]
Waist circumference, cm			
Men <90, women <80	1	—	—
Men ≥90, women ≥80	47.45	7.52–299.30	<0.001[c]

[a]Not significant.

[b]Significant at the $P < 0.05$ level.

[c]Highly significant at the $P < 0.001$ level.

man's disease". It is becoming a problem even among the middle-income and poorer sections of society. This may be due to changes in the lifestyle and standard of living of people from urban slum areas, as a result of urbanization. However, Mohan et al. in 2003 found a significant association between diabetes and higher socioeconomic class.[18] The present study noted that a high proportion of housewives were at high risk for developing diabetes. Arora et al. observed similar findings, with the highest prevalence in housewives among occupational groups in their study carried out in urban Haryana.[17] The probable reason for this is that housewives are not doing any other physical activity apart from their household work and are not involved in any other day-to-day exercise. However Rao et al. found that people engaged in service jobs were associated with a high risk for diabetes.[7]

The current study noted that, as age increases, the risk for diabetes also increases. Several other studies have noted similar findings.[18–20] Two further studies found a positive association between higher age and undiagnosed diabetes.[21, 22]

A high incidence of diabetes is seen among first-degree relatives where one has diabetes, and the risk of a child with a parental history of diabetes developing diabetes themself is more than 50%.[23] Two other studies have shown that increased risk for diabetes was associated with a family history of diabetes.[13,20] Thus, family history of diabetes is one of the major contributors for diabetes. Arora et al. noted that the majority of individuals with prediabetes had a family history.[17] Hadaeghet al., and Wang et al., in their studies done in an Iranian urban population and in Guangzhou urban community respectively, found an association between undiagnosed cases of diabetes and a family history of diabetes, as in the current study.[21,22]

Physical activity is one of the important modifiable risk factors for diabetes. Globally, physical inactivity accounts for 14% of diabetes,[24] and it also acts as a major risk factor for obesity, which again has a significant relationship with diabetes. Over the past few decades, a huge proportion of the working population has shifted from manual labour associated with the agriculture sector to less physically demanding office jobs.

India is undergoing rapid urbanization, which is associated with increasing obesity and decreasing physical activity, owing to changes in lifestyle and diet and a change from manual work to less physical occupations.[10,19,23] Gupta et al. reported similar findings to those of the present study, that individuals with a sedentary lifestyle or who undertook only mild physical activity, had a higher risk for diabetes;[16] also, the Chennai Urban Population Study (CUPS-14) conducted by Mohan et al. found a significant association between light physical activity and undiagnosed diabetes.[18]

Despite having a lower prevalence of obesity as defined by body mass index, Asian-Indians tend to have a higher waist circumference and waist-to-hip ratio compared to white Caucasians, thus having a greater degree of central obesity. Waist circumference is a more powerful determinant of a subsequent risk of diabetes mellitus.[10] Several other studies have noted a significant association between waist circumference and undiagnosed diabetes, which is similar to the findings of the present study.[8,21,23,25,26]

The scientific tests most frequently used to screen for diabetes are fasting plasma glucose and a 2-h oral glucose tolerance test. However, while these tests are useful for epidemiological studies, they are difficult, and relatively expensive, to do on a mass scale in a community setting. The most convenient way to screen a large number of people is to measure the random capillary blood glucose. This has the advantage that it can be undertaken at any time of the day, does not require a venipuncture and can even be performed by non-medically trained people. The present study observed that 43.6% of participants had a random capillary blood glucose level between 110 and 140 mg/dL, while a further 5.0% had a level above 140 mg/dL. Definitive testing by oral glucose tolerance test is recommended for these individuals, to detect their diabetes status. Mohan et al. observed in their study that 60% of those with high IDRS had a random capillary blood glucose level of ≥110 mg/dL.[14]

Conclusion

The IDRS was a simple tool used in a community-based study to detect individuals at high risk for diabetes. Non-modifiable risk factors like increasing age and family history of diabetes, and modifiable risk factors like lack of physical activity and central obesity were the most common factors found in participants who were at high risk for diabetes.

Use of a cost-effective tool like the IDRS for routine screening of people aged over 35 years is advisable for identification of participants at high risk for development of diabetes.

Definitive testing by oral glucose tolerance test is recommended to detect the status of diabetes in participants with a random capillary blood glucose above 110 mg/dL.

Development of suitable primary and secondary preventive approaches, including lifestyle and dietary modifications, is recommended for these high-risk participants.

REFERENCES

1. Reddy KS. Prevention and control of non-communicable diseases: status and strategies. New Delhi: Indian Council for Research on International Economic Relations; 2003 (Working Paper 104; https://www.syndromic.org/storage/documents/NCDs/NCDStatusIndia2003_SrinathReddy.pdf, accessed 22 February 2016).
2. Anand K, Shah B, Yadav K. Are the urban poor vulnerable to non-communicable diseases? A survey of risk factors for non-communicable in urban slums of Faridabad. Natl Med J India. 2007;20(3):115–20.
3. Misra A, Pandey RM, Rama DJ. High prevalence of diabetes, obesity and dyslipidemia in urban slum population in northern India. Int J Obes Relat Metab Disord. 2001;25(11):1722–9.
4. Mohan V, Deepa M, Deepa R, Shantirani CS, Farooq S, Ganesa A et al. Secular trends in prevalence of diabetes and glucose tolerance in urban south India – the Chennai urban rural epidemiology study (CURES 17). Diabetologia. 2006;49(6):1175–8.
5. Nandeshwar S, Jamra V, Pal DK. Indian Diabetes Risk Score for screening of undiagnosed diabetic subjects of Bhopal City. National Journal of Community Medicine. 2010;1(2):176–7.
6. Jadhav A. CHF India. Pune slum atlas released. Silver Spring, MD: Global Communities, Partners for Good; 2011 (www.globalcommunities.org/node/34889, accessed 22 February 2016).
7. Rao CR, Kamath VG, Shetty A, Kamat A.A study on the prevalence of type 2 diabetes in coastal Karnataka. Int J Diabetes Dev Ctries. 2010;30(2):80–5. doi:10.4103/0973-3930.62597.
8. Ramachandran A, Mary S, Yamuna A. High prevalence of diabetes and cardiovascular risk factors associated with urbanization in India. Diabetes Care. 2008;31:893–8.
9. Shah B. Development of sentinel health monitoring centers for surveillance of risk factors of non-communicable diseases in India (April 2003 to March 2005). Collated results of six centers. New Delhi: Division of Non-communicable Diseases, Indian Council of Medical Research; 2005 (http://www.who.int/chp/steps/IndiaSTEPSReport_6Centers.pdf, accessed 22 February 2016).
10. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res. 2007;125(3):217–30.
11. Mohan V, Deepa R, Deepa M, Somannavar S, Dutta M. A simplified Indian diabetes risk score for screening for undiagnosed diabetic subjects (CURES-24). J Assoc Physicians India. 2005;53:759–63.
12. Concepts and definitions used in NSS. Golden Jubilee publication. New Delhi: National Sample Survey, Organization Ministry of Statistics & Programme Implementation, Government of India; 2001 (http://mospi.nic.in/Mospi_New/upload/nsso/concepts_golden.pdf, accessed 22 February 2016).
13. Ahmad J, Masoodi MA, Ashraf M, Rashid R, Ahmad R, Ahmed A et al. Prevalence of diabetes mellitus and its risk factors in age group of 20 years and above in Kashmir, India. Al Ameen J Med Sci. 2011;4(1):38–44.
14. Shah SK, Msaikaka NN, Burman C, Snehlata AC, Ramachandran A. High prevalence of type 2 diabetes in urban population in northeastern India. Int J Diab Dev Ctries. 1999;19:144–6.
15. Mohan V, Pradeepa R, Deepa M, Anjana RM, Unnikrishnan I, Dutta M. How to detect the millions of people in India with undiagnosed diabetes cost effectively. Medicine Update. 2010;20:93–6.
16. Gupta SK, Singh Z , Purty AJ,Mohan V. Diabetes prevalence and its risk factors in urban Pondicherry. Int J Diabetes Dev Ctries. 2009;29(4):166–9. doi:10.4103/0973-3930.57348.
17. Arora V, Singh MJ, Khanna P, Goyal N, Kumar N, Singh M. Prevalence of diabetes in urban Haryana. Australas Med J. 2010;3(8):488–94.
18. Mohan V, Shanthirani CS, Deepa R. Glucose intolerance (diabetes and IGT) in a selected South Indian population with special reference to family history, obesity and lifestyle factors – the Chennai Urban Population Study (CUPS 14). J Assoc Physicians India. 2003;51:771–7.
19. Singh RB, Bajaj S, Niaz MA, Rastogi SS, Moshiri M. Prevalence of type 2 diabetes mellitus and risk of hypertension and coronary artery disease in rural and urban population with low rates of obesity. Int J Cardiol. 1998;66(1):65–72.

20. Menon VU, Kumar KV, Gilchrist A, Sugathan TN, Sundaram KR, Nair V et al. Prevalence of known and undetected diabetes and associated risk factors in central Kerala – ADEPS. Diabetes Res Clin Pract. 2006;74(3):289–94.

21. Hadaegh F, Bozorgmanesh MR, Ghasemi A, Harati H, Saadat N, Azizi F. High prevalence of undiagnosed diabetes and abnormal glucose tolerance in the Iranian urban population: Tehran lipid and glucose study. BMC Public Health. 2008;8:176. doi:10.1186/1471-2458-8-17.

22. Wang H, Qiu Q, Tan LL, Liu T, Deng XQ, Chen YM et al. Prevalence and determinants of diabetes and impaired fasting glucose among urban community – dwelling adults in Guangzhou, China. Diabetes Metab. 2009;35(5):378–84. doi:10.1016/j.diabet.2009.03.006.

23. Gupta R. Diabetes in India: current status. Express Health Care. 2008 (http://archivehealthcare.financialexpress.com/200808/diabetes02.shtml, accessed 9 March 2016).

24. Mohan V, Radhika G, Vijayalakshmi P, Sudha V. Can the diabetes/cardiovascular disease epidemic in India be explained, at least in part, by excess refined grain (rice) intake? Indian J Med Res. 2010;131:369–72.

25. Bener A, Zirie M, Janahi IM, Al-Hamaq AO, Musallam M, Wareham M. Prevalence of diagnosed and undiagnosed diabetes mellitus and its risk factors in a population-based study of Qatar. Diabetes Res Clin Pract. 2009;84(1):99–106. doi:10.1016/j.diabres.2009.02.003.

26. Satman I, Yilmaz T, Sengül A, Salman S, Salman F, Uygur S et al. Population-based study of diabetes and risk characteristics in Turkey: results of the Turkish Diabetes Epidemiology Study. Diabetes Care. 2002;25:1551–6.

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