Urban–rural disparities in blood pressure and lifestyle risk factors of hypertension among Indian individuals

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Abstract

Objectives: This study aims to assess the urban–rural difference in prevalence of hypertension (HT) and to explore the disparities in lifestyle risk factors of HT among urban and rural individuals aged 15–49 years in India. Study Design: The cross-sectional data collected as a part of the fourth round of National Family Health Survey (NFHS-4) was analysed in this observational study. NFHS-4 was conducted between January 2015 and December 2016 amongst men aged 15–54 years and women aged 15–49 years. In order to maintain uniformity, age group of 15–49 years was considered. Descriptive analyses were performed for sociodemographic and lifestyle factors. Binary logistic regression was conducted to assess the predictors of HT in men and women in urban and rural settings. The presence of HT was considered as the outcome variable. Results: The overall age adjusted prevalence of HT was 17.2% and was greater in urban (18.3%) than in rural population (15.5%). The age adjusted prevalence was also higher in males (18.2%) as compared to females (16.1%). Age and wealth were associated with HT in both urban and rural population. Education and dietary habits played a role in all except rural men. Alcohol consumption, diabetic status and marital status were significantly associated with HT in both urban and rural women. Occupation was associated with HT only in urban women. Conclusions: The study has shown higher HT prevalence in urban areas despite higher prevalence of lifestyle risk factors in rural settings. This calls for more robust screening and health education in the entire population, especially in rural areas.

Keywords: Blood pressure, hypertension, NFHS-4, risk factors

Introduction

Hypertension (HT) is a major noncommunicable disease (NCD) and preventable risk factor for cardiovascular diseases (CVDs) around the globe.[1] Global Burden of Hypertension Survey shows that HTN (in India) accounts for 32% of adult deaths and around 39 million Disability Adjusted Life Years in the year

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HT is associated with 9.5 million deaths worldwide. A sharp increase in HT prevalence from 23.8% in 2000 to 31.5% in 2010 was recorded amongst low- and middle-income countries (LMICs), despite recognition of HT as a risk factor for CVD, robust screening mechanisms and availability of inexpensive treatment. This may be attributed to rapid transition in demographics, environment and lifestyle.[3]

The Sustainable Development Goal targets for NCD include the reduction of prevalence of HT by 25% between 2010 and 2025[9], and India, as a developing nation, aims one-third reduction in the premature deaths due to NCDs by 2030. A National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke was launched by the Ministry of Health and Family Welfare, Govt. of India in 2010 and a component of population-based screening was added subsequently for achieving the committed targets. With age standardization, HT was higher in males (31.9%) than females (30.1%). Likewise, HTN is 31.9% in LMICs compared to 28.5% in high-income countries.[8]

The Prospective Urban Rural Epidemiology study conducted between 2003 and 2009 included 153,996 adults aged 35–70 years from 17 countries compared HT prevalence between rural–urban populations. The study found that awareness, treatment and control of HT were higher in urban than in rural populations in low-income countries. Pointers representing human resource development and infrastructure were developed to understand the rural–urban disparity. The proportion of hypertensive patients with controlled blood pressure was higher in urban areas in all countries invariably.[6]

A study by Daştan İ, Erem A and Çetinkaya V found that factors like age, obesity, diabetes mellitus, hyperlipidemia, alcohol intake and smoking were associated with HT regardless of the residential area (urban and rural). However, rural–urban differences were significant in the factors like marital status, occupation, mental health, diet and physical activity.[7]

Studies on urban rural disparities with respect to lifestyle factors have been conducted only on regional levels and the findings vary between the studies. Urbanization has been shown to cause a higher prevalence of risk factors of NCDs among women than men.[8] Rural to urban migration have shown to increase the prevalence of obesity, blood pressure, lipid and fasting glucose levels only in men.[9] Altered diets and diminished physical activity partly increase the conventional CVD risk factors in urban middle class men.[10] The current study attempts to assess the urban–rural disparities in HT prevalence and lifestyle risk factors of HT, using nationally representative data in India.

**Methods**

The data collected in one of the Demographic and Health Surveys (DHS), that is, National Family Health Survey 4 (NFHS-4), conducted between January 20, 2015 and December 4, 2016 across all 29 states and 7 union territories was used for the present study. NFHS 4 was led by the Indian Institute of population sciences, under Ministry of Health and Family Welfare, with technical guidance from ICF International. The survey is illustrative at the district, state and national levels. NFHS-4 followed a two-stage stratified random sampling approach by allotting primary sampling units and households in the first and second stage, respectively. Any respondent unavailable at the visits was tried to be contacted for a maximum of three times. The survey included men of 15–54 years and women of 15–49 years considering a 5-year spousal age gap. However, during analysis, men and women aged 15–49 years were taken to maintain uniformity in the age range.

The biomarker questionnaire collected details on blood pressure, which included three BP readings. The respondents were also asked if they had ever got their blood pressure measured before, if they had been diagnosed with HT previously and/or if they were taking any prescribed medicine for the same. The survey used a standardized field procedure for measuring biomarkers, questionnaires to provide high-quality data and ensure comparability across the country. The respondents’ arm circumference was measured to select an appropriate blood pressure monitor cuff size. Blood pressure readings were recorded thrice using the BP monitoring device OMRON. The first reading was made null and void, and the average of second and third readings was considered. If only two readings were available, the second was considered and if only single reading was available, the same was considered.

**Ethical approval**

This study is limited to publicly available, deidentified data collected as part of periodic surveillance. The study was ethically approved by the Institute’s Ethical Committee, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh (PGI/IEC/2019/002357).

**Statistical analysis**

SPSS licensed version 21.0 was used to perform the statistical analyses. The outcome of this study was the presence of HT. Hence, regression analysis was conducted only on those had either been diagnosed with HT previously (Q318) or taking prescribed antihypertensive medications (Q319) or had systolic reading of >139 mm Hg or diastolic reading >89 mm Hg (Q329–335). As shown in Figure 1, out of a total of 103,525 men and 699,686 women interviewed, 100,449 men and 687,246 women have been diagnosed with HT previously and/or they were taking prescribed medicine for the same. However, during analysis, men and women aged 15–49 years considering a 5-year spousal age gap. However, during analysis, men and women aged 15–49 years were taken to maintain uniformity in the age range.

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by gender and by urban–rural settings (urban–male, urban–female, rural–male, rural–female). Chi-square test was used to measure the association, with a P value of 0.05 and lesser was considered to be significant. Odds ratios were estimated with a 95% confidence interval.

**Dependent Variable:**

HT was considered as a dichotomous variable for persons aged between 15 and 49 years, normotensive = 0 and hypertensive = 1.

**Explanatory Variables:**

Predictors were chosen based on existing scientific evidence of their effects on HT.

1. **Sociodemographic variables:** age in 10-year groups (Q103), gender, type of place of residence (urban and rural), marital status (unmarried, married, formerly married) (Q213), caste (belonging to Scheduled caste, Scheduled Tribe, Other Backward Class and others (Q117), religion (Hindu, Muslim, Christian, Sikh, Buddhist, Sikh, Jain, Jewish, Parsi, no religion and others) (Q116); education (No education, primary education, secondary and higher education) (Q108), wealth quintile (poorest, poorer, middle, richer and richest) were included. The wealth index was calculated based on the assets and utilization of 33 utilities which show the standard of living. Occupation groups (Q123) were not included in the analyses owing to a large number of missing data.

2. **Lifestyle factors of HT:** presence of diabetes mellitus (Q622a), exposure to secondhand smoke, tobacco use, various forms of tobacco usage (cigarettes, bidi, pipe, hookah, chewing tobacco, snuff, cigars, khaini, gurka, pan and others) (Q604–614) frequency of alcohol consumption (Everyday, once a week, less than once a week and never), type of alcohol consumed (tadi madi, country liquor, beer, wine, hard liquor and others) (Q615–617), frequency of intake of milk/cord, pulse/beans, green leafy vegetables, fruits, eggs, fish, chicken/meat, fried foods, aerated drinks (never, daily, weekly and occasionally) (Q626a–i) besides screening for HT (Q317), oral cavity (Q627), cervical and breast cancers were included in the analyses. Dietary intake of any food item was considered frequent if the consumption was daily or weekly and infrequent if consumption was occasional or never.

**Results**

The study included a total of 803,211 participants, with 87% women and 13% men. Of them, 70% were rural residents and 30% belonged to urban areas. The overall age-adjusted prevalence of HT was 17.2%; it was higher in urban (18.3%) than in rural (15.5%) populations and in males (18.2%) as compared to females (16.1%). Figure 2 shows the spatial distribution of HT prevalence across the states of India. The prevalence of HT was found to be higher in the states of Haryana (32.25%) and Tamil Nadu (32.12%) in urban population, and in case of rural population, the prevalence of HT was found to be higher in the states of Sikkim (28.1%) and Tamil Nadu (27.8%).

Table 1 shows the sociodemographic characteristics of the study sample by urban–rural location. Around 60% of the participants belonged to lower socioeconomic status (poorest, poorer and middle wealth quintile), 70% were married, 50% reported to have attained secondary education and 74% practiced Hinduism.

Table 2 shows the distribution of exposure to established lifestyle risk factors of HT in the sample population by urbanity.
Around 97% of the sample population claimed that they did not suffer from diabetes mellitus, 60% had been screened for HT at least once, 12% of the sample population had an oral cavity examination at least once previously, and merely 9% of women had breast examination and 21% had a cervical examination, previously. About 85% of the population claimed not to use tobacco and 94% claimed not to consume alcohol. Exposure to secondary smoke was present in 52% of the sample population. Prevalence of diabetes and screening for HTN, oral, breast and cervical cancers was significantly higher in urban population.

About 65, 87 and 82% consumed milk/curd, pulses/beans and green leafy vegetables frequently, whereas only 43, 38 and 30% consumed fruits, eggs and fish/chicken/meat often, respectively. About 45% consumed fried foods and 25% consumed aerated drinks frequently. Urban population was noted to have significantly higher proportion of consuming all the mentioned food items.

Table 3 shows the statistical association between lifestyle factors, dietary habits, alcohol, tobacco consumption and type of residence (urban, rural) in both male and female populations. A statistically significant association was also observed between the place of residence and most factors, including the previous diagnosis of diabetes, previous screening for HT, exposure to secondary smoke, last oral cavity examination, tobacco and alcohol consumption, dietary intake of milk/curd, pulses/beans, green leafy vegetables, fruits, egg, fish, chicken, fried foods and aerated drinks. There was a significant association between distribution of sociodemographic characteristics like age group, wealth quintile, religion, caste, marital status and occupation in both male and female populations. Having had breast and cervical examinations were also significantly associated with place of residence in females.

Binary logistic regression analyses were performed with HTN as a dependent variable and sociodemographic profile, lifestyle factors including dietary behaviours as independent variables to assess variations in the determinants of HTN between urban–rural populations. Table 4 show the results of binary logistic regression analyses in the urban and rural settings.

Variates like wealth index [OR 1.12 (1.05,1.21)], education[OR 0.88 (0.81,0.95)], caste [OR 0.93 (0.87,0.99)] and oral screening[OR 1.13 (1.03,1.24)] were significant predictors of HT in urban men in addition to the consumption of milk/curd [OR (0.85 (0.73,0.99)], chicken[OR 0.85 (0.74,0.98)] and aerated drinks[OR 1.09 (1.03,1.18)].
Venkatesh, et al.: Urban–rural disparities in blood pressure among Indian individuals

A study conducted by Zhang Y. and Moran (2007, 2010) showed that the prevalence of HTN varies between male and female population, more so with urban and rural settings. This study also showed that the weighted prevalence of HTN in China was 18.3% in urban areas (15.5%). The increasing prevalence of HTN in India based on the study findings could be partially attributed to acculturation along with rapid and uncontrolled urbanization which brings along environmental risk factors and poor sanitation. The level of urbanization in India increased to 31.1% in 2011 from 27.7% in 2001, which has led to drastic changes in land cover, resulting in a sprawl that lacks basic amenities, more often than not.

Urbanization with a different pattern of occupation endorses a more sedentary lifestyle, which increases the occurrence of HTN globally. Various factors including age, gender, lifestyle and degree of urbanization affect the prevalence of HTN. This study provides the prevalence of HT across urban–rural populations in India and assesses associated sociodemographic and lifestyle factors, based on data from NFHS-4 (2015–2016).

HTN was found in over 17% of the Indian population aged 15–49 years. The age-adjusted prevalence of HTN was relatively higher in urban (18.3%) than in rural areas (15.5%). The increasing prevalence of HTN in India based on the study findings could be partially attributed to acculturation along with rapid and uncontrolled urbanization which brings along environmental risk factors and poor sanitation. The level of urbanization in India increased to 31.1% in 2011 from 27.7% in 2001, which has led to the drastic changes in land cover, resulting in a sprawl that lacks basic amenities, more often than not.

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Dietary consumption of milk [OR 0.906 (0.837, 0.981)] pulses/beans [OR 0.77 (0.6, 0.99)], chicken/meat [OR 1.32 (1.06, 1.63)] and fried foods [OR 0.81 (0.74, 0.89)] were significantly higher in rural female population.

### Discussion

HTN is emerging as a global public health in the developing economies including India and accounts for 9.5 million deaths globally.[12] Various factors including age, gender, lifestyle and degree of urbanization affect the prevalence of HTN. This study provides the prevalence of HT across urban–rural populations in India and assesses associated sociodemographic and lifestyle factors, based on data from NFHS-4 (2015–2016).

Further, increased levels of awareness coupled with increased access to health services in urban areas might have led to higher detection of HT cases in urban population. This re-emphasizes the need for aggressive community-based screening and health education focusing on rural population.[13]

This study showed that the odds of having HT increased with age more among urban women than men. Further, the odds of having HT increased by three times and six times in women belonging to 30–39 and 40–49 years of age, respectively. The odds of having HT increased with age in both rural men and women. Previous studies have clearly established age and gender as factors explaining the variations in HT prevalence both in rural and urban settings.[14] It is well established that prevalence of HT varies between male and female population, more so with advancing age.[15,18] A study conducted by Zhang Y. and Moran A.E. showed that the weighted prevalence of HT in China was higher in men (24.5%) than in women (21.9%) both in rural and urban settings.[18] The Seventh Report of the Joint National

### Table 1: Sociodemographic characteristics of sample population by urbanity, National Family Health Survey, 2015-2016

| Variable | Urban (n, %) | Rural (n, %) | Total (n, %) |
|----------|-------------|-------------|-------------|
| Hypertension | | | |
| No | 186,830 (78.66) | 469,656 (83.02) | 656,486 (81.55) |
| Yes | 43,523 (18.33) | 87,686 (15.5) | 131,209 (16.3) |
| No response | 7,153 (3.01) | 8,363 (1.48) | 15,516 (1.93) |
| Gender | | | |
| Male | 32,771 (13.8) | 70,754 (12.5) | 103,525 (12.9) |
| Female | 204,735 (86.2) | 495,951 (87.5) | 699,686 (87.1) |
| Age group in years | | | |
| 15-19 | 39,067 (16.45) | 104,893 (18.54) | 143,960 (17.88) |
| 20-29 | 79,671 (33.54) | 191,141 (33.79) | 270,812 (33.64) |
| 30-39 | 66,171 (27.86) | 149,847 (26.83) | 216,018 (26.83) |
| 40-49 | 52,597 (22.2) | 119,824 (21.18) | 172,421 (21.4) |
| Education | | | |
| No education | 35,451 (14.93) | 173,698 (30.7) | 209,149 (25.98) |
| Primary | 23,527 (9.91) | 77,447 (13.69) | 100,974 (12.54) |
| Secondary | 126,653 (53.33) | 269,980 (47.72) | 396,633 (49.27) |
| Higher | 51,875 (21.84) | 44,580 (7.88) | 96,455 (11.98) |
| Wealth quintile | | | |
| Poorest | 7,325 (3.08) | 142,959 (25.27) | 150,284 (18.67) |
| Poorer | 18,201 (7.66) | 152,849 (27.02) | 171,050 (21.25) |
| Middle | 39,075 (16.45) | 130,697 (23.1) | 169,772 (21.09) |
| Richer | 72,128 (30.37) | 87,809 (15.54) | 160,018 (19.88) |
| Richest | 100,777 (42.43) | 51,310 (9.07) | 152,087 (18.89) |
| Religion | | | |
| Hindu | 164,540 (69.28) | 431,856 (76.34) | 596,396 (74.09) |
| Muslim | 44,655 (18.8) | 64,373 (11.38) | 109,028 (13.54) |
| Christian | 18,098 (7.62) | 41,041 (7.25) | 59,139 (7.35) |
| Sikh | 4,804 (2.02) | 12,706 (2.25) | 17,510 (2.18) |
| Buddhist/Neo-Buddhist/Jain/Jewish/ Parsi | 3,477 (1.46) | 8,251 (1.46) | 11,728 (1.46) |
| No religion/other | 1,932 (0.81) | 7,478 (0.2) | 9,410 (1.17) |
| Marital status | | | |
| Never married | 70,144 (4.01) | 141,522 (25.02) | 211,666 (26.29) |
| Currently married | 157,842 (66.4) | 403,876 (71.39) | 561,718 (69.78) |
| Widowed/Divorced/Separated | 9,520 (4.01) | 20,307 (3.59) | 29,827 (3.71) |

Wealth index [OR 0.89 (0.83, 0.97)], age [OR 1.06 (1.01, 1.13)] and caste [OR 1.07 (1.01, 1.13)] were significantly associated with HT in rural men. However, age [OR 6.14 (5.24, 7.20)], OR 5.18 (4.65, 5.77), marital status [OR 1.65 (1.41, 1.93)], OR 1.50 (1.34, 1.69)], wealth index [OR 1.34 (1.11, 1.62)], OR 1.78 (1.63, 1.95)], education [OR 1.13 (1.03, 1.23)], OR 1.09 (1.03, 1.17)], alcohol consumption [OR 1.51 (1.03, 2.2)], OR 1.6 (1.38, 1.86)], diabetic status [OR 1.97 (1.72, 2.9)], OR 1.88 (1.63, 2.17)] and fish consumption [OR 0.84 (0.72, 0.99)] were significant in relation to HTN in urban population. Dietary intake of good leafy vegetables [OR 0.63 (0.41, 0.97)], fish [OR 0.84 (0.72, 0.99)] aerated drinks [OR 1.19 (1.02, 1.37)] and fried foods [OR 0.851 (0.726, 0.997)] were also significantly associated with HT in urban women. 

The Seventh Report of the Joint National...
Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) reported that the prevalence of HT in USA among men and women over 20 years of age were 34.5 and 33.4%, respectively. It was also observed that men have higher incidence of HT until the age of 45 years, both genders have comparable prevalence rates in the age group of 46–64 years and prevalence of HT in higher in women than men over 65 years of age. This has been cited due to the reversal of protective effect of oestrogen postmenopause.[39] A meta-analysis of 250,741 individuals from 13 different countries demonstrated a higher prevalence of prehypertension in men (40%) than women (33%).[38] Overall, it can be concluded that gender differences in the epidemiology of HT point out unique clinical characteristic of the disease in both genders.[39] This can be due to the fact that elasticity of blood vessels reduce with increasing age, contributing to HT pathology.[39]

In a study including 1.3 million Indian adults (2017), being in the richest household wealth quintile [4.15% (3.68–4.61)] was associated with higher probability of having HT compared to belonging to the poorest quintile [3.01% (2.38–3.65)] in rural and urban populations.[28] Similarly, the current study observed that urban and rural men belonging to richest wealth quintile had 12 and 11% lower odds of developing HT as compared to those in the poorest wealth quintile respectively. The odds of having HT was 78% higher in rural women of ‘richest’ category as compared to the women in poorest category, whereas the odds were only 45% higher in urban settings. Likewise, rural women belonging to ‘richer’ and ‘middle’ category also had 59 and 36% higher odds of having HT than women in the ‘poorest’ category. A long-term follow-up study conducted in Iran concluded that never married women had a lower risk of HT (0.58; 0.37–0.90) as compared to married women.[28] The current study adds evidence to this study as currently and formerly married women had 52 and 65% higher odds of having HT than women in the ‘poorest’ category. A long-term follow-up study conducted in Iran concluded that never married women had a lower risk of HT (0.58; 0.37–0.90) as compared to married women.[28] The current study adds evidence to this study as currently and formerly married women had 52 and 65% higher odds of having HT than women in the ‘poorest’ category. A long-term follow-up study conducted in Iran concluded that never married women had a lower risk of HT (0.58; 0.37–0.90) as compared to married women.[28] The current study adds evidence to this study as currently and formerly married women had 52 and 65% higher odds of having HT than women in the ‘poorest’ category. 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The Indian Migrant Study conducted in 2011 found that the intake of fruits, vegetables, meat, sugars and dairy products was higher in the urban population than in rural counterparts.[28] However, a cross-sectional STEPS Survey conducted by Tripathy P et al. among 5127 individuals in 2014–2015 found no difference.
in dietary practices among urban and rural population of Punjab. This posed the question of great Indian equalization [20]. The current study, however, found that there was a significant association between type of residence, that is urban–rural and many lifestyle risk factors including a previous diagnosis of diabetes, previous screening for HT, exposure to secondary smoke, previous oral cavity examination, tobacco and alcohol consumption and dietary habits. The proportion of people belonging to higher socioeconomic status and having higher levels of education are greater in urban areas, which increases
Table 4: Results of binary logistic regression on hypertension in the urban and rural populations, National Family Health Survey, 2015–2016

| Variable                       | URBAN               | FEMALE             | RURAL               | FEMALE             |
|--------------------------------|---------------------|--------------------|---------------------|--------------------|
|                                | OR (95% CI)         | P                  | OR (95% CI)         | P                  |
| Age in years                   |                     |                    |                     |                    |
| 15-19                          | Ref                 | 0.495              | Ref                 | <0.01              |
| 20-29                          | 1.081 (0.949,1.232) | 0.242              | 1.836 (1.588,2.123) | <0.01              |
| 30-39                          | 1.015 (0.923,1.116) | 0.759              | 3.413 (2.92,3.99)   | <0.01              |
| 40-49                          | 1.038 (0.958,1.124) | 0.365              | 6.143 (5.241,7.201) | <0.01              |
| Marital status                 |                     |                    |                     |                    |
| Never married                  | Ref                 | 0.208              | Ref                 | <0.01              |
| Currently married              | 1.064 (0.793,1.428) | 0.679              | 1.522 (1.364,1.698) | <0.01              |
| Widowed/Divorced/Separated     | 1.141 (0.858,1.518) | 0.364              | 1.652 (1.414,1.931) | <0.01              |
| Wealth index                   |                     |                    |                     |                    |
| Poorest                        | Ref                 | 0.011              | Ref                 | <0.01              |
| Poorer                         | 0.988 (0.827,1.181) | 0.895              | 1.066 (0.868,1.31)  | 0.542              |
| Middle                         | 0.992 (0.88,1.119)  | 0.899              | 1.265 (1.046,1.529) | 0.016              |
| Richer                         | 1.031 (0.943,1.126) | 0.504              | 1.449 (1.202,1.746) | <0.01              |
| Richest                        | 1.123 (1.046,1.205) | 0.001              | 1.342 (1.108,1.624) | 0.003              |
| Education                      |                     |                    |                     |                    |
| No education                   | Ref                 | 0.008              | Ref                 | 0.05               |
| Primary                        | 0.928 (0.814,1.056) | 0.257              | 1.116 (1.004,1.241) | 0.042              |
| Secondary                      | 0.93 (0.826,1.048)  | 0.236              | 1.125 (1.033,1.225) | 0.007              |
| Higher                         | 0.878 (0.813,0.949) | 0.001              | 1.107 (0.991,1.238) | 0.072              |
| Caste                          |                     |                    |                     |                    |
| Others                         | Ref                 | 0.218              | Ref                 | 0.778              |
| Scheduled caste                | 0.93 (0.869,0.995)  | 0.035              | 1.016 (0.928,1.113) | 0.728              |
| Scheduled Tribe                | 0.977 (0.899,1.062) | 0.584              | 1.055 (0.952,1.169) | 0.309              |
| OBC                            | 0.973 (0.878,1.079) | 0.601              | 1.006 (0.941,1.076) | 0.856              |
| Tobacco usage                  |                     |                    |                     |                    |
| No alcohol consumption         | Ref                 |                    | Ref                 |                    |
| Yes                            | 0.98 (0.919,1.046)  | 0.55               | 0.999 (0.902,1.106) | 0.983              |
| Alcohol consumption            |                     |                    |                     |                    |
| Never drinks                   | Ref                 | 0.461              | Ref                 | 0.063              |
| Less than once a week          | 0.962 (0.883,1.048) | 0.375              | 1.591 (0.623,4.064) | 0.332              |
| About once a week              | 0.881 (0.745,1.043) | 0.142              | 1.517 (1.032,2.23)  | 0.034              |
| Almost everyday                | 0.988 (0.886,1.101) | 0.823              | 1.22 (0.933,1.595)  | 0.146              |
| Intake of milk or curd         |                     |                    |                     |                    |
| Never                          | Ref                 | 0.642              | Ref                 | <0.01              |
| Daily                          | 0.85 (0.725,0.995)  | 0.043              | 1.103 (0.983,1.239) | 0.096              |
| Weekly                         | 1.057 (0.971,1.151) | 0.203              | 0.933 (0.828,1.057) | 0.282              |
| Occasionally                   | 1.034 (0.947,1.128) | 0.458              | 0.901 (0.799,1.017) | 0.092              |
| Intake of pulses or beans       |                     |                    |                     |                    |
| Never                          | Ref                 | 0.415              | Ref                 | <0.01              |
| Daily                          | 0.785 (0.483,1.272) | 0.326              | 0.74 (0.512,1.07)   | 0.11               |
| Weekly                         | 1.031 (0.922,1.154) | 0.589              | 0.791 (0.547,1.142) | 0.21               |
| Occasionally                   | 1.061 (0.952,1.184) | 0.285              | 0.921 (0.633,1.34)  | 0.667              |
| Intake of green leafy vegetable|                     |                    |                     |                    |
| Never                          | Ref                 | 0.709              | Ref                 | <0.01              |
| Daily                          | 1.273 (0.85,1.906)  | 0.241              | 0.626 (0.406,0.966) | 0.034              |
| Weekly                         | 1.007 (0.908,1.115) | 0.901              | 0.599 (0.385,0.917) | 0.019              |
| Occasionally                   | 1.01 (0.914,1.116)  | 0.847              | 0.521 (0.336,0.808) | 0.004              |
| Fish intake                    |                     |                    |                     |                    |
| Never                          | Ref                 | 0.386              | Ref                 | <0.01              |
| Daily                          | 0.984 (0.877,1.103) | 0.778              | 0.844 (0.716,0.996) | 0.045              |

Contd...
Interestingly, it was observed that women consuming chicken or meat had 16 and 11% lower odds than those never consuming it, respectively. Women who drank aerated drinks daily had 19% lower odds of being hypertensive as compared to those who never consumed the same. Men consuming fried foods had about 15–20% lower odds of developing HT.

Previous studies have found that diets rich in fruit, vegetables, whole grains, legumes, seeds, nuts, fish and dairy products helped to lower blood pressure.[27,28] In urban areas, men who consumed milk/curd daily had 15% lower odds of being hypertensive as compared to those never consuming the same. Men consuming fruits occasionally had 8% lower odds than those never eating fruits. Men who had daily or weekly intake of eggs had 13 and 16% higher odds than those never consuming eggs, respectively. Women who consumed milk, pulses and fish had 7–10, 17–23 and 16% higher odds than those never consuming eggs, respectively.

The current study also observed an higher odds of HT among women drinking alcohol as compared to the nondrinkers, in both urban and rural settings. Alcohol consumption was noted to be associated with a relative risk of 1.5 (1.3–1.6) to develop HT amongst adults aged 15–49 years in Northeast India.[24] Reduced alcohol consumption has been proven to help maintain lower levels of blood pressure in existing literature.[27,28]

Women who had a breast examination previously also had 13% higher odds of HT as compared to nondiabetic women. Women who drank aerated drinks daily had 19% higher odds than those who did not. Women who consumed green leafy vegetables daily, weekly or occasionally had 38, 41 and 48% lower odds, respectively, as compared to those who never consumed green leafy vegetables. All these findings are in concurrence with the currently available evidence.[27,28] A systematic review and meta-analysis of randomized controlled trials conducted by Ndauko RN et al.[23] concluded that a diet low in meat, sweets and alcohol helped to maintain blood pressure. An association between consumption of aerated drinks and HT among adults has been noted amongst Indian adults previously too.[28] Interestingly, it was observed that women consuming fried foods had about 15–20% lower odds of developing HT.
HT than non-diabetic women. A home-based survey amongst 1,192 women of rural India showed that only 0.9 and 1.3% had a breast and cervical examination, respectively, in the past 5 years. The study also noted that that only 50% were aware with regard to HT, while only 3.3% were familiar with it. Poor levels of awareness in relation to HT, diabetes and cancer as major health threats and importance of their early detection were also recorded in the study.\[8-10\]

Most previous studies have shown urban–rural disparities in lifestyles risk factors in men more than women.\[8-10\] However, this study has shown light on similar disparities in female population also.

**Strengths and limitations**

This study is based on the NFHS-4 data, which is based on a sample of households that is representative at the national, state and district levels, hence providing true estimates of the prevalence of HT across the country. The study has a few limitations. The findings of this study are limited to the persons aged 15–49 years, whereas we presume higher cases of HT in older population, thus underestimates the prevalence. Further, NFHS provides cross-sectional data that does not allow exploration of causal pathways behind the observed associations. We were not able to investigate the role of factors like physical inactivity, genetic factors, anxiety and lipid profile in this analysis due to the nonavailability of such information in the data set. Furthermore, alcohol and tobacco use were self-reported by the survey participants; hence, there is a chance of under- or over-reporting. Also, because of the NFHS-4’s focus on maternal and child health, the survey sampled substantially fewer men than women.

**Conclusion**

This study has shown that the prevalence of HT is higher in urban areas as compared to rural despite the higher level of risk factors prevalent in rural populations. Factors like age, wealth index, marital status, alcohol intake and dietary patterns were found to be significant variates of HT in both urban and rural populations. Occupation, caste, screening for diseases and diabetic status were significant predictors of HT in urban populations. Alcohol consumption, tobacco usage and unfavourable dietary habits were noted to be higher in rural than urban populations. Nevertheless, this calls for a more robust screening and health education in rural areas for early detection of HT. With rapid rate of urbanization, it becomes utmost important to reduce the prevalence of risk factors of HT, more so in the rural areas.

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**Conflicts of interest**

There are no conflicts of interest.

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