Journal of Pharmaceutical Research International

33(44B): 68-80, 2021; Article no.JPRI.73739
ISSN: 2456-9119
(Past name: British Journal of Pharmaceutical Research, Past ISSN: 2231-2919, NLM ID: 101631759)

A Cross-sectional Study to Assess the Risk of Diabetes Mellitus among Pre-diabetes Obese People of Selected Rural Area of Waghodia Taluka, Vadodara

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Authors' contributions

This work was carried out in collaboration among all authors. Conceptualization and Supervision: author SA. Methodology, Formal analysis and investigation : author SA. Writing - original draft preparation: author SA. Writing - review and editing: author SA, CR and MG. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i44B32652
Editor(s):
(1) Dr. Wenbin Zeng, Central South University, China.
Reviewers:
(1) Carmine Finelli, Ospedale Cav. R. Apicella, Italy.
(2) Yara M. Michelacci, UNIFESP, Brazil.
Complete Peer review History: https://www.sdiarticle4.com/review-history/73739

Original Research Article

Received 08 July 2021
Accepted 18 September 2021
Published 21 September 2021

ABSTRACT

Background: India is the diabetic capital of the world, with a maximum number of diabetic patients. There is a large burden of undetected diabetic cases in the community. There is an increasing risk of diabetes in urban slums and rural areas, because of illiteracy, lack of awareness, low socioeconomic status, and unhealthy lifestyle. The Indian Diabetes Risk Score (IDRS) is a simple, low-cost, feasible tool for mass screening programs at the community level. This background study was planned with the following aim. Aim: As72.2% of the Indian population resides in rural areas, the current study was carried to assess the risk of diabetes mellitus among Pre-Diabetes obese people and to find out the association between the risk of diabetes mellitus and selected demographic variables.
Materials and Methods: A cross-sectional, descriptive research design was adapted. 400 subjects

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were recruited by non-probability purposive sampling technique among Pre-Diabetes obese people The data gathering was carried out with an Indian Diabetic Risk Score scale (IDRS). The collected data was optimized and analyzed by using descriptive statistics and inferential statistics.
Results: With regards to the risk assessment of Diabetes Mellitus, Out of 400subjects, 19.5% of the subjects belonged to no/low risk, 58.75% of the subjects belonged to moderate risk and 21.75% of the subjects belonged to very high risk as per IDRS.
Conclusion: The present study revealed that the risk of diabetes among adults is on rising in rural areas. Hence it is essential to create awareness about diabetes and accessibility to health care services among the rural population. Physical activity likes regular exercise, diet, and lifestyle modification are some of the interventions that can reduce the risk of diabetes.

Keywords: Diabetes mellitus; prediabetes; prevalence; IDRS score; adult population; obese population and rural area.

1. INTRODUCTION

Southeast Asian countries are facing a socioeconomic and epidemiological transition. But as with many of the industrialized countries, there is also a concomitant significant emergence of non-communicable diseases, particularly diabetes mellitus [1].

India is diabetic capital of the world, with the maximum number of diabetic patients. The number of people with Diabetes mellitus is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity. Diabetes mellitus is an insidious public health problem. There is large burden of undetected diabetic cases in community [2].

Diabetes mellitus is expected to continue as a major health problem owing to serious complications. The World Health Organization predicts that such diseases will account for two-thirds of all deaths within the next 25 years in Southeast Asian countries. Type 2 diabetes mellitus is progressing rapidly, and it has been predicted that the number of individuals with diabetes mellitus in India will be the highest in the world (79.4 million) in 2030, with the incidence of cases manifesting at younger ages [3].

Every fifth diabetic in the world is an Indian [4]. An estimated 96 million people have Diabetes Mellitus in the South-East Asian region, 90% of who have type 2 Diabetes Mellitus, which is preventable. However, half of those cases remain undiagnosed; underscoring the need for rapid, low-cost solutions to reach the region's underserved areas [5].

India is diabetic capital of the world, with the maximum number of diabetic patients. There is a large burden of undetected diabetic cases in the community. There is an increasing risk of diabetes in rural area, because of illiteracy, lack of awareness, low socioeconomic status and unhealthy lifestyle [4].

Lack of effective health programs for primordial and primary prevention of these diseases and ineffective screening methods has been one of the reasons for this new epidemic in the developing world. Prevalence of Diabetes mellitus is increasing significantly throughout the globe and especially in a developing world including India thus becoming a major public health concern. The number of individuals with diabetes mellitus in India is 40.9 million by the end of 2010, and it is predicted to increase to 69.9 million individuals by 2025 and 79.4 million individuals by 2030 [6-7].

Early identification of at-risk individuals using simple screening tools like the Indian Diabetes Risk Score (IDRS) and appropriate lifestyle intervention would greatly help in preventing or postponing the onset of diabetes and thus reducing the burden on the community and the nation as a whole [7].

The Indian Diabetes Risk Score (IDRS) is a simple, low cost, feasible tool for mass screening programmes at the community level developed by V Mohan et al and has been validated by other researchers [7]. The IDRS has a sensitivity of 72.5% and specificity of 60.1% which takes into account two non-modifiable risk factors (age and family history of diabetes) and two modifiable risk factors (waist circumference and physical inactivity) which may be amenable to intervention and easy to measure at a very low cost, [8,4]. In a country like India, it can prove to

be a cost effective tool for screening of diabetes at the community level. The purpose of screening for diabetes is to differentiate asymptomatic individuals who are at high risk of Diabetes from individuals at lower risk, so that appropriate preventive strategies can be initiated early. Ideally, screening tests should be rapid, simple, and safe. Since diabetes is an ice-berg disease, most of the subjects remain asymptomatic. Screening for diabetes can identify patients at an early stage of the disease, and identify those who will derive benefit from prevention and early treatment methods [9].

Tools such as IDRS will help the investigator to formulate effective screening strategies to unmask the hidden burden of diabetes mellitus and also help the health personnels to use resources in a cost-effective manner.

In India, the prevalence of diabetes among adults has also increased from 5.5% in 1990 to 7.7% in 2016 [10]. Evidence from various studies suggests that people with prediabetes may have associated end-organ damages that are traditionally considered to be the complications of diabetes [11-13].

Currently, the use of non-invasive risk scores is acquiring popularity in screening diabetes due to higher community acceptance, cost-effectiveness and feasibility for large-scale application than the invasive procedures.

Keeping the above facts in view, personal and professional experience of the investigators, Investigators felt the need to do risk assessment of Diabetes mellitus among Pre-Diabetes obese people of rural areas

2. REVIEW OF LITERATURE

Rajappa, Thamarai & Karunanandham, Sivakumar, [14] conducted a community based cross-sectional study on Evaluation of risk for type 2 diabetes mellitus in rural population and its comparison with obesity indicators. The total sample size was 800. The study revealed that 19% of the population was found to have high risk score for diabetes. Overall, 109/800 (13.62%) and 132/800 (16.5%) individuals in this rural population had diabetes and prediabetes respectively. The prevalence of Diabetes was significantly higher among participants with a high IDRS 57/152 (37.5 %) and a medium IDRS 41/416 (9.85 %) compared with those with a low IDRS score 11/232 (4.74%) and the `p` value was significant (p=0.01). The study concluded that 19% was found to have high risk score for diabetes, 52% moderate risk score and 29% had low risk score. 109 (13.62%) and 132 (16.5%) individuals were diagnosed to be diabetes and prediabetes among the screened rural population [14].

Oruganti Aditya, Kavi Avinash and Walvekar R. Padmaja [7] conducted cross-sectional study on Risk of developing Diabetes Mellitus among urban poor South Indian population using Indian Diabetes Risk Score. Total sample size was 400 adults aged between 30 and 60 years. The proportion of low, moderate, and high risk of developing diabetes mellitus was 7%, 63%, and 30%, respectively. The prevalence of newly diagnosed cases was 10.25%. Moreover, 57.1% of them with positive family history were in the high risk category; 76.9% of the sedentary workers were at higher risk; overweight and obese individuals had higher proportion of the high and moderate risk ($P < 0.0001$). The study concluded that advancing age, low physical activity, family history, overweight, and obesity were the prominent factors that predicted the risk of diabetes in the near future [7].

Deepa M et al. (2018) conducted a cross-sectional study in both rural and urbanIndia with the aim of assessing awareness and knowledge about diabetes in the generalpopulation among patients with diabetes in selected regions in India. A sample of 6,607 individuals was employed. Researchers assessed awareness ofdiabetes and knowledge of causative factors and complications of diabetes through theuse of an interviewer administered structured questionnaire. The response rate was 86%. The study concluded that the level of knowledge andawareness about diabetes in India was poor in rural areas in comparison to urban areasbecause only 43.2% of the populations used were aware of the conditions of diabetes.However, urban residents presented higher awareness rates of 58.4% compared to 36.8% of rural residents. The study emphasized for the need for improvement inknowledge and awareness in the diabetic subjects and the general population with the aimof achieving better control and prevention of diabetes and its problems [15].

Shamima Akter, M MizanurRahman, Sarah Krull Abe & Papia Sultana (2019), conducted o nationwide survey on Prevalence of diabetes and prediabetes and their risk factors among

Bangladeshi adults. The objective of the study was to estimate the prevalence of diabetes and prediabetes in Bangladesh using national survey data and to identify risk factors. The total samples were 754. The study revealed that the overall age-adjusted prevalence of diabetes and prediabetes was 9.7% and 22.4%, respectively. The study concluded that almost one in ten adults in Bangladesh was found to have diabetes, which has recently become a major public health issue. Urgent action is needed to counter the rise in diabetes through better detection, awareness, prevention and treatment [16].

Muthunarayanan, Logaraj, Ramraj, Balajiand and Russel Kamala John [17], conducted a cross-sectional study on Prevalence of prediabetes and its associated risk factors among rural adults in Tamil Nadu. The objective of the study was to estimate the prevalence of prediabetes and associated factors among adults. A study was carried out among 544 individuals over the age of 20 years. The study revealed that a total of 544 participants above the age of 20 years were studied of which 72.6% were women and 27.4% were men. The prevalence of prediabetes was 8.5% and diabetes was 10.1%. Higher risk of being prediabetes and diabetic was noted above the age of 40 years (odds ratio [OR] = 7.79, 2.17), male gender (OR = 1.46, 2.34), body mass index of more than 23 kg/m2 (OR = 1.52, 2.13), waist hip ratio of men >1 and women >0.8 (OR = 1.49, 2.28), alcohol intake (OR = 1.59, 2.45), and systolic blood pressure of more than 140 mm of Hg (OR = 2.23 and 2.15). The study concluded that identifying people with prediabetes and creating awareness on the prevention of diabetes by lifestyle modification and development of cost-effective strategy to prevent or delay the progression of the prediabetes stage to diabetic stage is the need of the hour for the prevention of diabetes in country like India [17].

2.1 Statement of Study

A cross- sectional study to assess the risk of Diabetes Mellitus among Pre-Diabetes obese people of selected rural area of Waghodia Taluka, Vadodara".

❖ Objectives of the Study

- To identify the risk of diabetes mellitus among Pre-Diabetes obese people in selected rural area.
- To find out the association between the risk of diabetes mellitus and selected demographic variables.

❖ Assumptions

- Pre-diabetes obese people may have risk for diabetes mellitus.
- IDRS screening of individuals helps to increase the quality of life and delay complications.

❖ Hypothesis

- H_1: There will be significant association between the risk assessment of diabetes mellitus and selected demographic variables.

3. METHODOLOGY

The cross-sectional, descriptive research design was adopted. The study was carried out in rural areas of Waghodia Taluka, Vadodara District. 400 subjects were selected by using non-probability purposive sampling technique. Pre-Diabetes obese population who are aged above 18 years to 59 years and conversant in speaking and writing Hindi or Gujarati or English were included. Pre-Diabetes obese population who are unreachable, unwilling to give consent or co-operate to participate in the study, sick during data collection period and known diabetics, those suffering from any chronic illness whether on medication or not and pregnant women were excluded. Formal written permission was obtained from the Chief District Health Officer, Zilla Panchayat, Vadodara. The data collection was carried out in the month of January- March 2020. The Investigator introduced himself and explained the purpose of study, written consent was obtained with their anonymity and confidentiality of data. The investigator collected data using the IDRS scale. About 15 to 20 minutes was spent by each subject for assessment each time. Approximately 10 to 15 subjects were assessed per day .The obtained data was analyzed using SPSS-20 software. More specifically, descriptive statistics (frequency and percentage, mean, standard deviation) were used to describe the subjects characteristics and level of risk of diabetes mellitus. Chi – square test used in order to find out the association between the level of risk of diabetes mellitus and selected socio-demographic variables. The level of significance was set at $p<0.05$.

4. RESULTS

The data collected were analysed according to the plan for data analysis, which includes both descriptive and inferential statistics. The findings have been organized and presented under following sections.

Section A: Socio-demographic variables of Pre-Diabetes obese people.

Section B: Risk assessment of Diabetes Mellitus among Pre-Diabetes obese people

Section -C: Association between the risk assessment of diabetes mellitus and selected socio-demographic variables of Pre-Diabetes obese people.

Section A

Demographic Variables of Pre-diabetes Obese Individuals.

Table 1 depicts that, among four hundred (400) subjects, the majority of the subjects 126 (31.5%) belonged to the age group of 28years - 37 years and 72 (18%) of the subjects belonged to the age group of 18-27 years. It is observed that, 257 (64.3%) of the subjects were females and 143 (35.8%) of the subjects were males. In relation to religion, the majority of the subjects 386 (96.5%) belonged to Hindu and 2 (0.5%) of the subjects belonged to the Christian. Based on the educational status, majority of the subjects 165 (41.3%) were studied upto secondary education and 11(2.8%) of the subjects were studied upto graduation and above. Based on the occupational status, the majority of the subjects 182 (45.5%) were house wife and 29 (7.2%) of the subjects were Government employees. Regarding family monthly income, 100(25%) of the subjects had an income of Rs 10000/ - <15000/- and 27(6.8%) of the subjects had an income of Rs. <5000. With respect to the type of diet, the majority of the subjects 312(78%) were mixed diet and 88(22%) of the subjects were vegetarian. In relation to do you have a habit of smoking, the majority of the subjects 311(77.8%) had a habit of smoking and 89 (22.3%) of the subjects did not have a habit of smoking. It is observed that if you have a habit of tobacco chewing, the majority of the subjects 360(90%) did not have a habit of tobacco chewing and 40(10%) of the subjects had a habit of tobacco chewing. In relation to do you have a habit of drinking alcohol, majority of the subjects 372(93.8%) did not have a habit of drinking alcohol and 28 (7%) of the subjects had a habit of drinking alcohol. It is observed that if you have a habit of eating junk food, the majority of the subjects 204(51%) had a habit of eating junk food and 196 (49%) of the subjects were not having a habit of eating junk food. Based on the history of hereditary diseases in the family, the majority of the subjects 282 (70.5%) responded with the presence of hereditary diseases and 118(29.5%) of the subjects responded with the absence of hereditary diseases. In relation to physical activity, the majority of the subjects, 157(39.3%) were performing mild physical activity and 60 (15%) of the subjects were not performing physical activity.

Section B

Table 2 shows that the majority of the subjects 169 (42.3%) belonged to the age group of 35-49 years and 52(13%) of the subjects belonged to >50 years age group. Based on the waist circumference majority of the subjects 202(50.5%) were belongs to >80-89 cm for female and >90-99 cm male and 62(15.5%) were belongs to >90 cm for female and >100 cm for male. Based on the physical activities, the majority of the subjects 157(39.3%) were doing moderate exercise work-home and 136 (34%) were doing mild exercise work-home. In relation to the family history of diabetes, the majority of the subjects 226 (56.5%) had no family history and 133 (33.3%) of the subjects had a family history of present – either parent.

The Table 3 shows that, the mean score for risk assessment of Diabetes Mellitusis 41.20 and standard deviation is 17.98.

Table 4 depicts that the majority of the subjects 193(48.3%) belonged to 161cm -170cm and 3(0.8%) of the subjects belonged to 181-190 cm. In relation to weight, the majority of the subjects 232 (58.0%) belonged to 79-88kg and 3 (0.8%) of the subjects belonged to 99-108kg. Based on the waist circumference, the majority of the subjects 202 (50.5%) belonged to 86-90cm and only one (0.3%) of the subject belonged to each category 96-100cms and 100-105cms. In relation to hip circumference, 144 (36.0%) of the subjects were belongs to 96-100cms and 3 (0.8%) of the subjects were belongs to 80-85cms. Based on the Blood pressure, majority of the subjects 188 (47.0%) were belongs to130/85 mm of Hg - 139/89 mm of Hg and 4 (1.0) of the subjects were belongs to160/100 mm of Hg - 179/109 mm

of Hg. Regarding Body Mass Index, majority of the subjects 243 (60.8%) were belongs to 30-31kg/m2and 7 (1.8%) of the subjects were belongs to 33-34 kg/m^2.

Table 1. Frequency and percentage distribution of subjects according to their demographic variables. n= 400

SR.NO	Demographic Variable		Frequency	Percentage
1.	Age in years	a. 18 years – 27 years	72	18.0
		b. 28years - 37 years	126	31.5
		c. 38 years – 47 years	124	31.0
		d. 48 years – 57 years	78	19.5
2.	Gender	a. Male	143	35.8
		b. Female	257	64.3
3.	Religion	a. Hindu	386	96.5
		b. Muslim	12	3.0
		c. Christian	2	0.5
		d. Other	0	0
4.	Educational status	a. No formal education	24	6.0
		b. Primary education	164	41.0
		c. Secondary education	165	41.3
		d. Higher secondary education	36	9.0
		e. Graduation and above	11	2.8
5.	Occupational status	a. Farmer	58	14.5
		b. Government employee	29	7.2
		c. Private employee	55	13.8
		d. Self-employee	35	8.8
		e. Daily wage/ coolie worker	41	10.3
		f. House wife	182	45.5
6.	Family monthly income in rupees	a. <5000	27	6.8
		b. 5000-<10000	80	20.0
		c. 10000-<15000	100	25.0
		d. 15000-<20000	72	18.0
		e. 20000-<25000	76	19.0
7.	Type of diet	a. Vegetarian	88	22.0
		b. Mix diet	312	78.0
8.	Do you have a habit of smoking?	a. Yes	89	22.3
		b. No	311	77.8
9. .	Do you have a habit of tobacco chewing?	a. Yes	40	10.0
		b. No	360	90.0
10.	Do you have a habit of drinking alcohol?	a. Yes	28	7.0
		b. No	372	93.0
11.	Do you have a habit of eating junk food?	a. Yes	196	49.0
		b. No	204	51.0
12. .	History of hereditary diseases in the family.	a. Yes	282	70.5
		b. No	118	29.5
13. .	Physical activity	a. No physical activity	60	15.0
		b. Mild physical activity	157	39.3
		c. Moderate activity	136	34.0
		d. Vigorous activity	47	11.8

Table 2. Risk assessment of diabetes mellitus among pre-diabetes obese people n=400

SL.NO	Components	Gender		Frequency	Percentage
		Male	Female		
1.	Age				
	a. < 35 years	73	106	179	44.8
	b. 35-49 years	57	112	169	42.2
	c. >50 years	13	39	52	13.0
2.	Waist Circumference				
	a. <80 cm for female and <90cm for male	58	78	136	34.0
	b. >80-89 cm for female and >90-99 cm male	75	127	202	50.5
	c. >90 cm for female and >100 cm for male	10	52	62	15.5
3.	Physical Activities				
	a. Vigorous exercise or strenuous work	14	46	60	15.0
	b. Moderate exercise work-home	49	108	157	39.2
	c. Mild exercise work-home	58	81	136	34.0
	d. No exercise and sedentary work-home	22	25	47	11.8
4.	Family History of Diabetes				
	a. No family history	86	140	226	56.5
	b. Family history present - either parent	48	85	133	33.3
	c. Family history present - both parents	9	32	41	10.3

Table 3. Mean and standard deviation of risk assessment of diabetes mellitus among Pre-Diabetes obese people n=400

SL No	Risk Assessment of Diabetes mellitus	Number of Pre-Diabetes obese people.	Percentage	Mean	Standard deviation
1	Low risk	78	19.5%	41.20	17.98
2	Moderate risk	235	58.75%		
3	Very high risk	87	21.75%		

Table 4. Frequency and percentage distribution of subjects according to risk factors n= 400

SL No	Risk factors	Frequency	Percentage
1.	**Height (cms)**		
	a. 151cm -160cm	155	38.8
	b. 161cm-170cm	193	48.3
	c. 171-180cm	49	12.3
	d. 181-190 cm	3	0.8
2.	**Weight (kg)**		
	a. 69-78	126	31.5
	b. 79-88	232	58.0
	c. 89-98	39	9.8
	d. 99-108	3	0.8
3.	**Waist circumference**		

SL No	Risk factors	Frequency	Percentage
	a. 80-85cms	136	34.0
	b. 86-90cms	202	50.5
	c. 90-95cms	60	15.0
	d. 96-100cms	1	0.3
	e. 100-105cms	1	0.3
4.	**Hip circumference (cms)**		
	a. 80-85 cms	3	0.8
	b. 86-90cms	49	12.3
	c. 90-95cms	112	28.0
	d. 96-100cms	144	36.0
	e. 100-105cms	75	18.8
	f. 106-110cms	17	4.3
5.	**Blood pressure (mm of hg)**		
	a. 120/80-129/84	99	24.8
	b. 130/85 - 139/89	188	47.0
	c. 140/90- 159/99	109	27.3
	d. 160/100- 179/109	4	1.0
6.	**Body Mass Index (kg/m^2)**		
	a. 30-31	243	60.8
	b. 31-32	100	25.0
	c. 32-33	50	12.5
	d. 33-34	7	1.8

Table 5. The association of risk assessment of diabetes mellitus with selected demographic variables
n= 400

Sr. No	Demographic variable	Low risk	Moderate risk	Very high risk	Chi-square (χ^2)
1.	**Age in years**				
	a. 18 years – 27 years	36	34	32	117.22
	b. 28years - 37 years	33	81	12	df-6
	c. 38 years – 47 years	9	81	34	S*
	d. 48 years – 57 years	0	39	39	
2.	**Gender**				68.04
	a. Male	55	80	8	df-2
	b. Female	23	155	79	S*
3.	Rel**igion**				6.76
	a. Hindu	74	231	81	df-4
	b. Muslim	3	4	5	NS
	c. Christian	1	0	1	
4.	**Educational status**				11.51
	a. No formal education	5	12	7	df-8
	b. Primary education	25	105	34	NS
	c. Secondary education	38	93	34	
	d. Higher secondary education	6	18	12	
	e. Graduation and above	4	7	0	
5.	**Occupational status**				57.12
	a. Farmer	26	28	4	df -10
	b. Government employee	9	17	3	S*
	c. Private employee	13	32	10	
	d. Self-employee	7	23	5	
	e. Daily wage/ coolie worker	10	25	6	
	f. House wife	13	110	59	
6.	**Family monthly income**				5.27
	a. <5000	5	16	6	df-10

Sr. No	Demographic variable	Low risk	Moderate risk	Very high risk	Chi-square (χ^2)
	b. 5000-<10000	16	49	15	NS
	c. 10000-<15000	20	52	28	
	d. 15000-<20000	11	45	16	
	e. 20000-<25000	15	47	14	
	f. 25000-<30000	11	26	8	
7.	**Type of Diet**				3.18
	a. Vegetarian	23	47	18	df-2
	b. Mixed	55	188	69	NS
8.	**Habit of smoking**				53.18
	a. Yes	39	47	3	df-2
	b. No	39	188	84	**S***
9.	**Habit of drinking alcohol**				16.16
	a. Yes	13	14	1	df-2
	b. No	65	221	86	**S***
10.	**Habit of tobacco chewing**				3.48
	a. Yes	12	19	9	df-2
	b. No	66	216	78	NS

df=degree of freedom, p= 0.05 level

Table 6. The association of risk assessment of diabetes mellitus with selected demographic variables
n= 400

Sr. No	Demographic variable	Low risk	Moderate risk	Very high risk	Chi-square (χ^2)
11.	**Habit of eating junk food.**				1.16
	a. Yes	41	115	39	df-2
	b. No	36	120	48	NS
12.	**History of hereditary diseases in the family**				17.73
	a. Yes	43	165	74	df-2
	b. No	35	70	13	S*
13.	**Physical activity**				93.30
	a. No physical activity	0	28	32	df-6
	b. Mild physical activity	23	91	43	**S***
	c. Moderate activity	31	94	11	
	d. Vigorous activity	24	22	1	

df=degree of freedom, p= 0.05 level

Table 5 depicts that the calculated χ2 values was less than the table value in terms of religion, educational status, family monthly income, type of diet and habit of tobacco chewing, hence the research hypothesis H_1stated that there will be significant association between the risk of assessment of diabetes mellitus and selected demographic variables was rejected. But in relation to the age, gender, occupational status, habit of smoking and habit of drinking alcohol there was a significant association.

Table 6 depicts that the calculated χ2 values was less than the table value in terms of habit of eating junk food, hence the research hypothesis H_1stated that there will be significant association between the risk assessment of diabetes mellitus and selected demographic variable was rejected.But in relation to the history of hereditary diseases in the family and physical activitythere was a significant association.

5. DISCUSSION

One of the commonest non-communicable chronic diseases is diabetes mellitus with high worldwide prevalence in the current situation. Along with this, the prediabetes stage has also become prevalent. It is estimated that in 2025, 300 million people will be affected and so it continues to beworldwide-growing epidemic.

Recent studies have shown a rapid conversion of impaired glucose tolerance to diabetes in the

southern states of India, where the prevalence of diabetes among adults has reached approximately 20% in urban populations and approximately 10% in rural populations.

The present study used the IDRS to identify the individuals at risk for diabetes and to determine the association of various demographic variables with their risk status. IDRS is a cost-effective, simple, non-invasiveand accurate tool for screening of diabetes, which can be used at the community and the primary care settings.

The present study also elucidates the need for assessment of risk for type 2 diabetes in rural residents. In this study screening for diabetes was conducted for 400 subjects among pre-diabetic obese people in the rural community. Out of these 78 (19.5%) of the subjects were in low risk category, more than half 235 (58.75%) of the subjects were in moderate risk category and 87 (21.75%) of the subjects were in high risk category as per the IDRS. The study had more subjects with moderate risk followed by high risk These observations made in our study were close to that study conducted by the Anita Shankar Acharya et al in urban areas [9]. This shows that a large number of the study subjects had some kind of risk of developing diabetes in future. A similar study conducted by Ramaiah R et al14.84% (72) of study subjects had high risk of diabetes and 73.19% (355) had moderate risk of diabetes; 11.95% (58) had no /low risk of diabetes [18].

In the present study, 126 (31.5%) of the subjects were belong to the age group 28-37 years followed by age group 38-47years with 124 (31.0%) of the subjects. A study conducted by Sethuram, et al, 149 were in 26-45 (49.7) participants belong to the age group 26-45 followed by age group 46-65 with 132 (45.33%) participants [19]. In the study by Chiwanga F. S. et al the highest number of participants belonged to the age group of 30-39 years followed by the age group of 40 -49 [19]. In the study by Mohamed S. F. et al, it was found that majority of the participants 46.1% were in the age group of 18–29 followed by 32.7% in the age group 30–44 and then 15.9% in the age group 45–59 years of age [20].

In the present study, the number of females 257 (64.2%) was more than the number of males 143 (35.8%). This findings, however do not corroborate with study conducted by Sethuram, et al, the number of males 164(54.67%) was more than the number of females 136(45.33%) [19]. In the study by Chiwanga F. S. et al the number of female participants 80 (51.6%) was more than males 75 (48.4%) [20]. In the study by Mohamed S. F. et al, it was found that majority of the participants about 51% were females [21] and 53.96% were women and 46.03% were men in the study conducted by Anita Shankar Acharya et al. [9].

In the present study, 58 (14.5%) of the subjects were farmers, and 182 (45.5%) of the subjects were house wives. Among the study population 28 (7.0%) of the subjects were alcoholics, 89 (22.3%) of the subjects were smokers. 88 (22.0%) of the subjects were vegetarian and 312 (78.0%) of the subjects were non-vegetarian. Among the study population 47 (11.8%) of the subjects were physically active. 282 (70.5%) of the subjects had history of hereditary disease. Regarding Body Mass Index, majority of the subjects 243 (60.8%) were belongs to 30-31kg/m^2 and 7 (1.8%) of the subjects were belongs to 33-34 kg/m^2. A study conducted by Sethuram, et al, 33 (11%) of the subjects were farmers and 83 (27.7%) were house wives. Among the study population 85 (28.33%) of the subjects were alcoholics, 44 (14.67%) of the subjects were smokers. 40 (13.33%) were vegetarian and 260 (86.67%) of the subjects were non-vegetarian. Among the study population 257 (85.67%) of the subjects were physically active. 69 (23%) of the subjects had previous history of diabetes and 53 (17.67%) had hypertension and 128 (42.7%) of the participants were overweight (BMI-24-29.9), and 114 (38%) of the subjects were obese BMI >=30) [19].

In the present study, women having waist size more than 80cm – 89cm have the moderate risk (49.4%) and women having waist size less than 80 cm have the lowest risk (30%) which is similar to Gautam Praveen [22], Geetha Mani et al. [23] & Abhishek Arun et al. [24]. In the present study, prevalence of waist circumference (abdominal obesity) was 52.4% and 49.4 among males and females respectively. The study conducted by Brahmbhattet. al reported that the prevalence of abdominal obesity was 44% and 84% among males and females, respectively [25]. Another study conducted in South India reported it up to 31% and 66% among males and females, respectively [26].

In the present study there is a significant association with age, gender, occupational status, habit of smoking and habit of drinking

alcohol.A study conducted by Jayakiruthiga S et al revealed that highly significant association was observed between Diabetes risks with age [3]. Another similar finding by Muthunarayanan, et al. revealed that alcohol consumption increased risk of prediabetes[17]. Ghorpadeet al. reported significant association with sex, age group, educational status, per capita income, and alcohol use [27].

6. RELEVANCE OF THE STUDY

The application of Indian diabetic risk scores as a screening tool could not only help in predicting undiagnosed diabetics in the community settings however it also lend a hand in primary intervention strategies in the form of lifestyle and dietary modifications and to prevent further difficulties of diabetes among pre-diabetes population.

7. CONCLUSION

The present study among rural pre-diabetes obese adults revealed that the magnitude of risk for diabetes is on rise in rural areas.Increasing age is also a risk factor for prediabetes and diabetes. The prevalence of the diabetics and prediabetes is rising in rural population. Because of the considerable disparity in the availability and affordability of diabetes care, as well as low awareness of the disease it is high time to give attention to the people in rural areas of India. Hence, there is a need to create awareness about diabetes and accessibility to health care services regarding diabetes among pre-diabetes obese adult population in rural areas. Physical activity likes regular exercises, diet and lifestyle modification are some of the intervention that can reduce the risk of diabetes. For early detection, confirmation with GTT is required among the subjects with IDRS >60.

8. RECOMMENDATIONS

The Indian diabetic risk score is a simple, trouble -free and easy tool which can be used by health workers or a nursing students during internship or a other health personnels in mass screening programs for non-communicable diseases in a community settings.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

ACKNOWLEDGEMENT

The authors are thankful to the participants for their kind cooperation in this research project. The authors are also grateful to authors / editors of all those journals, and books from where the literature for this article has been received and discussed.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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DOI: 10.4103/2224-3151.206761

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/73739