ORIGINAL ARTICLE

Prevalence and Risk Factors of Type 2 Diabetes Mellitus in Urban and Rural Population of Kanpur

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ABSTRACT

Background: The rising trend of diabetes in populations is due to automation and specific risk factors that may contribute to the development of Type 2 Diabetes Mellitus (T2DM). 90-95% of people with T2DM.The present study assessed the prevalence and risk factors of T2DM in Kanpur's urban and rural populations. **Aim & Objective:** To determine the prevalence and risk factors of Type 2 diabetes mellitus in urban and rural populations of Kanpur Nagar. **Setting &Design:** A community based cross-sectional study. **Methods & Materials:** The study included adults aged 20 years and older. pre-designed, pretested questionnaire covering socio-demographic information, lifestyle, and anthropometry. Random blood sugar (RBS) test to screen for diabetes. Statistical analysis was conducted using SPSS, version 29.0.2.0(20). **Results:** Diabetes prevalence was 13% overall, with 17.6% in urban areas and 9.2% in rural areas. In both settings, a significant association of diabetes with physical activity, smoking, alcohol consumption, BMI (≥ 25), weight-height ratio (WHtR), waist-hip ratio (WHR), and a family history of diabetes was seen. **Conclusions:** Diabetes prevalence is higher in urban than rural areas. Early detection and assessment of high-risk individuals in both regions can help prevent or delay diabetes mellitus and its complications.

KEYWORDS

Type 2 diabetes mellitus (T2DM); Random blood sugar(RBS); Sagittal abdominal diameter (SAD); weight-height ratio (WHtR); waist-hip ratio (WHR); body mass index (BMI)

INTRODUCTION

Diabetes mellitus (DM), commonly referred to as diabetes, is a group of metabolic diseases characterized by high blood sugar levels over prolonged periods.(1) The classic symptoms of untreated diabetes are weight loss, polyuria polydipsia, and polyphagia(2) 90-95% of people with T2DM usually develop symptoms much more slowly and may be subtle or absent.(3) In a recent study conducted by ICMR INDIAB, the prevalence of diabetes was 11.4%, with a significantly higher prevalence in urban areas (16.4%) compared to rural areas (8.9%). (4).Most cases of T2DM are attributed to modifiable risk factors, which can be controlled through individual and population-based strategies.(5)

The increase in diabetes in rural India is a result of common eating habits, such as a rising interest in fast foods, more automation in agriculture, and a resultant lack of physical activity. (6) By early detection of the disorder, we would be able to give therapeutic and lifestyle interventions. This emphasizes the need for mass awareness and screening programs to detect undiagnosed diabetes and thus reduce the burden of diabetes in

India. Random blood sugar is a simple, fast method for identifying high-risk subjects.

Aim and Objective: To determine the prevalence and risk factors of Type 2 diabetes mellitus in the urban and rural population of Kanpur Nagar.

MATERIAL & METHODS

Study type & Study design: community-based cross-sectional study. **Study setting: urban** and rural areas of Kanpur Nagar district**. Study duration:** The study was carried out for a period of 1-year **Study population:** among adults aged 20 years and above with the inclusion of all those who had given written consent and were residents of Kanpur (> 1 year) and the exclusion of all who were previously diagnosed diabetics and taking hypoglycemic agent, pregnant, lactating females and bedridden patients. **Ethical consideration**: The Ethical Committee of the medical college approved the study on 20 February 2023.

Sample size calculation: Considering the prevalence of risk factors for diabetes (obesity) from previous studies (urban: 27.75%, rural: 17.25% as per NFHS 5 2019-21), with an allowable margin of error taken as 8% absolute precision and 95% confidence interval, the sample size was calculated as 202. Considering a 20% non-response rate, the total number of study subjects in each group was 202 + 40 = 242; the minimum sample size was 484, and 500 was taken as the final sample size.

Sampling Technique: The study was conducted using a multistage random sampling technique to cover the optimum sample size for the fulfilment of the study objectives. **Strategy for data collection**. In the **first stage**, in an urban area data was collected from two urban wards, Fazalganj and Maswanpur were chosen by simple random sampling without replacement. In the **second stage**, one mohalla from each selected ward was chosen using the Simple Random Sampling technique. Data was collected after **written informed consent** from a house-to-house survey until the target of 250 subjects from each selected mohalla was achieved. In rural areas, two blocks, Kalyanpur and Chaubepur, were selected from the list of 10 rural blocks using simple random sampling without replacement. In the second stage, village Bairi from Kalyanpur block and village Devlapur from Chaubepur were selected using simple random sampling. Study subjects were selected from each village to cover the optimum sample size required for the study objectives. By using a **working definition**, Weight: Hip Ratio> 1 male,>0.85 female, WHtR >0.5 over weight, BMI >25kg/m2, considered High Risk individual finally tested for Random blood sugar≥ 200 mg/dl is considered diabetic, < 200 were considered as nondiabetic

To collect relevant data, a predesigned and pretested questionnaire was used. The questionnaire was filled out by direct interview. House-to-house surveys were conducted until the optimum sample size was achieved. The collected data were classified, tabulated, and analyzed using SPSS trial version 29.0.2.0, and conclusions were drawn accordingly.

The following tools were used for data collection: Socio-demographic profile characteristics: name, age, marital status, religion, caste, education, occupation, number of family members, type of family, family income, and socioeconomic status according to Modified B.G. Prasad social classification 2022.

Lifestyle factors: physical activity, smoking, alcohol consumption, and eating habits. Anthropometry: height, weight, BMI, skinfold thickness, waist circumference, hip circumference, waist-hip ratio, waist-height ratio, sagittal abdominal diameter, family history of diabetes and Random blood sugar.

Statistical Analysis: Data was analyzed using SPSS, trial version 29.0.2.0 (20). Descriptive statistics such as frequency along with their percentage for categorical variables were determined. The chi-square test for independent variables was used to show the association between dependent and independent variables. Missing variables were excluded from the analysis. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Out of 250 participants from urban areas 148 (59.2%) were male and 102 (40.8) were female, while out of 250 in rural areas 119(47.6%) were male and 131 (52.4%) were female. The mean age of the study subjects was 45.42±13 years, with urban and rural areas having mean ages of 47.37±13 years and 43.44±13 years, respectively. In urban areas, majority 107 (42.8%) were in the age group of 50 years and above whereas in rural areas, the majority 94 (37.6%) were in the age group of 35-49 years.

The present study concluded that most of the study participants were Hindus, married, from a nuclear family, and unemployed. In urban areas, the majority of subjects 100 (40.6%) belonged to the upper class, whereas in rural areas, the majority of subjects 75 (30.6%) belonged to the middle class. 112 (22.4%) had one parent who was diabetic, and 18 (3.6%) had both parents who were diabetic (Table 1).

Among diabetics, those were higher aged ≥50 years, married, nuclear family, and upper class were having a high risk of diabetes in both settings but postgraduate, professional, and upper class in urban areas while high school, clerical/shop owner,

middle class in rural areas having a high risk of diabetes as compared to non-diabetics and this difference was found to be statistically significantly ($p<0.05$) (Table 2)

In urban areas, among diabetics, the majority of subjects 48% had a sedentary lifestyle compared to 11.2% among non-diabetics (p=.001). Similarly, in rural areas, among diabetics, most subjects (56.5%) had a sedentary lifestyle compared to 28.6% among non-diabetics and this difference was statistically significant (p=.042). Diabetics who were smokers were 72.7% compared to 14.45% among non-diabetics(p=.001). Similarly, in rural areas, among diabetics, the majority of subjects who were smokers were 73.9% compared to 13.6% among non-diabetics and this difference was statistically significant (p=.001). Among diabetics those were current alcoholics were 59.1% compared to 6.8% among non-diabetics(p=.001). In rural areas, among diabetics, 56.5% of subjects were current alcoholics compared to 4.9% among non-diabetics and this difference was statistically significant(p=.001). In urban areas, 43.2% of diabetics consumed fruit compared to 93.6% among non-diabetics(p=.001). In rural areas, 26% of diabetics consumed fruit compared to 73.1% among non-diabetics, and this difference was statistically significant (p=.001).

In urban areas, among diabetics, (81.8%) had a BMI ≥ 25 kg/m² compared to 59.7% among non-diabetics (p=0.042). In rural areas, among diabetics, (82.6%) had a BMI ≥ 25 kg/m² compared to 52.4% among non-diabetics this difference was found statistically significant (p=0.047). In urban areas, among diabetics, the majority of subjects (84%) had a high waist/Hip ratio (WHR) compared to 66.5% among non-diabetics(p=0.033). In rural areas, among diabetics, the majority of subjects (86.9%) had a high WHR compared to 13% among non-diabetics(p=0.025). In urban areas, among diabetics (79.5%) belonged to families with a history of diabetes compared to 23.3% among non-diabetics(p<0.01). In rural areas, among diabetics, 61.0% of subjects belonged to families with a history of diabetes compared to 17.2% among non-diabetics. The association between diabetes and family history of diabetes was statistically significant ($p < 0.01$). However, in the current study, no association was found between diabetes and caste, gender, religion, or eating habits in urban and rural areas. (Table 3)

Table 1 Distribution of Study Subjects based on sociodemographic profile(N=500)

Characteristics	Urban (N=250)		Rural (N=250)		Total (N=500)	
Gender	**n**	**%**	**n**	**%**	**n**	**%**
Male	148	59.2	119	47.6	267	53.4
Female	102	40.8	131	52.4	233	46.6
Age group (in years)						
20- 34	43	17.2	74	29.6	117	23.4
35-49	100	40.0	94	37.6	194	38.8
≥ 50	107	42.8	82	32.8	189	37.8
Religion						
Hindu	198	79.2	218	87.2	416	83.2
Muslim	43	17.2	28	11.2	71	14.2
Others	9	3.6	4	1.6	19	2.6
Marital status						
Unmarried	21	8.4	26	10.4	47	9.4
Married	209	83.6	216	86.4	425	85
Divorced/Separated	6	2.4	2	0.8	8	1.6
Widow /Widower	14	5.6	6	2.4	20	4.0
Type of Family						
Nuclear	163	65.2	140	56.0	303	60.6
Joint	87	34.8	110	44.0	197	39.4
Educational						
Illiterate	25	10.0	52	20.8	77	15.4
Primary	16	6.4	30	12.0	46	9.2
Middle	17	6.8	41	16.4.	58	11.6
High School	56	18.4	48	19.2	104	20.8
Intermediate	32	12.8	26	10.4	58	11.6
Graduate	69	27.6	38	15.2	107	21.4
Postgraduate	35	14.0	15	6.0	50	10.0
Occupation						
Unemployed	81	32.4	109	43.6	190	38.0

Characteristics	Urban (N=250)		Rural (N=250)		Total (N=500)	
Unskilled Worker	26	10.4	26	10.4	52	10.4
Semiskilled/Skilled worker	47	18.8	69	27.6	116	23.2
Clerical/shop owner/farmer	29	11.6	19	7.6	48	9.6
Semi Professional	25	10.0	14	5.6	39	8.0
Professional	42	16.8.	13	5.2	55	11.0
Socio economic status						
Upper Class	100	40.6	37	14.8	137	27.4
Upper mid Class	49	19.5	45	18.0	94	18.8
Middle Class	48	19.2	75	30.0	123	24.6
Lower mid Class	34	13.6	64	25.7	98	19.6
Lower Class	19	7.6	29	11.6	48	9.6
Family H/o Diabetes						
No parent is diabetic	179	35.8	191	38.2	370	74
One parent diabetic	61	12.2	51	10.2	112	22.4
Both parent diabetic	10	2.0	8	1.6	18	3.6

Table 2 Association of Diabetes with sociodemographic variables in urban and rural areas.

Age-group (in years)	Urban(N=250)					Rural (N=250)				
	Diabetic		Non Diabetic		p-value	Diabetic		Non Diabetic		p-value
	n	%	n	%	**0.02***	n	%	n	%	**0.029***
20-34	2	4.5	41	19.9		3	13.0	71	31.3	
35-49	16	36.4	84	40.8		6	26.0	88	38.7	
≥50	26	59.1	81	39.3		14	61.0	68	30.0	
Gender										
Male	30	68.1	118	57.2	**0.18**	9	39.1	111	48.9	**0.37**
Female	14	31.9	88	42.7		14	60.9	116	51.1	
Religion										
Hindu	33	75	165	80.0	**0.515**	20	87	207	91.2	**.461**
Muslim	10	22.7	41	20.0		2	8.7	17	7.5	
Others	1	2.3	8	88.9		1	4.3	3	1.3	
Caste										
General	25	57.0	116	56.3	**0.917**	10	43.4	124	54.6	**0.396**
OBC	15	34.0	67	32.5		9	39.2	59	26.1	
SC/ST	4	9.0	23	11.2		4	17.4	44	19.3	
Marital status										
Unmarried	1	2.3	20	9.6	**0.020***	3	13.1	23	10.0	**0.032***
Married	37	84.1	172	83.5		17	73.9	199	87.6	
Divorced/ Separated	0	0	06	3.0		1	4.3	1	0.4	
Widow/widower	06	13.7	08	3.9		2	8.7	4	2.0	
Type of family										
Nuclear	35	79.5	127	61.7	**0.02***	8	34.8	132	58.1	**0.03***
Joint	9	20.5	79	38.3		15	65.2	95	41.9	
Education										
Illiterate	2	4.5	23	11.2	**0.024***	0	0	52	23.0	**0.012****
Primary	3	7.0	13	6.3		0	0	30	13.2	
Middle	4	9.0	13	6.3		5	22	36	15.8	
High School	6	13.6	50	24.2		9	39.1	39	17.1	
Intermediate	7	16.0	25	12.3		2	8.6.	24	10.5	
Graduate	9	20.4	60	29.1		4	17.3	34	15.0	
Postgraduate	13	29.0	22	10.5		3	13.0	12	5.2	
Occupation										
Unemployed /Homemaker	6	14	75	36.4	**0.002***	1	4.3	108	47.6	**0.001***

Age-group (in years)	Urban(N=250)					Rural (N=250)				
	Diabetic		Non Diabetic		p-value	Diabetic		Non Diabetic		p-value
Unskilled worker	3	6.8	23	11.1		2	8.6	24	10.5	
Semi Skilled/Skilled	4	9.0	43	20.8		3	13.0	66	29.1	
Clerical/Shop owner /Farmer	9	20.1	20	9.7		7	30.4	12	5.3	
Semi Professional	7	16	18	8.7		4	17.3	10	4.4	
Professional	15	34.1	27	13.1		6	26.0	7	3.1	
Socioeconomic Status										
Upper class	26	59.0	74	36	**0.037***	11	47.8	35	15.4	**0.047***
Upper Middle Class	9	20.4	41	20		4	17.3	46	20.2	
Middle Class	5	11.3	43	20.8		7	30.4	66	29.1	
Lower Middle class	3	7.0	31	15.0		1	4.3	56	24.6	
Lower class	1	2.3	17	8.2		0	0	24	10.6	

Table 3 Association of Diabetes with various Risk factors in rural and urban areas.

Risk Factors	Urban (N=250)					Rural (N=250)				
	Diabetic		Non Diabetic		p-value	Diabetic		Non Diabetic		p-value
Physical activity	**No.**	**%**	**No**	**%**		**No**	**%**	**No**	**%**	
Sedentary	21	48.0	23	11.2	**.001****	13	56.5	65	28.6	**0.042***
Mild	12	27.0	44	21.4		6	26.1	77	34.0	
Moderate	9	20.5	90	43.7		3	13.0	50	22.0	
Heavy	2	4.5	49	23.7		1	4.4	35	15.4	
Smoking										
Yes	32	72.7	30	14.5	**.001****	17	73.9	31	13.6	**.001****
No	12	27.2	176	85.4		6	26.1	196	86.3	
Alcohol status										
Current alcoholic	26	59.1	14	6.8	**0.001****	13	56.5	11	4.9	**0.001****
Former alcoholic	10	22.7	42	20.4		6	26.1	26	11.4	
Non-alcoholic	8	18.2	150	72.8		4	17.4	190	83.7	
Eating Habit										
Vegetarian	24	54.5	110	53.3	**0.097***	11	47.8	132	58.1	**.0107***
Non- vegetarian	20	45.5	96	46.7		12	52.1	95	41.8	
Fruit Consumption										
Yes	19	43.2	193	93.6	**.001****	6	26	166	73.1	**.001***
No	25	56.8	13	6.3		17	74	61	26.9	
BMI Kg/m^2										
<18.5	1	2.3	13	6.3	**0.042***	0	0	15	6.6	**0.047***
18.5-22.9	3	6.8	39	18,9		2	8.7	50	22	
23-24.9	5	11.3	31	15,1		2	8.7	43	19.0	
≥25	35	81.8	123	59.7		19	82.6	119	52.4	
Skin fold thickness (% BODY FAT)										
*High	42	95.4	169	82.0	**0.025***	23	100	187	82.4	**0.028***
**Normal	2	4.5	37	17.9		0	0	40	17.6	
Waist/Hip Ratio										
High	37	84.0	137	66.5	**0.033***	20	86.9	145	64.0	**0.025***
Normal	7	16.0	69	33.4		3	13.0	82	36.0	
Waist /Height Ratio (WHtR)										
High	26	59.1	80	38.8	**0.046***	12	52.2	57	25.1	**0.017***
Moderate	14	31.8	94	45.6		10	43.5	137	60.4	
Normal	4	9.1	32	15.6		1	4.3	33	14.5	
Sagittal Abdomen Diameter (SAD) in c.m										
≥25cm	34	77.2	126	61.1	**0.043***	21	91.3	126	55.5	**0.001****

<25cm	10	22.7	80	38.8		2	8.6	101	44.5	
Family H/o Diabetes										
YES	35	79.5	48	23.3	**0.001****	14	61.0	39	17.2	**0.001****
No	9	20.5	158	76.4		9	39.0	188	82.8	

**significant at 0.05, **highly significant at 0.01*

DISCUSSION

In the present study, 500 participants participated. The proportion of male-to-female participants was 53.4% to 46.6%. The overall mean age of the study subjects was 45.4±13 years, with the mean age in urban areas being 47.3±13 years and in rural areas being 43.4±13 years. A similar finding was observed in the study by Anjana et al (4), where the overall mean age was 43 years, with 42.1 years in urban areas and 43.4 years in rural areas. In the current study, the overall prevalence of diabetes was 13.4%; with a prevalence of 17.6% in urban areas and 9.2% in rural areas. Anjana et al (4). observed similar findings, who reported 11.45% overall prevalence, 16.4% in urban areas, and 8.9% in rural areas. However, Prashant Mathur et al (3). and Gupta et al (7). observed an overall prevalence of diabetes of 9.3% and 9.2% respectively, and Ahmad et al (8). reported a prevalence of 11.37% in urban areas and 3.60% in rural areas, with an overall prevalence of 7.68%, which is much lower than the present study. The present study reveals that in urban areas, among diabetics, most study subjects (48%) have a sedentary lifestyle compared to 11.2% among non-diabetics. Similarly, in rural areas, 56.5% of diabetics have a sedentary lifestyle compared to 28.6% of non-diabetics. The association between physical activity and diabetes was found to be highly significant ($p<0.01$). However, Gangwar et al (9)2023. observed that 17.9% of their subjects had a sedentary lifestyle, 32.1% were involved in moderate activity, and 23.2% were involved in vigorous activity. Shah et al(10). found that 69.39% of diabetics were physically inactive. Similar findings were observed in rural areas by Kokiwar et al (11). and Sharma et al (12), who observed that 33.84% were sedentary, and 73% of participants were doing mild or no exercise. The present study reveals that in urban areas, among diabetics, the majority of study subjects were smokers (72.7%) compared to 14.45% among non-diabetics. Similarly, in rural areas, 73.9% of diabetics were smokers compared to 13.6% among non-diabetics. These findings are similar to those of Luo et al (13), who found that the overall risk of diabetes was significantly elevated in current smokers. However, Shah et al (10). did not observe any significant association. In the present study, 59.1% of diabetics were current alcoholics compared to 6.8% of non-diabetics, whereas in rural areas, 56.5% of diabetics were current alcoholics compared to 4.9% of non-diabetics. Similar associations were observed by Sowmiya et al (14), Venkatachalam et al (15), and Shah et al (10). However, Gangwar et al (9). showed no significant association between alcohol consumption and diabetes. The present study reveals that in urban areas, among diabetics, 54.5% of study subjects consumed a vegetarian diet compared to 53.3% of non-diabetics. In rural areas, 47.8% of diabetics were vegetarians compared to 58.1% of non-diabetics. However, Singh et al (16). (2019) found that 43.4% followed a vegetarian diet and 56.6% followed a mixed diet. In our study, 43.2% of diabetics consumed fruits compared to 93.6% of non-diabetics. A similar pattern was reported by Singh et al (16). (2019) 34.8% of diabetics and 65.2% of non-diabetics consumed fruits. In the present study, the majority of diabetics (55.2%) belonged to the upper class, and 1.49% to the lower class. Ramachandran et al (17). also observed that the upper class is more prone to developing diabetes. However, Verma et al. observed that the majority of diabetics (35.61%) were from the middle class. In the current study, 81.8% of diabetics in urban areas had a BMI ≥25 kg/m² compared to 59.7% among non-diabetics. In rural areas, 82.6% of diabetics had a BMI ≥25 kg/m² compared to 52.4% of non-diabetics. The association between diabetes and BMI was found to be statistically significant ($p<0.05$). Kokiwar et al (11). similarly reported that abnormal glucose tolerance was prevalent in rural subjects with BMI ≥25 kg/m² 27.47% compared to those with BMI ≤25 kg/m² (11.46%). Singh et al (16) found a higher percentage of diabetics in overweight individuals (30.7%), followed by obese (15.2%), and underweight (13.1%) subjects. Purohit et al (18) suggested that a higher BMI is a significant risk factor for developing T2DM.The present study reveals that in urban areas, the majority of diabetics 84% had a high waist-hip ratio (WHR) compared to 66.5% of non-diabetics. In rural areas, 86.9% of diabetics had a high WHR compared to 13% of non-diabetics. Similarly, Singh et al (16) observed that 32% of males and 17.5% of females had a higher waist-hip ratio. The present study reveals that in urban areas, most diabetics 79.5% had a family history of diabetes compared to 23.3% of non-diabetics. In rural areas, 61.0% of diabetics had a family history of diabetes compared to 17.2% of non-diabetics. Gupta et al (7) found that 76.9% of

their subjects had a positive family history of diabetes. However, Singh et al (16) observed 18%, and Ahmad et al (8). Reported 35.41% with a positive family history of diabetes among diabetics, finding a significant association between diabetes and family history.

Conclusion

The prevalence of diabetes was higher in urban areas as compared to rural areas. In both settings, diabetes prevalence increased with age and There was an association between diabetes and physical activity, socioeconomic status, smoking, alcohol consumption, obesity, skinfold thickness, weight-height ratio (WHtR), waist-hip ratio (WHR), sagittal abdominal diameter (SAD), and a family history of diabetes in both urban and rural areas of Kanpur. While eating habits were significantly associated with diabetes in rural areas, unlike in urban areas.

Recommendation

National policies and programs should emphasize weight reduction in the general population to prevent the onset of diabetes, given the significant association with BMI. Emphasize the importance of increased fruit consumption as part of daily diet, as it is inversely associated with diabetes. Rural areas need more focus on improving access to healthy foods. Reiterate the cessation of alcohol and smoking as part of diabetes prevention and control.

Limitations of the Study

- Data was based on participants' recollections, which may be subject to recall bias.
- Single Random blood sugar measurement may lead to over diagnosis of diabetes

Relevance of the Study

Similar studies have been done in other parts of India and globally but have not been done in Kanpur.

Authors Contribution

All authors have contributed equally.

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Nil

Conflict of Interest

There are no conflicts of interest.

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Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors haven't used any generative AI/AI-assisted technologies in the writing process.

References

1. Nations U. World Diabetes Day | United Nations. [cited 2024 Apr 30]; Available from: https://www.un.org/en/observances/diabetes-day
2. Federation ID. International Diabetes Federation Diabetes Atlas 2021. Available from: https://diabetes atlas. org/idf awp/resource-files/2021/07/IDF_Atlas_10th_ Edition 2021.pdf. [Last accessed on 2024 Apr 24].
3. Mathur P, Kulothungan V, Leburu S, Krishnan A, Chaturvedi HK, Salve HR, et al. National noncommunicable disease monitoring survey (NNMS) in India: Estimating risk factor prevalence in adult population. PLoS One [Internet]. 2021;16:1–17.
4. Anjana RM, Unnikrishnan R, Deepa M, Pradeepa R, Tandon N, Das AK, et al. Metabolic non-communicable disease health report of India: the ICMR-INDIAB national cross-sectional study (ICMR-INDIAB-17). Lancet Diabetes Endocrinol. 2023;11(7):474–89.
5. Chandrasekaran P, Weiskirchen R. The Role of Obesity in Type 2 Diabetes Mellitus—An Overview. Int J Mol Sci. 2024;25(3):1882.
6. S RKS, S K, A T, E DA, P G, N S, et al. Diabetes mellitus, fasting glucose, and risk of cause-specific death. N Engl J Med [Internet]. 2011;364(9):829–41.
7. Gupta MK, Raghav P, Tanvir T, et al. Recalibrating the Non-Communicable Diseases risk prediction tools for the rural population of Western India. BMC Public Health. 2022;22(1):376
8. Ahmad N, Chandra S, Sharma RP, Srivastava JP. An epidemiological study of diabetes mellitus amongst high risk age group population in urban and Rural areas of kanpur. Indian J Community Health [Internet]. 2003 Dec. 31 [cited 2025 May 16];15(2):31-5.
9. bhinav Gangwar1, Dhiraj Kumar Srivastava1* SK. International Journal of Community Medicine and Public Health| January2024| Vol 11| Issue 1Page 151International Journal of Community Medicine and Public HealthGangwar Aet al. Int J Community Med Public Health. 2024Jan;11(1):151-156
10. Shah A, Afzal M. Prevalence of diabetes and hypertension and association with various risk factors among different Muslim populations of Manipur, India. J Diabetes Metab Disord [Internet]. 2013;12(1):52
11. Kokiwar PR, Gupta S, Durge PM. Prevalence of diabetes in a rural area of central India. Int J Diabetes Dev Ctries [Internet]. 2007;27(1):8–10.
12. Sharma S, Bansal A, Singh S, Chaudhary A, Satija M, Singla A, et al. Assessment of diabetes risk profile in a rural population of northern India using the Indian Diabetes Risk Score – A community-based study. J Fam Med Prim Care [Internet]. 2022;11(11):7077.
13. Luo J, Rossouw J, Tong E, Giovino GA, Lee CC, Chen C, et al. Smoking and diabetes: does the increased risk ever go away? Am J Epidemiol [Internet]. 2013;178(6):937–45.
14. Sowmiya KR, Balaji SM, Arumugam B. Indian diabetic risk score- a screening tool for detecting type 2 diabetes mellitus at the primary health c. Indian diabetic risk score-a screening tool for detecting type 2 diabetes mellitus at the primary health care level Authors: Corresponding A. Natl J Res Community Med [Internet]. 2017;6(July):069–72.
15. Venkatachalam J VJ. Alcohol Consumption and Diabetes: A Case Control Study in a Rural Area of Kancheepuram District of Tamil Nadu. IOSR J Dent Med Sci. 2013;4(6):83–6.

16. Singh MM, Mangla V, Pangtey R, Garg S. Risk Assessment of Diabetes Using the Indian Diabetes Risk Score: A Study on Young Medical Students from Northern India. Indian J Endocrinol Metab [Internet]. 2019 Jan 1 [cited 2024 Jul 28];23(1):86. Available from: /pmc/articles/PMC6446666
17. Sarit Sharma, Aman Bansal, Surinder Pal Singh, Anurag Chaudhary, Mahesh Satija, Ankur Singla HK. Assessment of diabetes risk profile in a rural population of northern India using the Indian Diabetes Risk Score – A community-based study. J Fam Med Prim Care [Internet]. 2022;6(2):169–70. Available from: http://www.jfmpc.com/article.asp?issn=2249-4863;year=2017;volume=6;issue=1;spage=169;epage=170;aulast=Faizi
18. Ashish Purhoit. Int J Med. 2015 [cited 2024 Jul 28]. View of Study of BMI and Waist Hip Ratio of Indians with Type-2 Diabetes Mellitus | International Journal of Medical Research and Review. Available from: https://ijmrr.medresearch.in/index.php/ijmrr/article/view/163/316
19. Ruiz-Alejos A, Carrillo-Larco RM, Miranda JJ, Gilman RH, Smeeth L, Bernabé-Ortiz A. Skinfold thickness and the incidence of type 2 diabetes mellitus and hypertension: an analysis of the PERU MIGRANT study. Public Health Nutr [Internet]. 2020 Jan 1 [cited 2024 Jul 29];23(1):63. Available from: /pmc/articles/PMC6960014
20. Larasati AP, Prajitno JH, Purwanto B. Correlation between Skinfold Thickness and Total Daily Dose of Insulin in Patient with Type 2 Diabetes Mellitus in Dr Soetomo General Hospital. Curr Intern Med Res Pract Surabaya J [Internet]. 2023 Aug 31 [cited 2024 Jul 29];4(2). Available from: https://e-journal.unair.ac.id/CIMRJ/article/view/49154
21. Pajunen P, Rissanen H, Laaksonen MA, Heliövaara M, Reunanen A, Knekt P. Sagittal Abdominal Diameter as a New Predictor for Incident Diabetes. Diabetes Care [Internet]. 2013 Feb [cited 2024 Jul 29];36(2):283. Available from: /pmc/articles/PMC3554316
22. Vasques ACJ, Cassani RSL, E Forti AC, Vilela BS, Pareja JC, Tambascia MA, et al. Sagittal Abdominal Diameter as a Surrogate Marker of Insulin Resistance in an Admixtured Population--Brazilian Metabolic Syndrome Study (BRAMS). PLoS One [Internet]. 2015 May 7 [cited 2024 May 16];10(5). Available from: https://pubmed.ncbi.nlm.nih.gov/25951458