International Journal of Applied Social Science
(An International Double Blind Peer Reviewed / Refereed Research Journal of Social Science)
Volume 11 (3 & 4), March & April (2024) : 74-82
Received : 01.02.2024; Revised : 15.02.2024; Accepted : 01.03.2024

RESEARCH PAPER
ISSN : 2394-1405 (Print)
DOI: 10.36537/IJASS/11.3&4/74-82

Differential in Diabetes Among Women in Rural and Urban Areas of India: Evidence from NFHS-5

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ABSTRACT

India is facing a substantial burden of diabetes with second position globally, and understanding the disparities among different populations is crucial. This study aims to investigate the differential in diabetes among women residing in rural and urban areas. Based on National Family Health Survey-5, data on women aged 15 to 49 years were analyzed. Bivariate analysis, logistic regression, and Fairlie's decomposition technique were employed in this study. The overall prevalence of diabetes was found to be higher among urban women (8.4%) compared to their rural counterparts (7.1%). Moreover, women from rural areas exhibited a significantly lower likelihood of developing diabetes compared to their urban counterparts. The likelihood of diabetes was higher among women with high blood pressure (rural: odds ratio (OR)=1.56, confidence interval (CI)=1.49-1.62; urban: OR=1.66, CI=1.55-1.77), overweight (rural: OR=1.76, CI=1.67-1.86; urban: OR=2.09, CI=1.83-2.38), obese (rural: OR=2.73, CI=2.55-2.92; urban: OR=3.18, CI=2.77-3.65), higher waist to hip ratio (WHR) (rural: OR=1.27, CI=1.23-1.31; urban: OR=1.34, CI=1.26-1.43) and also among divorced/separated, <5 years schooling. Women's body mass index (BMI) accounted for a major part (86.46%) of the inequality in the rural-urban prevalence of diabetes, followed by wealth (27.27%) and WHR (7.53%). Education status alone accounts for a significant part (28.68%) in reducing the inequality gap. A healthy lifestyle and better education can help mitigate the risk of diabetes among women in both rural and urban settings.

Key Words : Diabetes, women's health, decomposition, India, NFHS

INTRODUCTION

Nearly 41 million people worldwide per year die from non-communicable diseases (NCDs), which are responsible for 71% of all deaths.The majority of deaths from NCDs (17.9 million) are caused by cardiovascular diseases, followed by cancer, respiratory conditions, and diabetes (GBD, 2015).Worldwide, 451 million people (aged 18 to 99) were predicted to have diabetes in 2017. By 2045, these numbers were projected to reach 693 million (Cho *et al.*, 2018). The majority of diabetics reside in countries with middle and lower incomes (Whiting *et al.,* 2011). Cardiovascular disease is at increased risk in those with diabetes (Nesto, 2004). Older persons are more likely to have diabetes because age is closely associated with the disease (Group, 2006; Porapakkham *et al.,* 2008). Every fifth diabetic in this world lives in India, which is known as the world's diabetes capital (Joshi and Parikh, 2007). The prevalence of diabetes also shows a clear urban-rural split. Numerous studies indicate that urban regions are in poorer condition than rural areas (Geldsetzer *et al.*, 2018; Mohan *et al.,* 2008; Siddiqui *et al.,* 2019). The reasons for these variations include variations in geographic locations, socioeconomic status, way of life, etc. (Geldsetzer *et al.*, 2018). As per a study, about a third of patients knew about their disease, and two-thirds of them were receiving medical treatment (Singh *et al.*, 2012). The awareness and amenities with which a person accepts a diagnosis and changes in behaviour that are necessary are greatly influenced by

How to cite this Article: Singha, Ranjan and Bansod, Dhananjay W. (2024). Differential in Diabetes Among Women in Rural and Urban Areas of India: Evidence from NFHS-5. *Internat. J. Appl. Soc. Sci.,* **11** (3&4) : 74-82.

their degree of education (Murugesan *et al.*, 2007; Saydah and Lochner, 2010).

Diabetes has emerged as a major public health concern in India, affecting a significant proportion of the population. While the burden of diabetes is well recognized in urban areas, there is limited understanding of its prevalence and distribution in rural areas, especially among females. The significance of gender-specific health disparities and the need to address them have gained more attention in recent years. In this context, the study aims to explore the rural-urban differential in diabetes among females in India.

The study of rural-urban differential in diabetes among women in India is essential for several reasons. India is a rapidly developing country with a high burden of diabetes, and there is a growing concern regarding the impact of urbanization on the health of individuals living in both urban and rural areas. The present study's objective is to assess the difference in diabetes among women in India (15-49 years) between rural and urban areas and to investigate the contribution of different socioeconomic and demographic factors associated with diabetes among women in India.

METHODOLOGY

Data and sample:

The data used in the present study was obtained from the National Family Health Survey-5 (2019-2021), which provides information about India's population, nutrition, and health. Each of the five NFHS surveys was conducted under the Ministry of Health and Family Welfare (MoHFW), Government of India. The survey used the 2011 Indian Census as its sampling frame and employed a two-stage sample stratification. Villages in the rural areas and census enumeration blocks in the urban areas were used as the primary sampling units and were picked with a probability proportional to the size within every stratum. For the women's survey, women between the ages of 15 and 49 were eligible. In addition to questions, there were measurements in the survey of weight, height, blood pressure, random blood glucose levels, and waist to hip (WHR) ratio of participants. Information was gathered by NFHS-5 from 636699 households where 724115 were women, and 101839 were men. Out of 724115 women, 682619 women's data were analyzed in this study as diabetes diagnosis was done for these women. The sample for random glucose levels was collected from all the men and women aged 15 years and above. But in this study, we have considered the data only for ages 15 to 49 years women. Because the NFHS survey mainly focuses on and collects data for the 15 to 49 years age group of women and all the predictor variables that we have considered in this study are available for the 15 to 49 years age group of women.

Outcome variable:

For this study, the outcome variable was diabetes (Random blood glucose level). This health outcome was based on diagnosis by health professionals. In this study, those females were taken as having diabetes, if their blood glucose level was greater than 140 mg/dl or if anyone was taking medicine for diabetes.

Predictor variables:

The study takes into account some important risk factors, as well as socioeconomic and demographic factors to explain the prevalence and rural-urban division in female diabetes. The predictor variables were body mass index (BMI) (Normal, underweight, overweight, obese), blood pressure (Normal, high), WHR (Normal, higher), anaemia (Anaemic, not anaemic), smoking tobacco (No, yes), consumption alcohol (No, yes), diet (Healthy, unhealthy), age (15-24 years, 25-39 years, 40-49 years), wealth index (Poor, middle class, rich), marital status (Never married, married, divorced/separated), education (No schooling, <5 years, 5-12 years, >12 years), caste (SC, ST, OBC, others), religion (Hindu, Muslim, others).

Statistical analysis:

Bivariate analyses were applied to assess the prevalence of diabetes in rural and urban areas and to analyze the rural-urban diabetes difference based on socioeconomic and demographic factors. Logistic regression was applied in both rural and urban areas to look at the likelihood of diabetes with socioeconomic and demographic variables. The outcome was presented as an odds ratio with a confidence interval of 95%. A non-linear decomposition method, which is Fairlie's decomposition method, was employed to assess the difference in the diabetes between rural and urban areas and the contribution of different variables in making the gap by estimating group differences (rural, urban) contributions. Stata/SE 16.0 software has been used to analyze the dataset.

RESULTS AND DISCUSSION

Fig. 1 shows the prevalence of the disease according to the place where women live. About 7.5% of women had diabetes. It is clear that there is a 1.3% difference between the prevalence of diabetes in rural and urban areas. In comparison to rural women, urban women found a higher prevalence of diabetes. Urban area's diabetes prevalence was 8.4% and it was 7.1% in the rural areas.

Table 1 shows the results for socioeconomic and demographic characteristics of women in addition to the occurrence of diabetes among them according to different background characteristics. The findings showed that women residing in urban regions had a higher prevalence of diabetes than women residing in rural areas for almost every background feature. In addition, it was found that women with high blood pressure, overweight/obese, higher WHR, aged 40-49 years, divorced/separated, non-poor, and less educated had a greater prevalence of diabetes. Here it was also found that anaemia was not contributing too much to the distribution of diabetes in

Table 1 : Socio demographic factors and diabetes prevalence among women in rural and urban areas

		Rural		Urban		Total	
		Diabetic (%)	N	Diabetic (%)	N	Diabetic (%)	N
Hypertension	Normal	6.2	403750	7.0	183039	6.5	586789
	High	14.4	49130	18.7	25980	15.9	75110
Body mass index	Underweight	4.3	97388	3.2	28176	4.0	125565
	Normal	6.0	278493	5.9	115474	6.0	393968
	Overweight	12.0	70133	12.4	48728	12.2	118861
	Obese	18.4	20479	19.4	21956	18.9	42436
Waist to hip ratio	Normal	5.4	206959	5.9	85194	5.5	292153
	Higher	8.5	260797	10.1	129670	9	390466
Anaemia	Not anaemic	6.9	189801	8.2	97645	7.4	287447
	Anaemic	7.2	277954	8.6	117218	7.6	395173
Ever consumed tobacco	No	7.0	444696	8.4	209266	7.4	653962
	Yes	9.3	23059	10.5	5597	9.5	28657
Ever consumed alcohol	No	7.1	463508	8.4	213971	7.5	677479
	Yes	7.7	4247	8.0	893	7.8	5141
Diet	Healthy	6.9	208460	8.5	90039	7.4	298499
	Unhealthy	7.3	259296	8.3	124825	7.6	384121
Age group	15-24	3.0	162745	2.7	64450	2.9	227195
	25-39	6.8	200582	7.3	97695	7.0	298277
	40-49	14.1	104429	17.3	52719	15.2	157147
Wealth	Poor	6.6	245129	7.8	21882	6.7	267010
	Middle class	7.4	107032	7.8	34932	7.5	141964
	Rich	8.0	115595	8.6	158050	8.4	273645
Education	No schooling	8.7	127567	11.4	27510	9.2	155076
	<5 years	10.2	27729	13.4	8284	10.9	36013
	5-12 years	6.4	263817	8.4	123974	7.0	387791
	>12 years	5.0	48643	6.1	55097	5.6	103740
Marital status	Never married	2.9	105120	3.0	54309	3.0	159429
	Married	8.1	343723	10.0	150547	8.7	494270
	Others	11.8	18912	13.5	10007	12.4	28920
Religion	Hindu	6.9	391549	8.4	167089	7.4	558638
	Muslim	8.1	53499	8.2	36148	8.1	89647
	Others	7.6	22708	8.8	11627	8.0	34334
Caste	SC	6.8	108235	7.9	42361	7.1	150596
	ST	5.7	55404	7.0	9159	5.9	64564
	OBC	6.9	201412	8.5	91793	7.4	293205
	Others	8.5	102704	8.8	71551	8.6	174254
Total		7.1	467755	8.4	214864	7.5	682619

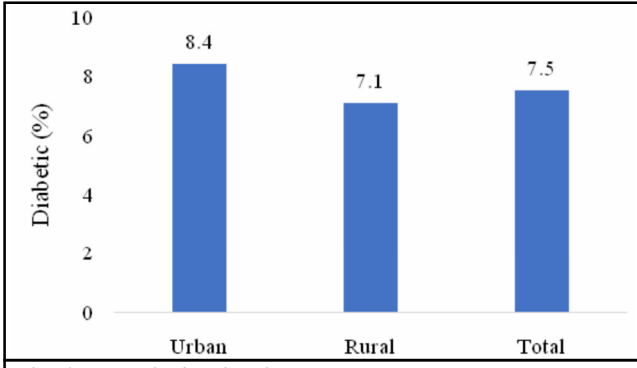

Fig. 1 : Variation in diabetes prevalence between urban and rural areas among women in India

urban as well as rural areas. Findings depict that consuming alcohol increases the prevalence of diabetes in rural areas but it was interestingly decreasing in urban areas. The number of diabetic females was increasing with age.

Also, the prevalence of diabetic females was decreasing with increasing education among females. The prevalence of diabetes was higher among females from other castes than among SC, ST, and OBC caste females.

Table 2 revealed the odds ratio for diabetes among women by risk factors and socio demographic factors separately for rural and urban areas. Findings showed that rural women with hypertension were 1.56 (OR=1.56,

Table 2 : Estimates of the odds ratio for diabetes among women by their socio demographic characteristics

		Rural		Urban		Total	
		Odds ratio	CI at 95%	Odds ratio	CI at 95%	Odds ratio	CI at 95%
Hypertension	Normal ®						
	High	1.56***	1.49-1.62	1.66***	1.55-1.77	1.59***	1.54-1.65
Body mass index	Underweight ®						
	Normal	1.09***	1.04-1.15	1.19**	1.05-1.35	1.11***	1.06-1.16
	Overweight	1.76***	1.67-1.86	2.09***	1.83-2.38	1.84***	1.75-1.94
	Obese	2.73***	2.55-2.92	3.18***	2.77-3.65	2.85***	2.69-3.03
Waist to hip ratio	Normal ®						
	Higher	1.27***	1.23-1.31	1.34***	1.26-1.43	1.29***	1.25-1.33
Anaemia	Not anaemic ®						
	Anaemic	1.12***	1.08-1.16	1.11***	1.05-1.18	1.12***	1.09-1.15
Ever consumed tobacco	No ®						
	Yes	1.07*	1.00-1.14	0.96	0.83-1.11	1.04	0.98-1.11
Ever consumed alcohol	No ®						
	Yes	0.89*	0.79-0.99	0.85	0.58-1.24	0.87*	0.76-0.97
Diet	Healthy ®						
	Unhealthy	1.03	1.00-1.06	0.98	0.92-1.03	1.01	0.98-1.04
Age group	15-24 ®						
	25-39	1.78***	1.68-1.89	1.97***	1.73-2.23	1.82***	1.72-1.92
	40-49	3.57***	3.35-3.81	4.16***	3.65-4.75	3.71***	3.49-3.93
Wealth	Poor ®						
	Middle class	1.00	0.96-1.04	0.90	0.80-1.01	0.98	0.94-1.02
	Rich	1.02	0.98-1.07	0.96	0.86-1.06	1.01	0.97-1.04
Education	No schooling ®						
	<5 years	1.22***	1.14-1.31	1.29***	1.12-1.48	1.25***	1.17-1.33
	5-12 years	1.08***	1.04-1.13	1.01	0.94-1.10	1.07***	1.04-1.11
	>12 years	0.97	0.90-1.05	0.80***	0.72-0.89	0.89***	0.84-0.95
Marital status	Never married ®						
	Married	1.17***	1.10-1.26	1.13*	1.00-1.28	1.17***	1.10-1.25
	Others	1.31***	1.20-1.44	1.17	0.99-1.37	1.27***	1.17-1.38
Religion	Hindu ®						
	Muslim	1.05	0.99-1.12	0.90*	0.83-0.98	0.99	0.94-1.04
	Others	0.96	0.90-1.02	0.99	0.88-1.12	0.97	0.91-1.03
Caste	SC ®						
	ST	0.88***	0.83-0.93	0.96	0.83-1.11	0.90***	0.85-0.94
	OBC	1.02	0.98-1.06	1.09*	1.02-1.18	1.04*	1.00-1.08
	Others	1.09**	1.03-1.15	1.06	0.97-1.15	1.07**	1.02-1.12

Note: P values are denoted as follows: p-value<0.001 (***), p-value <0.01 (**), p-value <0.05 (*) Reference denoted as ®

Table 3 : Decomposition result of the diabetes prevalence gap between urban and rural women in India

	Coefficient	Standard Error	P-value	Lower CI at 95%	Upper CI at 95%	Percent Contribution
Hypertension	-0.00106	0.00006	0	-0.00118	-0.00094	-8.17
Body mass index	0.01121	0.00038	0	0.01046	0.01195	86.46
Waist to hip ratio	0.00098	0.00009	0	0.00080	0.00115	7.53
Anaemia	-0.00014	0.00004	0	-0.00021	-0.00006	-1.05
Ever consumed tobacco	-0.00006	0.00008	0.422	-0.00022	0.00009	-0.50
Ever consumed alcohol	0.00004	0.00007	0.543	-0.00010	0.00019	0.34
Diet	-0.00001	0.00003	0.682	-0.00007	0.00004	-0.09
Wealth	0.00353	0.00114	0.002	0.00130	0.00577	27.27
Education	-0.00372	0.00034	0	-0.00438	-0.00306	-28.68
Marital Status	0.00136	0.00009	0	0.00118	0.00153	10.48
Religion	-0.00012	0.00009	0.173	-0.00029	0.00005	-0.91
Caste	0.00038	0.00023	0.098	-0.00007	0.00084	2.96

CI=1.49-1.62) times more likely for being diagnosed as diabetic than non-hypertensive women residing in rural areas. Females living in urban areas were 1.66 (OR=1.66, CI=1.54-1.65) times more likely for being diagnosed as diabetic than the non-hypertensive women residing in urban areas. Overweight females were 1.76 (OR=1.76, CI=1.67-1.86) times more likely for being diagnosed as diabetic and obese females were 2.73 (OR=2.73, CI=2.55-2.92) times more likely for being diagnosed as diabetic than underweight females living in rural areas. Where overweight females were 2.09 (OR=2.09, CI=1.83-2.38) times more likely for being diagnosed as diabetic and obese females were 3.18 (OR=3.18, CI=2.77-3.65) times more likely for being diagnosed as diabetic than underweight females living in urban areas. Education among women shows that those with higher education had a lower risk of being diagnosed with diabetes (OR=0.97, CI=0.90- 1.05) compared to rural residents without education. Whereas education among urban women shows that those with greater education seemed less likely (OR=0.80, CI=0.72-0.89) than those with lower education for being diagnosed with diabetes. It is visible that women with a higher WHR were 1.27 (OR=1.27, CI=1.23-1.31) times more likely for being diagnosed as diabetic than women with normal WHR in rural areas. Where females with a higher WHR were 1.34 (OR=1.34, CI=1.26-1.43) times more likely for being diagnosed as diabetic than women with the normal WHR in urban areas. Females smoking tobacco were 1.07 (OR=1.07, CI=1.00-1.14) times more likely for being diagnosed as diabetic than non-smokers in rural areas. On the other hand, females smoking tobacco were (OR=0.96, CI=0.83-1.11) less likely for being diagnosed as diabetic than non-smokers living in urban areas.

Table 3 The findings of Fairlie's decomposition analysis reflect the percentage contribution of each of the covariates to the difference in the disease and risk between rural and urban women. The coefficient was given as a percentage to make the result more convenient to read. A covariate's positive contribution means that it contributed to increasing the diabetes disparity among female populations in rural and urban areas. The negative sign of the coefficient indicates that the particular factor contributes to reducing the diabetes disparity between rural and urban areas (Fairlie, 2005). The difference between the prevalence of diabetes in rural and urban areas can be mostly attributed to women's BMI status (86.46%). The gap between rural and urban diabetes prevalence was also significantly influenced by wealth (27.27%). Other important factors were marital status (10.48%), WHR (7.53%), hypertension (-8.17%), education (-28.68%), and caste (2.96%). Factors that contributed to the increase in inequality like marital status (10.48%), WHR (7.53%), caste (2.96%), consumption of alcohol (0.34%), etc. Results further found that anaemia, hypertension, diet, education, and religion are the factors that reduce the inequality between diabetes prevalence in rural and urban areas. In simpler words, it indicates that anaemia, hypertension, diet, education, and religion are the factors minimising the difference between women's diabetes prevalence in rural and urban areas. Further, the findings revealed that only having a good education account to reduce the gap for a major part (-28.68%) of the inequality between urban and rural diabetes prevalence.

Discussion:

The findings made it clear that urban areas had a substantially higher prevalence of diabetes than rural areas (Ceesay *et al*., 1997; Ramachandran *et al*., 2001). Women in urban areas are changing their lifestyles due to rapid urbanization, which is causing them to consume too much junk food and participate in too little exercise, which is the main driver for the increase in diabetes in urban areas (Ebrahim *et al.*, 2010; Green *et al.*, 2003). Another study found that compared to the population of rural areas, urban residents had a 1.15 times higher chance of developing a chronic disease (Jana and Chattopadhyay, 2022). Diabetic Indians are unaware of their condition (Murugesan *et al.*, 2007), and a great number of these people face the risk of not being detected properly (Joshi, 2015). The most at-risk are younger age groups (Claypool *et al.,* 2020).The results show that the country's expanding diabetes epidemic in urban areas was additionally a result of poor diets, the use of tobacco products, and sedentary lifestyles brought on by rapid urbanization (Ramachandran *et al.,* 1999; Zimmet, 2003). Additionally, the differences in socioeconomic status, risk factors, and the standard of healthcare facilities offered in rural and urban areas could account for the variations in diabetes prevalence within those two places (Kapil *et al.*, 2018; Singh *et al.*, 2012).

The results of our study revealed that participants with elevated blood pressure had a higher risk of developing diabetes than those with normal blood pressure. The odds of diabetes for hypertension were also higher in urban areas than in rural areas. Females with high blood pressure often have insulin resistance and are more likely to develop diabetes (Petrie *et al.*, 2018). Another study also described that diabetic people tend to have hypertension (De Boer *et al.*, 2017). This study highlighted that anaemia was an equally responsible risk factor for the odds of diabetes in rural and urban areas. Further study also shows that the chance of developing diabetes complications rises with anaemia (Thomas *et al.*, 2006).After looking at the result it was visible that WHR was another important indicator of developing diabetes among women, especially in urban areas though rural areas were not lagging. So it can be said that in terms of estimating diabetes risk, the WHR contributed significantly (Jafari-Koshki *et al.*, 2016).This study showed that a significant risk factor for diabetes was increasing age. The likelihood of having diabetes increases with age (Suastika *et al.*, 2012). That also applies to adults and teenagers, whose prevalence of diabetes has rapidly increased in recent years (Lascar *et al.,* 2018). Diabetes was more prevalent among uneducated women compared to educated women (Borrell *et al.,* 2006). Perhaps women with higher levels of education have a greater chance of being conscious of their diabetes condition. In rural areas, those with higher levels of education were less likely to get diabetes than those with no education. This was also clearly visible in urban areas. Prior studies also indicated an increased risk of diabetes among uneducated people compared to the higher-educated population (Rahmanian *et al.,* 2013; Robbins *et al.,* 2005). Here low levels of education were associated with a higher risk of diabetes mellitus (Krishnan *et al.*, 2010). It was found that widowed, divorced, and separated females were at an increased risk of diabetes (de Oliveira *et al.,* 2020), the reason behind it may be living single, lack of people for care, unhealthy lifestyle, psychological distress, etc. However, there was not much difference between marital status and the odds of diabetes in rural and urban areas. The regression analysis reveals that the likelihood of diabetes has been increased by having a higher BMI. High BMI that was categorized as overweight and obese females were at higher risk of diabetes in urban areas compared to rural areas. It became apparent that rising BMI values were associated with an increase in the prevalence of diabetes. This study clearly shows that obesity is an essential demographic risk factor for diabetes, which reflects the results of other studies from India (Hossain *et al.*, 2007; Nahar *et al.*, 2012). According to a prior study, there is no disparity among men and women in the association between BMI and diabetes prevalence, but it appears stronger in younger than other individuals (Boffetta *et al.,* 2011). According to the study, non-poor people were more likely than poor people to have diabetes diagnosed. The likelihood of diabetes based on wealth was almost similar for both rural and urban areas. It may be said that wealth equally contributes to diabetes in rural as well as urban areas. Previous research has also shown that those from the greatest wealth quintiles have a higher prevalence of diabetes (Tareque *et al*., 2015). Although the non-poor had higher odds of diabetes risk than the poor, the prevalence of the disease among women shows that diabetes is also very common among those who are poor (Bijlsma-Rutte *et al.,* 2018; Kim *et al.*, 2015; Tanaka *et al.,* 2012). Non-poor women have a tendency to adopt sedentary lifestyles, which increases

their chance of developing diabetes. Within Hindu, Muslim, and other religions diabetes was not much varied among women in this study. The caste of women was also a significant factor in this study. Women from the ST population had a lower risk of diabetes, whereas women from OBC and other populations had a relatively higher risk of diagnosing diabetes than women from the SC and ST populations.

The findings of the decomposition analysis provided greater clarity that BMI accounted for above four-fifths per cent of the gap in diabetes prevalence among women in rural and urban areas. Prior study has also shown that being overweight, particularly obese, especially in younger age groups, raises the lifetime risk of being diagnosed with diabetes significantly, While their impact on diabetes risk, life expectancy, and diabetes duration declines with age (Narayan *et al.*, 2007). Among other factors wealth, marital status, and WHR contributed to increase in the diabetes prevalence gap between rural and urban areas. Here this situation might be caused by wealth inequality. It is important to note that the education of women alone is responsible to reduce above one-fourth of the diabetes prevalence gap between rural and urban areas, education status variation between rural and urban areas may be a determining factor.

Conclusions:

The findings of the present study indicate that there is a substantial variation between the prevalence of diabetes in rural and urban areas. It is found that urban areas have a higher prevalence of diabetes among women, but rural areas are not far behind. The efforts of policymakers to address the vulnerability of women should be favoured in urban as well as in rural areas when designing programs for diabetes prevention and management. Since the prevalence of diabetes is high among uneducated females, practices must be identified for an uneducated female population to overcome the barrier. Public health initiatives should concentrate on risk factors that can be modified in order to slow the diabetes epidemic among this population. It is essential to promote healthy lifestyle choices, enhance accessibility to healthcare services and promote awareness about the importance of diabetes management and prevention. By implementing these measures, we can mitigate the impact of diabetes on the health and well-being of females in India and ultimately achieve better health outcomes for all. Additional research is required to determine the preferable array of services required to manage diabetes, in rural and urban settings because this trend may have an adverse effect on health outcomes.

Declarations :

Availability of data and materials*:* Data are available for download via the Demographic and Health Survey (DHS) data distribution system. ICF International owns the DHS website. Visit https://dhsprogram.com/ for additional information on accessing NFHS data.

Competing interests: The authors declare that they have no competing interests.

Funding: The authors did not receive any funding to carry out this research.

Authors' contribution: Both authors have equal contributions and approved the final manuscript.

Acknowledgement: We would like to thank the Demographic and Health Survey (NFHS) for providing the data.

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