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Assessment of T2DM Onset Risk: A Study in Bengalee Young Adult Females

***Abstract*: India has the second largest number of people living with diabetes and almost one in every two people with diabetes are unaware about their status of being diabetics. Early screening of people at risk is fundamental to prevent or reduce the disease onset and consequences thereof to improve the quality of life. In this context, an attempt has been made to find out the scenario of risk of developing type 2 diabetes mellitus (T2DM) using Indian Diabetes Risk Score (IDRS) in young Bengalee adult females and to assess the association between IDRS and other predictors of diabetes risk such as body mass index (BMI), waist hip ratio (WHR), waist to height ratio (WHtR), neck circumference (NC) and socioeconomic status (SES). The present study was carried out on 51 young Bengalee adult consenting females in the age group of 18-24y residing in greater Kolkata. Anthropometric parameters including body height (cm), body weight (kg), waist circumference (cm) and hip circumference (cm) were measured and BMI ($kg.m^{-2}$), WHR and WHtR were computed. SES was assessed by collecting required information. Information about two modifiable risk factors – waist circumference and status of physical activity and two non-modifiable risk factors - family history with regard to diabetes and age was recorded to identify the risk scenario of developing T2DM. The mean age of the participants was 20.4y. Mean values of BMI ($kg.m^{-2}$), WC (cm), WHR, WHtR and IDRS of the participants were 26.99, 88.6, 0.86, 0.58 and 43.4 respectively. It could be noted from the present study that majority of the participants had moderate-high-risk of T2DM, and IDRS was significantly ($P<0.05$) correlated with other factors of T2DM.**

Keywords: Diabetes screening, modifiable risk factors, nonmodifiable risk factors, diabetes risk score, quality of life

The occurrence of T2DM is increasing at an alarming rate across the globe and India is not an exception. India has over 74 million people living with diabetes which bring India in second position in terms of number of people with diabetes, only after China and is further projected to rise to 124.9 million in 2045. Approximately 71% of all deaths in the world are caused by non-communicable diseases among which diabetes ranked fourth. It has been estimated that 12.2% of global deaths are attributed to diabetes and India has the 3rd highest number of deaths from diabetes which is 0.6 million deaths annually [1]. Diabetes is no longer considered as the disease of elderly as it has been found that the disease is also prevalent among the persons in 30's age bracket[2]. This age group mostly represents adolescents and young adults which are the most productive periods of life. Obesity is the most important modifiable risk factor[3-4] for diabetes however, obesity alone could not increase the risk of the disease and other factors like unhealthy food habit[5-7] hereditary predisposition, socioeconomic status, increased screen time, parental conflict, stress, improper sleep, poor access to health care facility which together contribute to increase the disease risk among young adults[8]. Lack of physical activity[9-13] among young population also plays a role in occurrence of the disease, and it has been found that adolescents who practised regular structured recreational physical exercise had the lowest cardiometabolic risk than those who did not practise any form of physical exercise and lead sedentary life[14-20] Unfortunately, one in two people that is around 53% of people living with diabetes in India were found to be unaware about their health status which further increases the disease burden[1]. 87.5% of all cases of undiagnosed diabetes in the world was found to be from low and middle-income countries. Insufficient access to health care facility, high cost of laboratory tests and lack of knowledge altogether are the possible reason of people to remain undiagnosed. It is essential to early diagnose the people who are at risk of developing T2DM to slowdown or prevent the onset of the disease, improve quality of life and to reduce the incidence of premature death. Therefore, cost-effective screening approaches[21-22] are of urgent need to identify the people at risk to reduce the disease prevalence. There is dearth of information regarding the risk scenario of T2DM among young Bengalee adults in West Bengal. In this backdrop, an attempt has been made to find out the scenario of risk of developing T2DM among young Bengalee adult females by using Indian Diabetes Risk Score (IDRS) and to assess

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the relationship between IDRS and other risk predictors of T2DM.

Methodology: Selection of Volunteers: The study was carried out among young Bengalee adult females attending higher education institutions (HEIs) located in and around Kolkata. At first the study requirements were explained to the individuals showing initial interest. 51 consenting females in the age group of 18-24 years constituted the study participants' set. Inclusion Criteria: The consenting female adults in the age group of 18-24y with no prior self-reported history of any chronic diseases and diabetes were included in the study. Exclusion Criteria: Those receiving any medication or reported to have any disease were excluded. Collection of Background Information: Information about age (y), ethnicity, level of physical activity, educational status, general health, family history with regard to diabetes of the study participants was recorded in a pre-designed schedule. Identification of Socioeconomic Status (SES): Information regarding educational status and occupation of head of the family and total family income of the participants was collected to get an idea about SES[23]. Assessment of Anthropometric Parameters: Anthropometric parameters including body height (BH), body weight (BW), neck circumference (NC), waist circumference (WC) and hip circumference (HC) were measured. BH (cm) was measured using anthropometric measurement set to the nearest 0.1 cm. BW (kg) was measured using a weighing scale to the nearest 0.1 kg, with subjects in socially acceptable minimal clothing. NC (cm), WC (cm) and HC (cm) were measured using non-stretchable measuring tape to the nearest 0.1 cm. NC was measured in the midway of the neck, between mid-cervical spine and mid anterior neck, to within 0.1 cm. WC was measured midway between the lowest ribs and the iliac crest at the end of expiration. HC was measured at the largest circumference around the buttocks[24-25]. Body mass index (BMI) in $kg.m^{-2}$, waist hip ratio (WHR) and waist to height ratio (WHtR) were computed. Identification of Diabetes Risk: Information, about two modifiable risk factors – waist circumference (cm) and status of physical activity and two non-modifiable risk factors - family history with regard to diabetes and age(y), was recorded to identify the risk scenario of developing T2DM[26]. Obtained scores in all the four components was summed up to get the total value of IDRS and based on this value the study participants were categorised as high, moderate and low - risk groups. Statistical Analysis: The obtained data were tabulated for statistical analysis and P value lower than 0.05 was considered significant.

Results: The background information of the study participants has been presented in table 1.

Table 1: Background information of the study participants

Variables	Values
Number of study participants	51
Age (y)#	20.4 ± 1.84

AM ± SD

The mean age of the participants was 20.4 years. They belonged to upper-middle socio-economic group, on the basis of the average of the computed score; out of 51 subjects, 23(46%), 15(29%), 7(13%), 6(12%) respectively belonged to upper middle (score range: 16-25), upper lower (score range: 5-10), lower middle(score range: 11-15), upper(score range: 26-29) classes.

The study participants have been distributed among different component of IDRS and presented in table 2

Table 2: Distribution of study participants as per the components of IDRS

Particulars	Values (%)
Age (y)	
<35	100
35-49	0
≥ 50	0
Abdominal obesity	
WC < 80cm	30
WC 80-89cm	21
WC ≥ 90cm	49
Physical activity	
Daily exercise + strenuous work	0
Daily exercise or strenuous work	26
No exercise and sedentary work	74
Family history with regard to diabetes	
No parent with diabetes	66
Single parent with diabetes	23
Both parents with diabetes	11

From table 2 it can be noted that almost half of the total participants had 2^0 abdominal obesity and more than 70% of the participants were physically inactive. 34% of the total participants in the present study was reported to have family history with regard to diabetes. Based on the

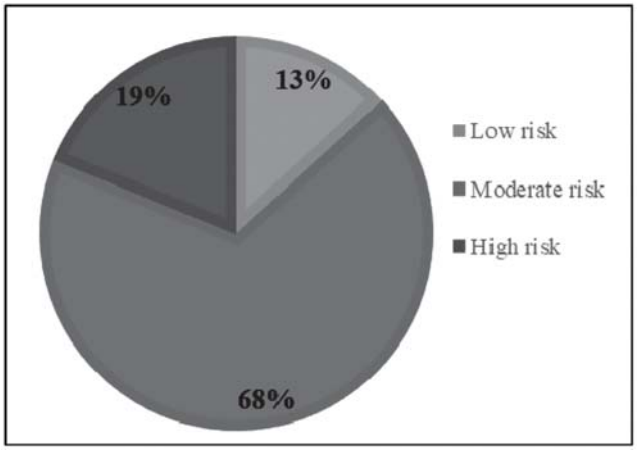


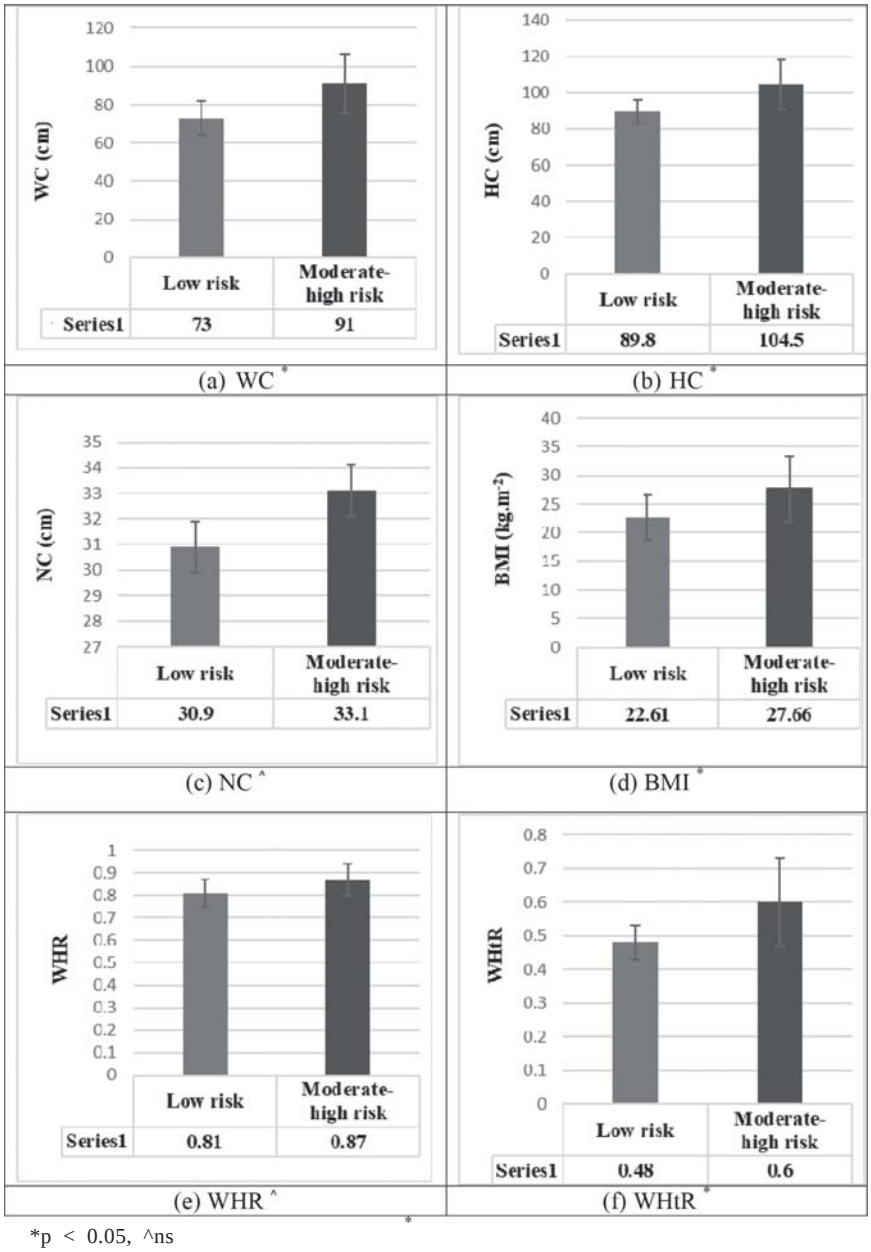
Fig. 1: Distribution of participants among three risk groups.

obtained score from the IDRS components, the participants were categorised under three risk groups and presented graphically in figure 1. The mean IDRS value of the participants in the present study was 43.4. Figure 1 depicted that majority of the participants, that is 68% of the total participants, was in moderate risk group; this was followed by 19% and 13% in high risk and low risk groups respectively.

The mean value of different surrogate indicators of T2DM has been compared between the risk groups and presented in figure 2. From figure 2, it can be noted that individuals in low-risk group had normal body weight whereas those in moderate-high-risk group were falling under the category of overweight or obesity. Similarly, mean values of WC, NC and WHtR were also lower in low-risk group compared to moderate-high-risk counterparts.

Values of correlation coefficient between markers of T2DM and IDRS of the participants have been presented in table 3. The data presented in table 3 indicated that except for socioeconomic status, all other variables were having positively significant ($P<0.05$) positive correlation with IDRS.

Discussion: The present study was conducted in 51 young Bengalee adult females with mean age of 20.4 y. Mean value of BMI of the study participants was found to be around 27 $kg.m^{-2}$, which indicated that the participants were falling under the obese category. The mean value of WC (88.6cm) of the participants crossed the cut-off value as applicable for being referred to as normal, and 70% of the total participants reported to have central obesity in terms of WC; the findings of the present study are in agreement with a few earlier studies conducted in Bengalee young adult female population[27-29]. Other than BMI and WC, the mean value of all the other parameters which are used as indicators of



*p < 0.05, ^ns

Fig. 2: Comparison between the risk groups in terms of surrogate indicators of T2DM

Table 3: Relationship between markers of T2DM and IDRS

Variables	Values
Level of Physical Activity	0.63**
Family history of diabetes	0.69**
Socioeconomic status	0.27^
Neck circumference	0.41**
Waist circumference	0.50**
Waist to height ratio	0.31*
Body mass index	0.43**

**P< 0.01, *P<0.05, ^ns

T2DM, crossed the cut-off value to be regarded as normal. The result is not surprising as all the participants were students by profession where there is not much of physical labour requirement and most of them also did not carry out any form of physical exercise. Studies have reported that carrying out strenuous occupational activity or regular practicing of any form of leisure time physical activity help to prevent obesity and associated disorders[30-36]. The status of central obesity in the participants of the present study was higher compared to an earlier study which reported that 46% of the study participants had increased waist circumference[37]. The familial predisposition towards T2DM, a strong independent risk factor for T2DM[38], was recorded among 34% of the participating subjects in the present study which was in line with findings of another study[37]. Physical inactivity has been found to increase the chance of metabolic disorder including T2DM irrespective of any other risk factors and more than 70% of the participating volunteers in the present study were physically inactive.

The calculated mean IDRS value of the participants in the present study was 43 which is indicating that on an average the participants were under moderate risk category. The mean IDRS value in the present study was higher than that obtained in a study conducted among medical college students in Telangana[39]. In the present study, 19%, 68% and 13% of total participants were in high, moderate and low risk category respectively. Studies had revealed that significant association existed between presence of diabetes and IDRS value of ≥ 60[40] and it has also been shown that IDRS value of ≥ 60 has the optimum specificity and sensitivity to identify undiagnosed diabetes cases[41-42]. In the present study, less number of people were having the high risk of diabetes compared to another study[43]. This may be due to the fact that the risk of diabetes increased with age[44]. However, the value for the high-risk category in the present study was found to be much higher compared with other studies carried out among similar age group[45-47]. Almost similar findings of moderate risk have been reported in a study carried out among young medical students in Chennai[47].

The findings of the present study indicated that values of BMI, WC, and WHtR were increasing with increased IDRS value and significant differences existed between low-risk and moderate-high-risk groups. In agreement with the present study, another study has also reported significant association between BMI and increased diabetes risk [48]. BMI was significantly positively correlated with diabetes risk in the present study participants. No significant correlation has been found between socioeconomic status and IDRS. Similar to other study, all the components of IDRS were significantly ($P < 0.05$) positively correlated with increased risk of diabetes in the present study.

Indian diabetes risk score, IDRS, is a cost-effective tool for identification of undiagnosed diabetes cases and/ or people who are at greater risk of developing diabetes**.** This type of scoring system is of importance to be used as screening tool of diabetes especially for country like India where the occurrence of diabetes is on rise and over half of the population remain undiagnosed. IDRS has been made up of four risk factors, which are recommended by American Diabetes Association; among which age is one of the important components where maximum score of 30 is assigned. And as the present study was conducted on young adults (<35y), none of the participant got any weightage in respect of age. Other than it, 66% of the participants reported to have no family history with regard to diabetes. Both of these are indicating that the modifiable risk factors are putting most of the participants into moderate-high risk group which is quite serious and need consideration. The findings of the present study emphasized on the fact that modification of lifestyle factors in terms of physical activity and dietary habit should be cultivated by the individual at risk at the earliest to slowdown or prevent the onset of the disease.

Conclusion

From the present study it may be noted that more than 85% of the total study participants were at moderate-high risk of diabetes which is alarming. Additionally, expectedly the study also found that the commonly used markers of T2DM had a positive correlation with IDRS of the participants.

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