e- ISSN 0976-0342
Print ISSN 2229-7456

International Journal of Pharmacy & Therapeutics

Journal homepage: www.ijptjournal.com

Research article

A CROSS SECTIONAL STUDY ON ASSESSMENT OF RISK OF DIABETES MELLITUS USING INDIAN DIABETIC RISK SCORE (IDRS) IN COMMUNITY SETTING

Kammili Siva Durga*[1], Anumolu Monica[1], Gade Jhansi[1], Siva Reddy Challa*[2], N. Krishna Kumari[2], K.S. Karuna Murthy[3]

[1]Pharm-d student, Department of Pharmacy Practice, KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada, Andhra Pradesh, INDIA.
[2]Department of Pharmacology, KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada, Andhra Pradesh, INDIA.

ABSTRACT

Introduction: Community screening method such as IDRS increases the public awareness and highlights the seriousness of the disease and could help in identifying asymptomatic individuals, who can ultimately be brought into management and can modify the course and complication of diabetes. In fact, their diagnosis is often delayed until the development of complications or disease is diagnosed incidentally by a health professional. Therefore, early diagnosis of diabetes mellitus could favor the implementation of preventive measures aimed at preventing complications associated with diabetes mellitus. **Aims & objectives:** The present study aimed to identify individuals at risk for diabetes, in a community setting, using the IDRS. **Study methodology:** A cross sectional study was under taken to evaluate the performance of Indian diabetic risk score among adult population in community setting located in Vijayawada, Andhra Pradesh (India). 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 to gain their confidence. **Results:** Out of 381 participants, the majority of participants (181; 47.5%) were in the high-risk category (IDRS>60), 164(43%) were at moderate risk score (IDRS 30-50), and 36(9.44%) participants were found to be at low risk for diabetes (IDRS <30). Of all the participants, 182 (47.7%) participants were male and 199 (49.3%) were female. In high risk category, male 96(52.7) participants were more compared to females 85 (42.7%) while under moderate risk catergory, female participants 90(45.2) were more than males 74(40.6). Similarly, female 24(12.06) participants were more than males 12 (6.5) in low risk category. **Conclusion:** The Indian diabetes risk score is highly sensitive test for early diagnosis of pre-diabetes, and if screening is done in the pre-diabetic stage then we can prevent it into conversion in diabetes mellitus and late diabetic complications in Indian community. 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. So we conclude that the risk of diabetes can be reduced by the change in modifiable factors in high risk population and also reduced by decreasing the waist to hip ratio.

Key Words:- IDRS scoring, Diabetes mellitus, Healthy Life Style Modifications For Diabetes.

Access this article online

Home page: http://ijptjournal.com/

DOI: http://dx.doi.org/10.21276/ijpt.2020.10.1.7

Quick Response code

Received:05.02.2020 **Revised**:12.02.2020 **Accepted**:25.02.2020

Corresponding Author

Siva Reddy Challa, M.Pharm, Ph.D,
Professor & HOD, Department of Pharmacology and Pharmacy Practice, KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada-520010 Andhra Pradesh, INDIA.

E-mail: **sivareddypharma@ gmail.com**

INTRODUCTION

Diabetes mellitus is an important global health issue as the number of people with diabetes is rising every year, particularly of type 2 diabetes (Zimmet PZ). The prevalence of diabetes in rural areas was assumed to be one-quarter that of urban areas for Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka. Unfortunately more than 50% of the diabetic subjects in rural India remain unaware about the disease (Taksande B *et al*., 2011).WHO projects that diabetes will be the 7th leading cause of death in 2030. In another 20 years nearly one-fifth of the world's diabetic population will be in India (Ancy Paul *et al*., 2017).By 2030 this will have risen to 552 million. International Diabetes Federation estimates, around 7 crores people will have diabetes in India by 2025 Worldwide 183 million people (50%) with diabetes are undiagnosed. An estimated 1 million new cases are identified each year in people aged ≥20 years. (Subramani R *et al*, 2014). IDRS score structure is given in table 1. Although great efforts have been made by developed countries to control infectious diseases, non-communicable diseases have not received the same attention (Gupta SK *et al*., 2009)The most disturbing trend is the shift in the age of onset of diabetes to a younger age in the recent years (Ramaiah R *et al*., 2017).

Table 1 : Indian Diabetes Risk Score [IDRS]

Categorized risk factors	Score
Age	
<35 years	0
35-49 years	20
≥50 years	30
Abdominal obesity	
Waist circumference Female <80cm, Male <90cm(Reference)	0
Female 80-89,Male 90-99 cm	10
Female ≥ 90 cm, Male ≥ 100cm	20
Physical activity	
Vigorous exercise or strenuous at work	0
Moderate exercise at work/home	10
Mild exercise at work/home	20
No exercise and sedentary at work/home	
Family history	
Two non-diabetic patients	0
Either parent diabetic	10
Both parents diabetic	20
Maximum score	100

Score ≥60: High risk, 30-50:Medium risk, <30: Low risk

Community screening method such as IDRS increases the public awareness and highlights the seriousness of the disease and could help in identifying asymptomatic individuals, who can ultimately be brought into management and can modify the course and complication of diabetes (Taksande B *et al*., 2011). In fact, their diagnosis is often delayed until the development of complications or the disease is diagnosed incidentally by a health professional. Therefore, early diagnosis of diabetes mellitus could favor the implementation of preventive measures aimed at preventing complications associated with diabetes mellitus. It is well understood that Type2 diabetes mellitus is a preventable disease, so earlier detection of population at risk and subsequent follow-up with interventional strategies can prevent Type 2 diabetes mellitus, improve glycemic control, and decrease its incidence in the population and complication associated with it (Sheikh MohdSaleem *et al*., 2017).

Indian Diabetic Risk Score (IDRS), Finnish Diabetes Risk Score (FDRS), are the two commonly used calculators to assess the risk of diabetes. IDRS was a simple cost-effective tool used in a community-based study to detect individuals at high risk for diabetes.

Aims & objectives:

The present study aimed to identify individuals at risk for diabetes, in a community setting, using the IDRS.

MATERIALS & METHODS:

Study design:

A community-based cross-sectional study was conducted for a period of 6 months during November 2017 and April, 2018 in Vijayawada community.

Inclusion criteria:

(i) Participants with age > 20 years old.
(ii) Participants who were willing to participate.
(iii) Participants without diabetes.

Exclusion criteria:

(i) Participants who were critically ill and pregnant women.
(ii) Participants with altered mental status.

Approval for the study:

Our study protocol was approved by Institutional Ethics Committee of Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation. The protocol number was PG/230/2017.

Experimental design:

A total of 401 patients were assessed for eligibility. A total of 381 patients who met the inclusion criteria were recruited into the study. Experimental design was shown in a flowchart (Figure 1).

Study methodology:

A cross sectional study was under taken to evaluate the performance of Indian diabetic risk score among adult population in community setting located in Vijayawada, Andhra Pradesh(India). 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 to gain their confidence. Data were collected using structured questionnaire consists of two parts. First part includes socio demographic information, in second part idrs score was estimated and in the third part the risk factors were assessed.

The participants were classified as high risk, moderate risk and low risk, based on IDRS as per the following score- upto30 score as low risk, 30-50 score as moderate risk and 60 above as high risk.

The modified risk factors included for this study are:

1. **Age:** This was categorized into 3 groups; age <35 Years was scored as 0, 35- 49 years as 20 and ≥ 50 Years as 30.
2. **Abdominal obesity:**

Males: Individuals with waist Circumference < 90 cm for males was scored as 0, those with 90-99 cm as 10 and the rest with ≥ 100cm as 20.

Females: individuals with waist circumference <80cm as 0, those with 80-89 as 20 and the rest with ≥100 as 20.

3. **Physical activity:** Individuals were coded as 0 if they did vigorous, those with moderate exercise as 10, and those with mild exercise as 20 the rest with no exercise 30.
4. **Family history of diabetes**: Individuals with no family history of diabetes were coded as 0, those with one diabetic parent as 10 and those with both Parent's diabetic as 20.

The information for these risk factors can be obtained Based on four simple questions and one anthropometric Measurement namely waist circumference.

The chi-square test was used to establish whether there was an association between the risk of diabetes and each of the potential risk factors. The obtained data shall be analyzed using the statistical tools like Graph Pad Prism Software version 5.0 and Epi-info. All statistical significance was assessed at the 5% significance level.

RESULTS:

Out of 381 participants, the majority of participants (181; 47.5%) were in the high-risk category (IDRS>60), 164(43%) were at moderate risk score (IDRS 30-50), and 36(9.44%) participants were found to be at low risk for diabetes (IDRS <30). Of all the participants, 182 (47.7%) participants were male and 199 (49.3%) were female. In high risk category, male 96(52.7) participants were more compared to females 85 (42.7%) while under moderate risk catergory, female participants 90(45.2) were more than males 74(40.6). Similarly, female 24(12.06) participants were more than males 12 (6.5) in low risk category.

Out of total study participants, participants with secondary education was found to be highest [117(30.7%)] followed by illiterate [107(28%)]. Population with degree 46(12%) and post graduate (PG) 20(5.24) were found to be less when compared to other categories. Results reveal that the population at various levels of education have fallen majorly in high risk and moderate risk categories of IDRS. However, less number of participants has low risk of IDRS.

Frequency distribution of 35-49 years age group population was found to high 175(45.9%) when compared to the age groups 20-34 108(28.3%) and >50 98(25.7%).35-49 age group population were fallen majorly under high and moderate risk category of IDRS. Low risk category is negligible in this age group.

With respect to the family history population with neither parent diabetic were found to be at high risk. The majority of participants were involved in mild 141(37%) to moderate exercise 136(35.6%) followed by no exercise which accounts for 80(20.9%).

Males with waist circumference 90-99 cm were found to be high in number 104(27.2) as well as at high risk of diabetes when compared to waist circumferences <90cm and >100cm. whereas, females with waist circumference 80-89 cm were found to be in high number 90(23.6%) and also at high risk of diabetes when compared to waist circumferences <80cm and >90cm

Frequency of population with BMI 20-30 were found to be high 294(77.1%) and were found to be at high risk of diabetes when compared to the population with BMI <20 24 (6.2%) and >30 63(16.5%). Population with waist to hip ratio > 0.9 were found to be high in number 180 (47.2%) and were found to at high risk of diabetes when compared to the other ratios <0.8 24(6.2) and 0.8-0.9 105(27.5).

With respect to age, 91(23.88%) participants aged 35-49 years were at high risk, 81(21.25%) in the age group age group 35-49 years were at moderate risk and 33(8.66%) in the age group 20-34 were at low risk (p<0.001). Either- parent diabetic 88(23.0) participants were at high risk category. There is significant (p<0.001) association between family history and risk status. However, despite both the parents are non-diabetic, high number of participants were fallen in the category of high risk.

The majority of participants were involved in moderate to mild to moderate exercise and mild exercise 90(23.6%) participants were at high risk. The association Between physical activity and risk status was highly significant statistically. Waist circumference of males 90-99cm were at high risk 56(14.6%) (p=0.0002). 47(12.3%) waist circumference of females 80-90cm were in high risk (P<0.0001); 20-30 Body mass index participants were at high risk 135(35.43%) (p<0.0001). The persons who takes rice twice a day 110(28.8%) were found to be at high risk (p=0.0044) (Table 2).

Table 2: Frequency distribution of risk of study participants based on IDRS score

Risk	(n)	Percentage
High (IDRS >60)	181	47.5
Medium (IDRS 30-50)	164	43
Low (IDRS <30)	36	9.44

Table 3: Association between variables and IDRS Risk

Characteristics	Total (%) N=381	High risk N (%)	Moderate risk N (%)	Low risk N (%)	Chi-squared p-value
Gender					
Male	182	96(52.7)	74(40.6)	12(6.5)	Reference
Female	199	85(42.7)	90(45.2)	24(12.06)	0.0645^{NS}
Education					
Illiterate	107	47(43.9)	47(43.9)	13(12.1)	Reference
Primary	91	40(43.9)	42(46.1)	9(9.89)	0.8692 ^{NS}
Secondary	117	58(49.5)	49(41.88)	10(8.54)	0.5652 ^{NS}
Graduation	46	26(56.5)	18(39.1)	2(4.3)	0.1978 ^{NS}
Post-Graduation	20	10(50)	8(40)	2(10)	0.8762 ^{NS}
Employment status					
Employed	101	47(46.5)	42(41.5)	12(11.8)	Reference
Unemployed	198	87(43.9)	89(44.9)	22(11.1)	0.8571
Self employed	82	47(60.5)	33(36.6)	2(2.81)	0.0425*
Age					
20-34	108	11(10.18)	64(59.2)	33(30.5)	Reference
35-49	175	91(52)	81(46.2)	3(1.71)	<0.001***
>50	98	79(80.6)	19(19.38)	0	<0.001***
Family history					
Two-non-diabetic parents	190	67(35.2)	93(48.9)	30(15.9)	Reference
Either-parents diabetic	160	88(55)	66(41.25)	6(3.75)	<0.001***
Both-parents diabetic	31	26(83.8)	5(16.2)	0	<0.001***
Physical activity					
Vigorous-exercise at work /home	24	0	18(75)	6(25)	Reference
Moderate-exercise at work /home	136	21(15.44)	87(63.9)	28(20.58)	0.1182
Mild exercise at work/home	141	90(63.8)	49(34.7)	2(1.41)	<0.001***
No exercise at work /home	80	70(87.5)	10(12.5)	0	<0.001***
Waist circumference (male)					
<90cm	53	26(49.05)	18(33.9)	9(16.9)	Reference
90-99cm	104	56(53.8)	45(43.2)	3(2.88)	0.0066**
>100cm	45	34(75.5)	11(24.44)	0	0.0037**

Waist circumference (female)					
<80cm	54	3(5.55)	34(62.9)	17(31.4)	Reference
80-89cm	90	47(52.2)	36(40)	7(7.77)	<0.001***
>90cm	56	36(64.2)	20(35.7)	0(0)	<0.001***
Body Mass Index (BMI)					
<20	24	5(20.8)	11(45.8)	8 (33.3)	Reference
20-30	294	135(45.9)	131(44.5)	28(9.52)	<0.001***
>30	63	41(65.07)	22(34.9)	0	<0.001***
Waist to hip ratio					
<0.8	24	6(25)	12(50)	6(25)	Reference
0.8-0.9	105	8(7.61)	78(74.28)	19(18.09)	0.0227*
>0.9	180	98(54.4)	69(38.3)	13(7.22)	0.0032**

IDRS: Madras Diabetes Research Foundation Indian Diabetes Risk Score; NA: not available.
*Significant at the P < 0.05; **Significant at the P < 0.01 level, ***Significant at the P < 0.001

Male participants with waist circumference 90-99cm were more and most of them fallen under high risk 56(53.8) and moderate risk 45(43.2) categories whereas, waist circumference with <90cm fallen under low risk 9(16.9). Statistically significant association observed between waist circumference of male and IDRS risk at ($p<0.01$).

Female participants with waist circumference 80-89 cm were high and majority of them fallen under high and moderate risk categories whereas waist circumference with <80cm fallen under low risk 17(31.4). Statistical significant association was observed between waist circumference of female and IDRS risk at ($p<0.001$).

Majority of the participants among 294 fallen under body mass index of 20-30. Statistically significant association between body mass index and IDRS risk at ($p<0.001$). At high risk category, waist to hip ratio of >0.9 were more, participants with waist to hip ratio of 0.8-0.9 were high at moderate 78(74.28) and low risk 19(18.09) categories.

DISCUSSION:

There are many screening questionnaires and tools developed by various national and international diabetic associations throughout the world, which vary according to the ethnic group, life style and races. Indian diabetic risk score is one such screening tool which clear and easy to use tool developed by madras diabetic research foundation (MDRF) which takes in account only four risk factors like age, waist circumference, physical activity and family history. Indian diabetic risk score is a unique in a way that it takes measurement of waist circumference as a measure of abdominal obesity because Indian population is a characteristic of type II Diabetes mellitus with lean body mass index and waist to hip ratio. The use of waist circumference in the screening makes it a better screening tool for assessing type II diabetes mellitus. Since the finish group diabetes risk score has included body mass index and waist to hip ratio and waist circumference having family history and physical activity and measurement of waist circumference as a measure of abdominal obesity this plays a very important role in determining the role of developing type II diabetes mellitus.

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 present study shows that 181(47.5%) of the participants in rural area were at high risk of developing type II diabetes mellitus as per the IDRS assessment. The proportion of individuals at high risk for diabetes was 36.55%. Similar findings were published by (Gupta *et al*., 2009) who reported that 31.2% of the population in urban Pondicherry had a high risk score .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 (Mohan *et al*., 2006). 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 (Gupta *et al.*, 2009). 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. 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. Similar to the present study, (Arora *et al.*, 2010) noted that more high-risk cases were women than men in urban Haryana, and there was a statistically significant association (Arora *et al.*, 2010). However, a study done by (Misra *et al*., 2001) in an urban slum of Delhi showed no statistically significant association by sex.

The current study noted that, as age increases, the risk for diabetes also increases. Several other studies have noted similar findings. (Shashank R Joshi *et al*., 2005); (Reshma S Patil *et al*., 2016); (Sumana M*et al*., 2018). Two further studies found a positive association between higher age and undiagnosed diabetes. (Yoseph Cherinet Megerssa *et al*., 2013), 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%. (Anjali D. Turale *et al*., 2017) Two other studies have shown that increased risk for diabetes was associated with a family history of diabetes. (Sheikh Mohd Saleem T al., 2017); (Sumana M*et al*., 2018).Thus, family history of diabetes is one of the major contributors for diabetes (Arora *et al*, 2010) noted that the majority of individuals with prediabetes had a family history (Arora *et al*, 2010).Our study states that either parent diabetic is one of the major contributors for diabetes in male participants. Our results were somewhat deviated from findings observed in (Reshma S Patil *et al*., 2016) with family history of diabetes is one of the major contributors for diabetes. Family history is not associated with the risk of diabetes their life style is the main criteria for the risk of diabetes (Reshma S Patil *et al*., 2016).

Physical activity is one of the important modifiable risk factors for diabetes. Globally, physical inactivity accounts for 14% of diabetes, (Lindstrom J *et al*., 2003) 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. (Gupta SK *et al*., 2009); (Anjali D. Turale *et al*., 2017); (Reshma S Patil *et al*., 2016)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; (Gupta SK *et al*., 2009) also, the Chennai Urban Population Study (CUPS-14) conducted by Mohan *et al*. found a significant association between light physical activity and undiagnosed diabetes. (Misra A *et al*., 2001)

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. (Gupta SK *et al*., 2009) Several other studies have noted a significant association between waist circumference and undiagnosed diabetes, which is similar to the findings of the present study. (Bharati Taksande *et al*.,2012; Yoseph Cherinet Megerssa *et al*., 2013; Anjali D. Turale *et al*.,2017;Glumer C *et al*.,2004; Heikes KE *et al*., 2008. In the present study the prevalence of abdominal obesity was 27.2% and 23.6% among males and females respectively. While a study conducted in Krutarth R et.al. Using the same cut off values for waist circumference reported prevalence of abdominal obesity up to 44 and 84% among males and females. (Krutarth R Brahmbhatt *et al*., 2016)

CONCLUSION:

The Indian diabetes risk score is highly sensitive test for early diagnosis of pre-diabetes, and if screening is done in the pre-diabetic stage then we can prevent it into conversion in diabetes mellitus and late diabetic complications in Indian community. 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. So we conclude that the risk of diabetes can be reduced by the change in modifiable factors in high risk population and also reduced by decreasing the waist to hip ratio. The finding of our study may aid in convincing health care professionals and people at high risk of developing diabetes to take stern action towards healthy lifestyle and achieving the goal of ‘’Health for all’’.

Funding: The work is not supported by any funding agency.

Conflicts of interest: Authors declare that there is no conflict of interest.

ACKNOWLEDGEMENTS

We thank our Principal (Prof. G. Devala Rao) and management of KVSR Siddhartha College of Pharmaceutical Sciences for providing continuous support during this work. We also thank Director General (Dr.C.Nageswara Rao), Hospital Superintendent & HOD, Dept. of General Medicine (Dr.N.V. Krishna Rao) and Principal (Dr.P.Satyanarayana Murthy) of Dr.Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation for granting permission to do Pharm.D Project work and providing the facilities for completion of this work.

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Cite this article:
Kammili Siva Durga, Anumolu Monica, Gade Jhansi, Siva Reddy challa, N. Krishna Kumari, K.S. Karuna Murthy. A Cross Sectional Study On Assessment Of Risk Of Diabetes Mellitus Using Indian Diabetic Risk Score (IDRS) in Community Setting. *International Journal of Pharmacy & Therapeutics*, 11(1), 2020, 31-37. DOI: http://dx.doi.org/10.21276/ijpt.2020.10.1.7