Original Article

Diabetes, hypertension, and other cardiovascular disease risk factors among adults in an urban underprivileged community in Bangalore city, India

David John[1], Avita R. Johnson[2], Farah N. Fathima[2], Rose Mundackal[2]

[1]*Department of General Surgery, Basingstoke and North Hampshire Hosptial, United Kingdom,* [2]*Department of Community Medicine, St Johns National Academy of Health Sciences, Bangalore, Karnataka, India*

Abstract

Aim: Diabetes and hypertension are major risk factors of cardiovascular disease, which is known to be the leading cause of global mortality in the world today. Studies have shown that the prevalence of these risk factors is on the rise, with the burden of diabetes alone increasing by 80% in the last two decades. Complications of diabetes and hypertension result in huge public health challenges for the country and catastrophic medical expenditures for families among the urban poor. Our study aims to estimate the prevalence of diabetes, hypertension, and other cardiovascular risk factors among adults in an urban underprivileged community of Bengaluru city. **Objectives and Methods:** A cross-sectional study was conducted over a period of 6 months where 2245 individuals aged 30 or older were interviewed using a structured interviewer-administered questionnaire used to capture sociodemographic details that assessed modifiable risk factors for diabetes and hypertension. Inclusion criteria for diabetes were considered if the random blood sugar reading was ≥200 mg/dL, whereas a diagnosis of hypertension was taken into consideration if the systolic blood pressure reading was ≥140 mmHg and/or diastolic blood pressure was ≥90 mmHg. **Results:** Among the 2245 participants that took part in the study, 15.5% were diabetics and 17.2% were hypertensive. There was a strong association of diabetes among consumers of alcohol, with more than one-third having a high prevalence of the disease (odds ratio (OR): 2.09, 95% confidence interval (95% CI): 1.1–3.9). More than half the population were consumers of junk food; the prevalence of diabetes in this group was 1.35 times higher than that in their counterparts (OR: 1.35, 95% CI: 1.0–1.8). A significant association of diabetes was also seen among those identified with central obesity (OR: 1.83, 95% CI: 1.4–2.5). One-third of the population who consumed alcohol were found to be diagnosed with hypertension (OR: 3.08, 95% CI: 1.6–5.9), and one-fifth of individuals who were regular consumers of junk food had a higher prevalence of hypertension (OR: 1.41, 95% CI: 1.1–1.8). A higher prevalence of hypertension was also seen among individuals with central obesity or a body mass index (BMI) of >30 (OR: 1.59, 95% CI: 1.2–2.1; OR: 1.92, 95% CI: 1.4–2.6). **Conclusion:** The findings from our study conducted in an urban underprivileged area of Bengaluru city shed light on the significant associations between diabetes and hypertension and various demographic and lifestyle factors. Specifically, male gender and lower educational status were found to have a significant association with diabetes, whereas being unmarried and having a high BMI status were strongly linked to hypertension. In addition, the study revealed that elderly individuals, alcohol consumers, junk food eaters, and those with central obesity demonstrated an increased risk for both diabetes and hypertension. By identifying these risk factors, targeted interventions can be developed to address the unique challenges faced by this vulnerable section of society. Strategies can be designed to raise awareness, encourage healthier lifestyle choices, and improve access to healthcare services to effectively prevent and manage diabetes and hypertension in this community.

Keywords: Adults in urban underprivileged area, cardiovascular disease risk factors, diabetes, hypertension, preventive measures

Address for correspondence: Dr. Farah N. Fathima, Department of Community Medicine, St Johns National Academy of Health Sciences, Bangalore - 560 034, Karnataka, India. E-mail: doc.farah@gmail.com

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Introduction

India is confronted with a formidable health challenge, earning the title of "diabetes capital of the world" due to the staggering number of over 50 million people afflicted with diabetes in the country.[1] In addition, a staggering 207 million adults suffer from hypertension, compounding the country's healthcare burden.[1] Both diabetes and hypertension represent major risk factors for cardiovascular disease (CVD), which remains the leading cause of global mortality.[2,3] The global INTERHEART study, encompassing 52 countries, has identified various modifiable risk factors associated with CVD, including hypertension, diabetes, abnormal lipids, abdominal obesity, psychosocial factors, lack of consumption of fruits and vegetables, alcohol intake, and lack of physical activity.[4]

Recent studies indicate a worrying trend, showcasing a substantial increase in the prevalence of these diseases. Deaths attributed to diabetes alone have doubled over the course of nearly three decades, attributed to a combination of genetic, physiological, environmental, and behavioral factors.[5,6] The complications arising from diabetes and hypertension pose significant public health challenges for the country and lead to catastrophic medical expenses for affected families.[3]

Among the most vulnerable are the urban poor, facing barriers in accessing quality healthcare. A lack of awareness, affordability, and social issues among this population exacerbate the risk factors for CVD.

Addressing these complex challenges and implementing effective preventive measures are crucial to alleviating the burden of diabetes, hypertension, and their associated complications. Thus, we conducted a research study to assess how prevalent diabetes, hypertension, and other cardiovascular risk factors are among adults in an underprivileged urban community in Bengaluru city. The results of this study will aid in creating specific interventions to reduce the impact of these health issues in communities with similar sociocultural backgrounds.

Materials and Methods

Study design and setting

This was a cross-sectional study conducted over a period of 6 months in the underprivileged area of Austin town, Bangalore, the urban field practice area of the Department of Community Health, St. John's Medical College, Bangalore, an urban health center of the medical college located in Austin Town. Sampling frame: Individuals aged 30 years and above were deemed eligible to be part of the study if they resided in the "Cement Line" area of Austin town for a minimum of 1 year prior to recruitment.

Sample size

The minimum sample size for this study was determined to be 182, based on a 13.7% prevalence of diabetes in India, as per the ICMR-INDIAB population-based study, with a 5% relative precision and 95% confidence level.[7] However, because this study was being conducted in the urban field practice area, we felt that no adult in this underprivileged community should miss the opportunity for screening and subsequent treatment if required. Therefore, a universal sampling technique was employed, and 2245 participants took part in this study.

Data collection

A team of female community health workers of the medical college's urban health center was trained for data collection. Training included how to obtain written informed consent and how to administer the questionnaire. Even though they were adept at checking blood pressure, recording height and weight, and using a glucometer for blood sugar estimation in the health center as well as in the community, they underwent a refresher training on how to perform these assessments. House-to-house visits were conducted. On explaining the purpose of the study and handing over the subject information sheet, written informed consent was obtained from all participants. To ensure privacy for the subject, a study tool was administered while measuring and assessing the variables. To include all subjects, two mop-up rounds were carried out for the subjects not available at home during the primary survey. At the end of the interview, subjects with high blood sugar, high blood pressure, or obesity were then referred to the medical college's urban health center for further evaluation and management.

Study tools

A structured interviewer-administered questionnaire was used to capture sociodemographic details which assessed various modifiable risk factors for diabetes and hypertension such as tobacco, alcohol, physical activity, dietary factors, overweight, and obesity as outlined in the INTERHEART study. This questionnaire was further face-validated by two experts in the field of non-communicable disease.

Measurement of outcome variables

Individuals were included in the diabetic population group if a random blood sugar reading of ≥200 mg/dL was obtained or if they self-reported being previously diagnosed with diabetes. Random blood sugar was estimated using a portable digital glucometer (Accu Chek Active 4 New-Gen kit).

Participants were considered to have hypertension if they self-reported being previously diagnosed with hypertension or if a systolic blood pressure reading of ≥140 mm Hg and/or diastolic blood pressure of ≥90 mmHg was recorded using a calibrated digital sphygmomanometer (Omron HEM 7124, a fully automatic digital blood pressure monitor). This was confirmed by taking two separate readings 15 min apart, with the patient sitting up and accordingly calculating the average systolic and diastolic blood pressure. Overweight and obesity were determined using Asian cutoffs of body mass index (BMI) of 23–24.9 and ≥25 kg/m^2, respectively. BMI was expressed as weight in kg per height in m^2.

Height was measured to the nearest 0.1 cm by using a portable stadiometer, and weight was recorded to the nearest 100 g by using a calibrated digital weighing scale. Central obesity was calculated with a cutoff waist circumference of ³90 cm for men and ³80 cm for women. The waist circumference was measured to the nearest 0.1 cm in the horizontal plane midway between the lowest rib and the iliac crest. This was carried out using non-stretchable tape.

Statistical analysis

The data were entered in Microsoft Excel and analyzed using IBM Statistical Package for Social Sciences version 20 (IBM SPSS Statistics for Windows, version XX (IBM Corp., Armonk, N.Y., USA)). Sociodemographic and CVD risk factors were described using frequencies and proportions, mean and standard deviation, and median and interquartile range. Chi-square test was used to associate each outcome variable with various independent covariates (sociodemographic factors, diet, physical activity, smoking, and alcohol consumption). Logistic regression analysis was done to calculate adjusted odds ratio (OR) and 95% confidence interval (95% CI) values. A *P*-value of <0.05 was considered statistically significant for all analyses.

Results

Out of the 2245 participants who took part in the study, the average age was determined to be 46.7 ± 12.9 years. The majority of the participants were married (78.8%), and the largest religious group was Hindu (59.7%), followed by Christians, accounting for just over a third of the participants (32.2%).

Regarding education, the median years of formal schooling were 8, with an interquartile range (IQR) of 5–10 years. Notably, 5.7% of the individuals had not received any formal education. However, a significant proportion (65.7%) of the participants had completed at least high-school education.

In terms of occupation, 65.7% of the individuals were homemakers, and 34.3% were gainfully employed.

An income-based classification was also utilized, with a cutoff of ≥Rs. 1407 per-capita monthly income for above poverty line (APL)/below poverty line (BPL). The results revealed that nearly all participants (94%) belonged to the BPL category [Table 1].

Table 1: Sociodemographic profile of the study participants

Variable	Category	*n* (%)
Age in completed years	Mean±SD	46.7±12.9
Marital status	Married	1769 (78.8)
	Single/Divorced/Widowed	476 (21.2)
Religion	Hindu	1341 (59.7)
	Christian	722 (32.2)
	Muslim	178 (7.9)
	Others	4 (0.2)
Years of formal education	Mean years of education±SD	7.7±4.1
	Median years of education (IQR)	8 (5,10)
Education categories	No formal schooling	128 (5.7)
	Up to primary	328 (14.6)
	Up to high school	1476 (65.7)
	Pre-university and College	313 (13.9)
Occupation	Gainfully employed	770 (34.3)
	At home (homemaker/unemployed)	1475 (65.7)
Socioeconomic classification (APL/BPL)	Above poverty line (APL)	134 (6)
	Below poverty line (BPL)	2111 (94)

Sociodemographic factors and disease risk

The occurrence of diabetes within the study population stood at 15.5%, and hypertension was observed at an overall prevalence of 17.2%. Notably, the proportion of males diagnosed with diabetes was higher (18.7%) [Table 2] compared to females, with an OR of 1.65 (95% CI: 1.2–2.3). In addition, a stronger association of diabetes was found among individuals aged 60 and above, with a prevalence of 27.6% [Table 2] and an OR of 2.35 (95% CI: 1.7–3.2) [Table 3]. Furthermore, individuals with an education level up to high school demonstrated a diabetes prevalence that was 1.68 times higher than those who received education beyond high school (OR: 1.68, 95% CI: 1.1–2.5).

The elderly population aged 60 and above exhibited a significantly higher association with hypertension, with an OR of 2.69 (95% CI: 2.0–3.6). Similarly, the unmarried segment of the population also demonstrated a notable association with hypertension, showing an OR of 1.73 (95% CI: 1.3–2.3) [Table 3].

Lifestyle risk factors and disease risk

There was a notable correlation between diabetes and alcohol consumption within 30 days of the interview, with more than one-third of the consumers [Table 4] showing a prevalence of the disease (OR: 2.09, 95% CI: 1.1–3.9). In addition, it was observed that over half of the population consumed junk food, and the prevalence of diabetes in this group was 1.35 times higher than in those who had not consumed any junk food in the week leading up to the interview (OR: 1.35, 95% CI: 1.0–1.8) [Table 3].

Furthermore, a significant association of diabetes was identified among individuals with central obesity (OR: 1.83, 95% CI: 1.4–2.5).

Among the population known to be consumers of alcohol, a significant portion, approximately one-third, was diagnosed with hypertension (OR: 3.08, 95% CI: 1.6–5.9). Similarly, among regular consumers of junk food, approximately one-fifth had a higher prevalence of hypertension compared to non-junk food eaters (OR: 1.41, 95% CI: 1.1–1.8). In addition, individuals with central obesity (BMI >30) showed a higher prevalence of hypertension (OR: 1.59, 95% CI: 1.2–2.1), and the same was observed for those with a BMI greater than 30 (OR: 1.92, 95% CI: 1.4–2.6) [Table 3].

However, there was no significant association of diabetes among unmarried individuals or those with high BMI readings. Similarly,

Table 2: Association between sociodemographic details with diabetes and hypertension

Variable	Category	Total *n* (%)	Diabetes Yes (*n*=347)	*P*	Hypertension Yes (*n*=386)	*P*
Gender	Male	572 (25.5%)	107 (18.7%)	0.013	84 (14.7%)	0.066
	Female	1673 (74.5)	240 (14.3%)		302 (18.1%)	
Age	<60 years	1832 (81.6%)	233 (12.7%)	0.000	242 (13.2%)	0.000
	≥60 years	413 (18.4%)	114 (27.6%)		144 (34.9%)	
Marital Status	Married	1769 (78.8%)	255 (14.4%)	0.008	242 (13.7%)	0.000
	Single/Divorced/Widowed	476 (21.2%)	92 (19.3%)		144 (30.3%)	
Education Category	Up to 10th std	1932 (86.1%)	317 (16.4%)	0.002	352 (18.2%)	0.001
	≥PUC	313 (13.9%)	30 (9.6%)		34 (10.9%)	
Occupation	Gainfully employed	770 (34.3%)	121 (15.7%)	0.807	111 (14.4%)	0.012
	Household work	1475 (65.7%)	226 (15.3%)		275 (18.6%)	
Socioeconomic Classification	APL	2111 (94.0%)	317 (15%)	0.022	337 (16%)	0.000
	BPL	134 (6.0%)	30 (22.4%)		49 (36.6%)	
Type of family	Nuclear	1534 (68.3%)	221 (14.4%)	0.043	233 (15.2%)	0.000
	Joint	711 (31.7%)	126 (17.7%)		153 (21.5%)	

*All percentages in the total column are "column percentages" and in the diabetes and hypertension column are "row percentages"

Table 3: Determinants of diabetes mellitus and hypertension (odds ratio) among the study participants

Variable	Diabetes mellitus		Hypertension	
	Unadjusted OR with 95% confidence interval	Adjusted OR with 95% confidence interval	Unadjusted OR with 95% confidence interval	Adjusted OR with 95% confidence interval
Male gender	1.37 (1.1–1.8)	**1.65 (1.2–2.3)**	0.78 (0.6–1.0)	1.06 (0.7–1.5)
Age ≥60 years	2.62 (2.0–3.4)	**2.35 (1.7–3.2)**	3.52 (2.8–4.5)	**2.69 (2.0–3.6)**
Unmarried	1.42 (1.1–1.9)	1.00 (0.7–1.4)	2.74 (2.2–3.5)	**1.73 (1.3–2.3)**
Up to high school	1.85 (1.2–2.7)	**1.68 (1.1–2.5)**	1.83 (1.3–2.7)	1.41 (0.9–2.1)
Below poverty line	1.63 (1.1–2.5)	0.99 (0.6–1.6	3.04 (2.1–4.4)	1.31 (0.8–2.0)
Joint family	1.3 (1.0–1.6)	1.01 (0.9–1.1)	1.53 (1.2–1.9)	0.98 (0.9–1.0)
Active tobacco consumption	2.12 (1.4–3.1)	1.54 (0.9–2.4)	1.63 (1.1–2.4)	1.27 (0.8–2.0)
Alcohol past 30 days	3.35 (1.9–5.9)	**2.09 (1.1–3.9)**	2.70 (1.5–4.8)	**3.08 (1.6–5.9)**
Salty food last week	0.69 (0.5–0.9)	0.75 (0.5–1.0)	0.77 (0.6–1.0)	0.88 (0.6–1.2)
Consumption of junk food last week	1.51 (1.2–1.9)	**1.35 (1.0–1.8)**	1.71 (1.4–2.2)	**1.41 (1.1–1.8)**
<150 min a week of physical activity	0.59 (0.5–0.8)	**0.65 (0.5–0.9)**	0.65 (0.5–0.8)	**0.68 (0.5–0.9)**
BMI ≥30	1.10 (0.8–1.4)	1.03 (0.8–1.4)	1.60 (1.3–2.0)	**1.59 (1.2–2.1)**
Central Obesity	1.41 (1.1–1.8)	**1.83 (1.4–2.5)**	2.04 (1.6–2.6)	**1.92 (1.4–2.6)**

***Bold=*P*≤0.05**

Table 4: Risk factors - diabetes and hypertension

Risk factors	Category	Total *n* (%)	Diabetes *n* (% of total)	*P*	Hypertension *n* (% of total)	*P*
Current Tobacco Consumption	Yes	142 (6.3%)	38 (26.8%)	0.000	35 (24.6%)	0.015
	No	2103 (93.7%)	309 (14.7%)		351 (16.7%)	
Consumed alcohol within the past 30 days	Yes	54 (2.4%)	20 (37.0%)	0.000	19 (35.2%)	0.000
	No	2191 (97.6%)	327 (14.9%)		367 (16.8%)	
Average no. of fruit and vegetable servings per day	0 (<1)	84 (3.7%)	16 (19%)	0.193	13 (15.5%)	0.053
	<4 (1–4)	2139 (95.3%)	325 (15.2%)		365 (17.1)	
	≥4	22 (1%)	347 (15.5%)		8 (36.4%)	
Per capita monthly consumption of oil	≤500 mL	329 (14.7%)	53 (16.1%)	0.723	69 (21%)	0.049
	>500 mL	1916 (85.3%)	294 (15.3%)		317 (16.5%)	
Consumption of salty foods in the last week	Yes	1900 (84.6%)	278 (14.6%)	0.011	315 (16.6%)	0.070
	No	345 (15.4%)	69 (20%)		71 (20.6%)	
Consumption of junk food in the last week	Yes	1303 (58%)	230 (17.7%)	0.001	264 (20.3%)	0.000
	No	942 (42%)	117 (12.4%)		122 (13%)	
Total strenuous activity per week (In minutes)	≥150	521 (23.2%)	111 (21.3%)	0.000	116 (22.3%)	0.000
	<150	1724 (76.8%)	236 (13.7%)		270 (15.7%)	
BMI	<30	1700 (75.7%)	258 (15.2%)	0.517	263 (15.5%)	0.000
	≥30	545 (24.3%)	89 (16.3%)		123 (22.6%)	
Central Obesity (Men >102/Women >88) In cm	Yes	1288 (57.4%)	223 (17.3%)	0.005	274 (21.3%)	0.000
	No	957 (42.6%)	124 (13%)		112 (11.7%)	

*All percentages in the total column are "column percentages" and in the diabetes and hypertension column are "row percentage there was no significant prevalence of hypertension among the male population or among those educated up to the high-school level. Furthermore, diabetes or hypertension was not significantly associated with individuals living below the poverty line, those belonging to joint families, active consumers of tobacco, or those known to be consumers of high-salt content in their diet.

Discussion

In urban underprivileged settings, non-modifiable risk factors play a significant role and are critical determinants of diabetes and hypertension. Our study revealed that men had a higher risk of developing diabetes, which could be attributed to the larger amounts of visceral fat deposition. This specific fat distribution is widely recognized to have a strong association with the development of diabetes.[8] Indeed, the findings reported by us align with another study that examined international age-standardized rates for diabetes. The data from various Asian populations indicated a slightly higher prevalence of diabetes among men compared to women. This consistent trend emphasizes the significance of gender-specific factors, such as visceral fat deposition, in contributing to the variation in diabetes prevalence between men and women in these populations.[9] Our study unveiled compelling evidence that advancing age, specifically beyond 60 years, significantly elevated the risk of diabetes by nearly twofold. Moreover, the same age group exhibited a substantial threefold increase in the risk of developing hypertension. These findings resonate with prior research conducted by Spinelli, R., Parrillo, L., Longo, and M. *et al*., wherein it was proposed that senescent cell accumulation, escalating with age, plays a key role in inducing and exacerbating diabetes. The process of aging itself contributes to arterial stiffening, which, in turn, leads to the development of isolated systolic hypertension. Furthermore, age-related dysregulation of neurohormonal and autonomic systems also emerges as a contributory factor in the pathogenesis of these conditions. Our study and the aforementioned research collectively accentuate the complex interplay of age-related factors in influencing the risk and progression of diabetes and hypertension.[10]

The association of diabetes in those aged above 60 in a Chinese population and a North East Indian rural population showed similar results to our study.[11,12] According to a study conducted in South India, the odds of developing hypertension for individuals aged above 60 were found to be more than 15 times higher than those below the age of 25.[13] In North-eastern India, a notable trend emerged where individuals with high-school education and beyond exhibited a higher prevalence of diabetes compared to the rest of the population. This finding suggests a link between diabetes prevalence and higher-affluent segments of Indian society, particularly in urban areas as opposed to rural regions. The association of diabetes with higher education levels in the population points to potential lifestyle and socioeconomic factors that may contribute to the disease's increased occurrence among more educated and urban populations in this region.[14] Similarly, the study conducted by Corsi *et al*. in 2019, utilizing data from the India National Family Health Survey, corroborated the findings mentioned earlier. The research demonstrated that individuals with higher levels of education and greater asset ownership had a higher proportion of diabetes, hypertension, and obesity.[13] In contrast, our research revealed an intriguing inverse relationship. We observed that individuals with a lower educational status had higher levels of diabetes. This discrepancy might be attributed to several factors, including the lack of awareness regarding disease risk factors and a potential failure to recognize the benefits of early treatment.

Unhealthy dietary habits have been consistently linked to the development of both diabetes and hypertension. The risk of these conditions escalates with increased consumption of junk food[15] as the high salt content in fast foods contributes to insulin resistance and elevated blood pressure.[14]

Furthermore, our research found that individuals with a BMI of ≥ 30 kg/m^2 were 1.5 times more likely to have hypertension. A similar study conducted on a rural population in Western India also demonstrated that higher BMI levels (>25 kg/m^2) correlated with an increased risk of hypertension. The accumulation of body fat, particularly in central regions, tends to intensify after middle age. Coupled with physical inactivity, this leads to reduced insulin sensitivity and decreased oxidation of fatty acids, making individuals more susceptible to diabetes and hypertension. Another study conducted in an urban area in China reported a significant association between diabetes and hypertension and central obesity.[16]

Physical exercise is known to be a protective factor against diabetes and hypertension as it improves endothelial function and shows beneficial changes in insulin sensitivity and inflammation.[17] The study conducted in rural south India revealed a strong association between decreased physical activity and hypertension. Conversely, our research results indicated that the prevalence of diabetes was high among individuals who engaged in more than 150 min of physical activity per week. This finding might be explained by the fact that these individuals were already diagnosed with diabetes and were advised by their doctors to participate in daily physical activity as part of their treatment regimen.

In our study population, the risk of developing diabetes was found to double, and the risk of hypertension was observed to triple among consumers of alcohol. Chronic alcohol usage is known to lead to impaired glucose metabolism, thereby increasing the likelihood of developing diabetes. However, interestingly, our study also revealed that moderate alcohol consumption may have a protective effect.

Regarding alcohol-induced hypertension, several mechanisms come into play. Chronic alcohol intake can disrupt the baroreceptor reflex, lead to increased activity of the renin-angiotensin-aldosterone system, and result in elevated cortisol and calcium levels. In addition, alcohol consumption may induce endothelial dysfunction and oxidative stress, further contributing to hypertension development.[18] The study conducted in rural China highlighted a clear association between alcohol consumption in men exceeding the recommended WHO levels and an increased risk of diabetes. Interestingly, the risk appeared to be higher if the initiation of alcohol consumption occurred early in life. However, no clear association between alcohol consumption and diabetes was found in women[19] This suggests that the impact of alcohol on diabetes risk may vary between genders and could be influenced by factors such as drinking patterns, duration, and age of initiation. In another study conducted in a rural block district of Tamil Nadu, India, a significant association was observed between hypertension and consumption of alcohol.[20] This finding further emphasizes the potential link between alcohol consumption and hypertension risk, particularly in rural populations. The impact of alcohol on diabetes risk may vary between genders and could be influenced by factors such as drinking patterns, duration, and age of initiation.

Prevention and control interventions form an integral part of the National Program for Prevention of Cancer, Diabetes, Cardiovascular Diseases, and Stroke [NCPDCS].[5] Health promotion strategies play a critical role in addressing non-communicable diseases (NCDs). Creating awareness and educating communities about adopting a healthy lifestyle is vital. It is recommended that all individuals above the age of 30 undergo screening for NCDs to facilitate early detection and intervention. To support these efforts, counselors are recruited at the district and community health center levels to provide health promotion and counseling services. Public health systems must organize regular NCD screenings, with a particular focus on the male population due to the higher burden of these diseases among men. Educating the general public about the existing risk factors for NCDs is crucial to empower individuals to make informed health choices.

The increasing proportion of elderly individuals in the country, as a result of advancements in healthcare and public health initiatives, adds stress to the government to address the rising prevalence of metabolic diseases in this population. Incorporating teaching sessions on the prevalence of diabetes and its harmful effects into the school curriculum can create a broader awareness of the disease and its impact on public health.

Challenges such as lack of affordability and accessibility to healthcare, along with high costs of fresh fruits and vegetables, lead to unhealthy dietary habits among the study population, resulting in increased consumption of high-energy dense junk foods. To combat the prevalence of obesity, public health systems should develop strategies that include community worker-led health education visits, systematic screening programs, and identifying individuals at risk of nutritional issues. In addition, using waist circumference as a marker of obesity alongside BMI during health inspections and community clinics has been shown to be more effective in tackling metabolic diseases.

Limitations

Despite its significance, the study has some limitations, including data collection during working hours, which distorted gender representation in the study.

According to the 2020 International Society of Hypertension Global Hypertension Practice Guidelines, the diagnosis of hypertension is typically based on multiple blood pressure measurements. It is recommended that hypertension be diagnosed if a person's systolic blood pressure in a clinical setting is ≥140 mmHg and/or their diastolic blood pressure is ≥90 mmHg, following repeated examinations. Ideally, the diagnosis should not rely on a single office visit, but rather on 2–3 office visits at 1–4-week intervals to confirm the diagnosis of hypertension.[21] Due to logistical constraints and the specific scope of our research, we used two readings on the same day for hypertension diagnosis.

Furthermore, the study only considered alcohol consumption in a general sense, without specific quantity details, and it did not capture information on known consumers versus non-consumers. Addressing these limitations and integrating comprehensive health promotion strategies can lead to more effective interventions and improved public health outcomes in managing NCDs.

Conclusion

Our study conducted in an urban underprivileged area of Bengaluru city unveiled significant associations between diabetes and hypertension and various demographic and lifestyle factors. Specifically, male gender and lower educational status were strongly linked to diabetes, whereas being unmarried and having a high BMI status were found to be associated with hypertension. In addition, elderly individuals, alcohol consumers, junk food eaters, and those with central obesity demonstrated an increased risk for both diabetes and hypertension.

Based on these compelling findings, it is imperative to devise a tailored health education program aimed at this section of society. The program should focus on creating awareness about the risk factors of diabetes and hypertension and promoting lifestyle modifications to mitigate these risks effectively. Furthermore, enhancing accessibility to comprehensive screening facilities will facilitate early detection and timely management of these chronic conditions.

By implementing targeted interventions and empowering individuals with knowledge and resources, we can work toward alleviating the burden of diabetes and hypertension in urban underprivileged populations worldwide. These efforts hold the potential to foster better health outcomes and enhance the overall well-being of this vulnerable community.

Recommendations

Based on the broad and updated data from this study, several recommendations can be made to address the risk factors of diabetes and hypertension among the underprivileged urban population:

1. Public awareness campaigns: Health and government systems should undertake targeted public awareness campaigns to educate the population about the risk factors of diabetes and hypertension. Utilizing various mediums such as television advertisements and banners in public spaces can be an effective way to reach this section of society and raise awareness about the importance of healthy lifestyle choices.
2. Learn from successful campaigns: Taking inspiration from successful public health campaigns, such as the Pulse Polio Campaign in India, can provide valuable insights into designing impactful initiatives. Tele advertisements and banners can play a significant role in encouraging behavioral changes and promoting healthier habits.
3. Cost reduction of fresh fruits and vegetables: Access to fresh fruits and vegetables can be improved by initiatives that reduce their cost. This can be achieved through partnerships with local farmers, subsidies, or establishing community gardens, making these nutritious options more affordable and accessible to the underprivileged population.
4. Health education programs: Implementing comprehensive health education programs within the community can provide individuals with the knowledge and tools to prevent and manage diabetes and hypertension effectively. These programs can focus on lifestyle modifications, diet, physical activity, and regular health screenings.
5. Collaboration with community organizations: Collaborating with local community organizations and NGOs can help reach a wider audience and ensure the delivery of targeted health interventions to those in need.
6. Government support: Policy-level interventions and support from the government are crucial in tackling the prevalence of diabetes and hypertension. This can include enacting regulations on junk food advertising, implementing health promotion policies, and allocating resources for screening and treatment programs.

By implementing these recommendations, we can work toward reducing the burden of diabetes and hypertension in the underprivileged urban population and improve the overall health and well-being of this vulnerable section of society.

Consent

Informed written consent was obtained from all the participants.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Gupta R, Gaur K, S Ram CV. Emerging trends in hypertension epidemiology in India. J Hum Hypertens 2019;33:575-87.
2. Non-communicable Diseases | National Health Portal of India. Available from: https://www.nhp.gov.in/healthlyliving/ncd2019. [Last accessed on 2022 Jul 20].
3. Heart Disease and Stroke | Healthy People 2020. Available from: https://www.healthypeople.gov/2020/topics-objectives/topic/heart-disease-and-stroke. [Last accessed on 2022 Jul 20].
4. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, *et al*. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. Lancet 2004;364:937-52.
5. Khan MA, Hashim MJ, King JK, Govender RD, Mustafa H, Al Kaabi J. Epidemiology of type 2 diabetes - Global burden of disease and forecasted trends. J Epidemiol Glob Health 2020;10:107-11.
6. The India State-Level Disease Burden Initiative - Public Health Foundation of India. Available from: https://phfi.org/the-work/research/the-india-state-level-disease-burden-initiative/. [Last accessed on 2022 Jul 20].
7. Anjana RM, Deepa M, Pradeepa R, Mahanta J, Narain K, Das HK, *et al*. Prevalence of diabetes and prediabetes in 15 states of India: Results from the ICMR-INDIAB population-based cross-sectional study. Lancet Diabetes Endocrinol 2017;5:585-96.
8. Nordström A, Hadrévi J, Olsson T, Franks PW, Nordström P. Higher prevalence of type 2 diabetes in men than in women is associated with differences in visceral fat mass. J Clin Endocrinol Metab 2016;101:3740-6.
9. Huebschmann AG, Huxley RR, Kohrt WM, Zeitler P, Regensteiner JG, Reusch JEB. Sex differences in the burden of type 2 diabetes and cardiovascular risk across the life course. Diabetologia 2019;62:1761-72.
10. Spinelli R, Parrillo L, Longo M, Florese P, Desiderio A, Zatterale F, *et al*. Molecular basis of ageing in chronic metabolic diseases. J Endocrinol Invest 2020;43:1373-89.
11. Wang Q, Zhang X, Fang L, Guan Q, Guan L, Li Q. Prevalence, awareness, treatment and control of diabetes mellitus among middle-aged and elderly people in a rural Chinese population: A cross-sectional study. PLoS One 2018;13:e0198343.
12. Medhi GK, Dutta G, Borah P, Lyngdoh M, Sarma A. Prevalence of diabetes and its relationship with body mass index among elderly people in a rural area of northeastern state of India. Cureus 2021;13:e12747.
13. Corsi DJ, Subramanian SV. Socioeconomic gradients and distribution of diabetes, hypertension, and obesity in India. JAMA Netw Open 2019;2:e190411.
14. Singh M, Kotwal A, Mittal C, Babu SR, Bharti S, Ram CVS. Prevalence and correlates of hypertension in a semi-rural population of Southern India. J Hum Hypertens 2017;32:66-74.
15. Sami W, Ansari T, Butt NS, Hamid MRA. Effect of diet on type 2 diabetes mellitus: A review. Int J Health Sci (Qassim) 2017;11:65-71.
16. Zhang P, Wang R, Gao C, Jiang L, Lv X, Song Y, *et al*. Prevalence of central obesity among adults with normal BMI and its association with metabolic diseases in northeast China. PLoS One 2016;11:e0160402.

17. Gao J, Pan X, Li G, Chatterjee E, Xiao J. Physical exercise protects against endothelial dysfunction in cardiovascular and metabolic diseases. J Cardiovasc Transl Res 2022;15:604-20.
18. Husain K, Ansari RA, Ferder L. Alcohol-induced hypertension: Mechanism and prevention. World J Cardiol 2014;6:245-52.
19. Wu X, Liu X, Liao W, Kang N, Dong X, Abdulai T, *et al*. Prevalence and characteristics of alcohol consumption and risk of type 2 diabetes mellitus in rural China. BMC Public Health 2021;21:1644.
20. Oommen AM, Abraham VJ, George K, Jose VJ. Prevalence of risk factors for non-communicable diseases in rural & urban Tamil Nadu. Indian J Med Res 2016;144:460-71.
21. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, *et al*. 2020 International society of hypertension global hypertension practice guidelines. Hypertension 2020;75:1334-57. doi: 10.1161/HYPERTENSIONAHA.120.15026.