

Original Research Article

Association of lifestyle factors and non-communicable diseases among patients attending the NCD clinic of a Government Health Facility in Rural Uttar Pradesh, India

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ABSTRACT

Background: Non-communicable diseases (NCDs) such as hypertension and diabetes are on the rise in rural India, largely driven by modifiable lifestyle factors. Rural populations, despite slower urbanization, are increasingly experiencing health transitions marked by physical inactivity, tobacco use, and obesity. Objective of this study was to assess the burden of non-communicable diseases and examine the association of anthropometric and lifestyle risk factors among patients attending the NCD Clinic at CHC Mohanlalganj, Lucknow.

Methods: A descriptive cross-sectional study was conducted among 273 patients aged ≥ 30 years attending the NCD Clinic at CHC Mohanlalganj from January to March 2025. Data were collected using a structured questionnaire and clinical assessment. Anthropometric indicators (BMI, waist circumference), behavioral factors (tobacco, alcohol, physical inactivity), and clinical markers (skin tags, acanthosis nigricans) were evaluated. Bivariate logistic regression was used to assess associations with hypertension and diabetes.

Results: The prevalence of hypertension and diabetes was 36.3% and 28.6%, respectively. Hypertension was significantly associated with older age ($p=0.002$). Participants with BMI ≥ 25 kg/m² had higher odds of hypertension (OR=3.418, $p=0.013$) and diabetes (OR=7.027, $p=0.010$). Raised waist circumference, tobacco use, alcohol intake, sedentary lifestyle, and family history were significantly associated with both conditions. Skin tags and acanthosis nigricans were also strong predictors of NCDs.

Conclusions: This study highlights the significant role of modifiable lifestyle factors and simple clinical markers in the rising burden of NCDs in rural India. Early screening, health education, and behaviour change interventions especially at the primary care level are essential to curb the growing NCD epidemic.

Keywords: Anthropometry, Diabetes, Hypertension, Lifestyle factors, Non-communicable diseases, Rural health, Obesity

INTRODUCTION

Obesity is a complex, multifactorial disease and a major public health concern that has reached epidemic proportions over the past 50 years. According to the WHO, overweight and obesity significantly increase the risk of non-communicable diseases (NCDs). In the last 45

years, global obesity rates have nearly tripled, with 1.9 billion adults classified as overweight and 650 million as obese.¹ Elevated BMI is a critical health issue worldwide, contributing to approximately 2.8 million deaths annually.²

India is a diverse nation currently undergoing an epidemiological health transition, marked by rapid

urbanization across many states.³ This urbanization has facilitated economic advancement, which in turn has contributed to increased food consumption, higher tobacco use, and reduced levels of physical activity.⁴ As a consequence of this economic shift, there has been a notable transition in the disease burden, shifting from predominantly communicable diseases to a rising prevalence of non-communicable diseases (NCDs).⁵ Despite rapid urbanization, two-thirds of the population still resides in rural areas, with limited healthcare access and high treatment costs for chronic conditions. The rising prevalence of non-communicable disease risk factors in rural India poses significant public health challenges.⁶

The primary risk factors contributing to the development of non-communicable diseases (NCDs) include tobacco use, alcohol consumption, physical inactivity, obesity, and elevated blood pressure.⁷ In India, successive studies indicate a rapid increase in obesity, with recent prevalence estimates exceeding 15%. Hypertension is a key modifiable risk factor for cardiovascular disease (CVD), accounting for 45% of heart disease deaths and 51% of stroke deaths globally. In India, it directly contributes to 57% of stroke deaths and 24% of coronary heart disease (CHD) deaths.⁸ The rise in obesity and hypertension is often attributed to the sedentary lifestyles and dietary changes associated with urbanization and modernization. However, limited research has explored the risk factors driving the growing prevalence in rural areas, where 70% of the population resides, and the pace of modernization has been comparatively slower.⁹

The WHO recommends the "STEPS" approach for monitoring common NCD risk factors across countries. This method collects core and expanded data on established risk factors through three assessment levels: risk factor history (Step 1), physical measurements (Step 2), and biochemical measurements (Step 3).¹⁰ Although the NFHS-5 data highlight the prevalence of overweight and obesity in Lucknow, there is a lack of comprehensive studies examining the association between obesity and multiple non-communicable diseases (NCDs) in rural areas. This study aims to assess the burden of obesity and investigate its relationship with NCDs among patients attending the NCD clinic at the Community Health Center (CHC) Mohanlalganj.

Objective of this study was to assess the anthropometric and lifestyle determinants of non-communicable diseases (NCDs) and examine their association among patients attending the NCD Clinic at CHC Mohanlalganj, Lucknow.

METHODS

Study design

The study was a descriptive cross-sectional study.

Study setting

NCD (non-communicable diseases) Clinic, CHC (community health centre) Mohanlalganj, Lucknow, Uttar Pradesh.

Study period

Study period was January 2025 to March 2025.

Study population

Patients aged 30 years and above attending the NCD Clinic during the study period.

Sample size and sampling

A total of 346 patients attended the NCD clinic during the study period. Of these, 273 patients met the eligibility criteria and provided informed consent to participate in the study. Purposive sampling was used to select participants based on inclusion and exclusion criteria.

Inclusion criteria

Age ≥ 30 years. Visited the NCD Clinic for screening or management of non-communicable diseases. Provided informed consent.

Exclusion criteria

Individuals with cognitive or communication impairments.

Data collection

Data were collected using a structured questionnaire covering demographic characteristics, behavioral risk factors, family history, and dermatological markers. Anthropometric and clinical measurements were also recorded.

Anthropometric measurements

Height (cm): Measured using a stadiometer, with the participant barefoot.

Weight (kg): Measured using a calibrated digital scale.

BMI (kg/m^2): Body Mass Index is calculated as weight in kilograms divided by height in meters squared. Categorized using WHO Asian-Pacific cutoffs.¹¹:

Underweight: $<18.5 \text{ kg}/\text{m}^2$

Normal: $18.5\text{--}22.9 \text{ kg}/\text{m}^2$

Overweight: $23\text{--}24.9 \text{ kg}/\text{m}^2$

Obese: ≥ 25 kg/m²

Waist circumference (cm): Measured at midpoint between rib cage and iliac crest. Cutoffs: >90 cm (males), >80 cm (females).¹²

Hip circumference (cm): Widest portion of buttocks.

Waist/hip ratio: Waist/hip circumference, ≥ 0.86 (females), ≥ 1.0 (males).¹²

Clinical parameters

Blood pressure: Measured after 5 min rest; hypertension defined as systolic ≥ 140 mmHg or diastolic ≥ 90 mmHg.¹³ Patients on antihypertensive medication were also considered hypertensive.

Blood sugar level: Fasting blood glucose ≥ 126 mg/dl indicated diabetes.¹³ Patients on antidiabetic medication were also considered diabetic.

Behavioral and lifestyle Factors: Information on smoking, alcohol, tobacco use, and sedentary lifestyle was collected through interviews.

Tobacco use: A participant is considered a current tobacco user if they have used tobacco in any form (gutka, khaini, paan with tobacco, or similar products) on a daily basis over the past six months.

Smoking: A participant is classified as a smoker if they have smoked in any form daily (e.g., cigarettes, bidis, or hookah) during the previous six months.

Alcohol consumption: A participant is considered a regular alcohol consumer if they have consumed alcoholic beverages (such as beer, wine, spirits, or country liquor) on 10 or more days per month, on average, over the past six months.⁶

Sedentary lifestyle: A participant is considered to have a sedentary lifestyle if they engage in less than 150 minutes of moderate physical activity per week.⁵

Family history: Participants reported family history of hypertension and diabetes.

Dermatological markers

Skin tags (ST): Two or more benign polyp-like growths in skin folds.¹⁴

Acanthosis Nigricans (AN): Symmetrical, hyperpigmented, velvety thickening of the skin on flexural areas (neck, axillae).¹⁵

RESULTS

The present study assessed the association between lifestyle factors and non-communicable diseases (NCDs) among 273 patients attending the NCD clinic of a government health facility in rural Uttar Pradesh, India.

The socio-demographic distribution revealed that the majority of participants were females (55.68%), with males accounting for 44.32%. Most participants belonged to rural areas (86.44%), and the highest proportion (34.4%) were in the 51–60 years age group.

Table 1: Distribution of participants by socio-demographic characteristics (n=273).

Variables		Age (in years)					Total (n=273)
		30-40 (n=47)	41-50 (n=65)	51-60 (n=94)	61-70 (n=50)	70+ (n=17)	
Gender	Male	21 (17.4%)	23 (19%)	40 (33.1%)	26 (9.1%)	11 (9.1%)	121 (44.32%)
	Female	26 (17.1%)	42 (27.6%)	54 (35.5%)	24 (15.8%)	6 (3.9%)	152 (55.68%)
Residency	Urban	7 (18.9%)	10 (27%)	12 (32.4%)	7 (18.9%)	1 (2.7%)	37 (13.56%)
	Rural	40 (16.9%)	55 (23.3%)	82 (34.7%)	43 (18.2 %)	16 (6.8%)	236 (86.44%)

Table 2 examined the gender- and age-wise distribution of hypertension and diabetes. Hypertension was observed in 36.3% of the participants, with a marginally higher prevalence among males (41.32%) compared to females (32.24%), though the difference was not statistically significant ($p=0.953$). The prevalence of hypertension increased significantly with age ($p=0.002$), rising from 23.4% in the 30–40 age group to 52% in the 61–70 age group. Diabetes was present in 28.6% of participants, with no significant gender ($p=0.143$) or age association ($p=0.726$). Co-occurrence of both hypertension and

diabetes was reported in 10.6% of participants, without statistically significant associations with either gender or age.

Table 3 presented the association of anthropometric indicators with NCDs using bivariate logistic regression. Participants with a BMI ≥ 25 kg/m² had significantly higher odds of hypertension (OR=3.418, $p=0.013$) and diabetes (OR=7.027, $p=0.010$). Similarly, those with raised waist circumference had significantly higher odds of both hypertension (OR=2.108, $p=0.011$) and diabetes

(OR=2.3, p=0.010). However, raised waist-to-hip ratio was not significantly associated with either condition.

Table 2: Gender- and age-wise distribution of patients with hypertension and diabetes.

Variables	Gender		P value	Age (in years)					P value
	Male (n=121)	Female (n=152)		30-40 (n=47)	41-50 (n=65)	51-60 (n=94)	61-70 (n=50)	70+ (n=17)	
Hypertensive	Yes (n=99, 50 36.30%)	49 (32.24%)	0.953	11 (23.40%)	19 (29.20%)	36 (38.40%)	26 (52.00%)	7 (41.10%)	0.002**
	No (n=174 71 63.70%)	103 (67.76%)		36 (76.60%)	46 (70.80%)	58 (61.60%)	24 (48.00%)	10 (58.90%)	
Diabetic	Yes (n=78, 40 28.60%)	38 (25.00%)	0.143	11 (23.40%)	20 (30.80%)	29 (30.90%)	15 (30.00%)	3 (17.60%)	0.726
	No (n=195 81 71.40%)	114 (75.00%)		36 (76.60%)	45 (69.20%)	65 (69.10%)	35 (70.00%)	14 (82.40%)	
Both hypertensive and diabetic	Yes (n=29, 15 10.60%)	14 (9.2%)	0.433	2 (4.3%)	4 (6.2%)	11 (11.7%)	10 (20.0%)	2 (11.8%)	.086
	No (n=244 106 89.40%)	138 (90.8%)		45 (95.7%)	61 (93.8%)	83 (88.3%)	40 (80.0%)	15 (88.2%)	

*Significant at p<0.05. **Significant at p<0.01. ***Significant at p<0.001

Table 3: Association of anthropometric indicators with hypertension and diabetes (n=273).

Variable	Hypertension OR (95 % CI)	P value	Diabetes OR (95 % CI)	P value	Hypertension and diabetes OR (95%CI)	P value
BMI	23–24.9 kg/m ² 2.226 (0.752, 6.591)	0.148	5.281 (1.092, 25.540)	0.038*	1.929 (0.191, 19.51)	0.578
	≥25 kg/m ² 3.418 (1.290, 9.058)	0.013*	7.027 (1.586, 31.141)	0.010*	5.062 (0.646, 39.658)	0.123
Raised waist circumference	2.108 (1.189, 3.737)	0.011*	2.3 (1.219, 4.34)	0.010*	7.157 (0.407, 125.776)	0.178
Raised waist to hip ratio	1.427 (0.869, 2.341)	0.16	1.376 (0.812, 2.329)	0.235	1.451 (0.669, 3.145)	0.346

*Significant at p<0.05. **Significant at p<0.01. ***Significant at p<0.001

Table 4: Association of lifestyle habits and other risk factors with hypertension and diabetes (n=273).

Variable	Hypertension OR (95 % CI)	P value	Diabetes OR (95 % CI)	P value	Hypertension and diabetes OR (95%CI)	P value
Smoking	2.023 (1.141, 3.585)	0.016*	2.135 (1.182, 3.857)	0.012*	3.714 (1.681, 8.207)	0.002**
Alcohol	1.811 (1.048, 3.128)	0.033*	2.031 (1.15, 3.587)	0.015*	3.436 (1.566, 7.539)	0.002**
Tobacco	1.843 (1.116, 3.044)	0.017*	2.243 (1.315, 3.827)	0.003**	2.222 (1.016, 4.859)	0.046*
Sedentary lifestyle	3.404 (2.019, 5.739)	<0.001***	2.03 (1.185, 3.479)	0.01*	4.820 (2.098, 11.072)	<0.001***
Family History	6.526 (3.512, 12.129)	<0.001***	28.44 (8.251, 98.059)	<0.001***	9.347 (3.097, 28.205)	<0.001***
≥ 2 Skin tags	4.041 (2.254, 7.243)	<0.001***	2.391 (1.332, 4.292)	0.0032**	3.000 (1.357, 6.633)	0.007**
Acanthosis Nigricans	2.469 (1.267, 4.809)	0.008**	2.712 (1.381, 5.324)	0.004**	2.877 (1.208, 6.854)	0.017*

*Significant at p<0.05. **Significant at p<0.01. ***Significant at p<0.001

Table 4 explored lifestyle habits and other risk factors in relation to hypertension and diabetes. Smoking was significantly associated with higher odds of hypertension (OR=2.023, $p=0.016$), diabetes (OR=2.135, $p=0.012$), and their coexistence (OR=3.714, $p=0.002$). Alcohol consumption and tobacco use were also significantly associated with both conditions. A sedentary lifestyle was a strong predictor for hypertension (OR=3.404, $p<0.001$), diabetes (OR=2.03, $p=0.01$), and their coexistence (OR=4.820, $p<0.001$).

Family history emerged as the strongest predictor, with extremely high odds for diabetes (OR=28.44, $p<0.001$), hypertension (OR=6.526, $p<0.001$), and both conditions together (OR=9.347, $p<0.001$). Skin markers like presence of ≥ 2 skin tags (OR=4.041 for hypertension, $p<0.001$; OR=2.391 for diabetes, $p=0.0032$) and acanthosis nigricans (OR=2.469 for hypertension, $p=0.008$; OR=2.712 for diabetes, $p=0.004$) were also significantly associated with increased odds of NCDs.

DISCUSSION

This study examined the association between lifestyle factors and non-communicable diseases (NCDs), specifically hypertension and diabetes, among 273 patients attending an NCD clinic in rural Uttar Pradesh. The findings highlight a substantial burden of NCDs in this rural population and emphasize the role of modifiable and non-modifiable risk factors.

Hypertension was present in 36.3% of participants, which is comparable to findings from rural India reported by Gupta et al where prevalence ranged between 30–40% depending on age and region.¹⁶ The current study showed that the prevalence of hypertension significantly increased with age ($p=0.002$), particularly among those aged 61–70 years (52%), corroborating the age-related rise in blood pressure observed in several Indian and global studies (Kearney et al, Anchala et al).¹⁷ Although males had a slightly higher prevalence (41.3%) compared to females (32.2%), the gender difference was not statistically significant ($p=0.953$), aligning with findings from Iyer et al, who observed narrowing gender gaps in hypertension prevalence in rural populations.¹⁸

Diabetes was observed in 28.6% of participants, with a slightly higher prevalence among males (33.1%) than females (25%), though not statistically significant ($p=0.143$). Similar prevalence rates have been reported in rural studies by Ramachandran et al suggesting that diabetes is no longer confined to urban populations.¹⁹ Interestingly, no significant association was observed between age and diabetes ($p=0.726$), which may reflect the rising incidence of early-onset type 2 diabetes linked to lifestyle transitions even in younger adults (Mohan et al).²⁰

Anthropometric indicators showed strong associations with both hypertension and diabetes. A BMI ≥ 25 kg/m²

significantly increased the odds of hypertension (OR=3.418, $p=0.013$) and diabetes (OR=7.027, $p=0.010$), consistent with reports by Misra et al that excess body weight is a primary driver of metabolic disorders in Indians. Raised waist circumference was also significantly associated with both hypertension (OR=2.108, $p=0.011$) and diabetes (OR=2.3, $p=0.010$), highlighting abdominal obesity as a key risk factor, as previously emphasized by Deepa et al.²¹ However, waist-to-hip ratio was not significantly associated, in line with findings by Snehalatha et al who noted its limited discriminatory power in South Asian populations.²²

Lifestyle habits were significantly associated with NCDs. Smoking doubled the odds of hypertension (OR=2.023, $p=0.016$) and diabetes (OR=2.135, $p=0.012$), and more than tripled the odds of their co-existence (OR=3.714, $p=0.002$). These findings echo results from Prabhakaran et al who emphasized tobacco as a significant cardiovascular and metabolic risk factor.²³ Alcohol consumption and smokeless tobacco use were similarly associated with increased odds of both conditions, reflecting patterns noted in rural Indian studies (Reddy et al).²⁴

Physical inactivity emerged as a potent risk factor, with sedentary individuals showing markedly higher odds of hypertension (OR=3.404, $p<0.001$), diabetes (OR=2.03, $p=0.01$), and their co-existence (OR=4.820, $p<0.001$). These findings are consistent with WHO reports and studies by Anjana et al which attribute increasing NCD prevalence to declining physical activity levels in both urban and rural India due to occupational and lifestyle shifts.^{25,26}

Family history of NCDs emerged as the strongest predictor in this study, with significantly elevated odds for diabetes (OR=28.44, $p<0.001$), hypertension (OR=6.526, $p<0.001$), and both (OR=9.347, $p<0.001$). These associations are consistent with findings by Ramachandran et al who reported strong hereditary links, particularly for diabetes in South Asians.¹⁹ The magnitude of these associations emphasizes the need for targeted screening and early interventions in individuals with positive family history.

Interestingly, clinical skin markers often underutilized in primary care were significantly associated with both hypertension and diabetes. The presence of ≥ 2 skin tags increased the odds of hypertension (OR=4.041, $p<0.001$) and diabetes (OR=2.391, $p=0.0032$), supporting findings by Verma et al who linked skin tags to insulin resistance and metabolic syndrome.²⁷ Acanthosis nigricans, a recognized dermatological marker of insulin resistance, was associated with higher odds of hypertension (OR=2.469, $p=0.008$) and diabetes (OR=2.712, $p=0.004$), consistent with observations by Joseph et al and Rao et al.^{28,29} These skin manifestations may serve as useful screening tools in low-resource rural settings where biochemical testing is less feasible.

CONCLUSION

This study underscores the multifactorial nature of NCD risk, with significant contributions from behavioural factors (tobacco, alcohol, sedentary lifestyle), anthropometry (high BMI and central obesity), hereditary predisposition, and clinical signs (skin tags, acanthosis). The findings support the urgent need for integrated, community-based interventions focused on lifestyle modification, early screening, and education, particularly in underserved rural areas. Involvement of frontline health workers, including ASHAs and ANMs, in promoting physical activity, tobacco cessation, and recognition of early risk indicators could be pivotal in reducing the NCD burden.

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