Tobacco consumption influencing the prevalence of hypertension among Indian women aged above 15 years: An in-depth analysis using National Family Health Survey (NFHS - 5), 2019–2021

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KEYWORDS

Blood pressure indices, tobacco consumption, hypertension, Indian women

ABSTRACT

Objectives: Globally, hypertension associated with tobacco consumption is one of the leading causes of death. The aim of this study is to explore the possible association between tobacco consumption and hypertension among women aged 15 years and above in India.
Methods: Data available from the National Family Health Survey (NFHS 5) survey was used for the study. The study examined the relationship between tobacco consumption and hypertension by analysing blood pressure indices among women aged above 15 years in India. The weighted proportion was computed with 95% CI for the cross-tabulations. Multivariable logistic regression was used to determine the risk factors for hypertension, high mean arterial pressure, and wide pulse pressure.
Results: Among 625116 women aged 15 years and above, 41181 (6.6%) of them were tobacco consumers; among them, 3.4% had wide pulse pressure, 6% had hypertension, and 20.2% had high mean arterial pressure. Tobacco consumers were 1.11 times (1.03-1.20) and 1.09 (1.05-1.14) times more likely to have hypertension and high mean arterial pressure respectively, compared to those who didn't consume tobacco. Smokeless tobacco consumers were 1.12 (1.04-1.21) times more likely to develop hypertension.
Conclusion: From this study, we found that factors like older age, mixed diet, alcohol use, and obesity have contributed to the risk of hypertension. Smokeless tobacco users were at risk of developing hypertension compared to users of other forms of tobacco.

1. Introduction

Non-communicable diseases (NCDs) account for 41 million annual fatalities, which is 71% of fatalities worldwide1. Among NCDs, 1.2 billion people all over the globe are affected by hypertension annually2. In India, 57% of stroke deaths and 24% of coronary deaths are due to hypertension. The prevalence of hypertension adjusted for the World Health Organisation (WHO) reference population is 32.8% and among women, it is 23.7% in India (2019)3.

In 2020, 36.7% of all men and 7.8% of all women consumed cigarettes globally, representing 22.3% of the world's population; about 80% of the 1.3 billion tobacco smokers worldwide reside in low- and middle-income nations. More than 8 million people lose their lives due to tobacco usage each year4,5. According to National Family Health Survey-5 (NFHS-5) data, 8.9% of women who are aged 15 and above consume tobacco in any form in India6.

Globally, hypertension and tobacco consumption are the leading preventable causes of death. The Risk of hypertension among tobacco consumers is more among Asian and developing nations as compared to developed countries7,8. NFHS-5 data reveals that 21% of women aged 15 years and above have hypertension, which is lower than men's prevalence of 25%, however, it still is at alarming levels; this survey also highlighted the proportion of women among tobacco consumers which is significantly higher than in surveys conducted two decades ago in India9.

Existing studies from the United States of America (USA) and the Czech Republic showed an increasing focus on 'women cigarette users' while other forms of tobacco and its effects have largely been unexplored10. The American Heart Association (AHA) recommended that blood pressure indices (BP Indices) such as Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), and Pulse Pressure (PP) should be used clinically to manage `vascular disease and hypertension11. Thus far, not many studies have sought the association between tobacco consumption and BP Indices. The existing research on hypertension shows variations in frequency across urban and rural areas; across the country and risk factors linked to undiagnosed hypertension12-15. There are few studies done on the combined risk of tobacco usage and hypertension among women in India, however, they have been confined only to some specific regions16.

Considering the aforementioned context, we aim to plug the research gaps by finding an association between tobacco consumption and hypertension (BP indices) among women aged 15 years and above in India using NFHS-5 data in this article.

2. Methodology

Data source:

In the present study, we have used the data collected from the NFHS-5, India's equivalent of the Demographic and Health Survey conducted in 2019-21 by the International Institute for Population Sciences, Mumbai, a designated nodal agency under the Ministry of Health and Family Welfare, India[6].

Sample size and techniques:

NFHS-5 is a large-scale, multi-round survey conducted in a representative sample of households throughout India. A uniform sample design, which is representative at the national, state/union territory, and district levels, was adopted in each round of the survey since its inception in 1992-93. Each district is stratified into urban and rural areas. To choose PSUs, the 2011 census served as the sampling frame. Two stages of stratification were used to create the NFHS-5 sample. Each stratum was sub-stratified into smaller substrata. Within each explicit sampling stratum, a sample of Census Enumeration Blocks and villages in urban and rural regions were selected as Primary Sampling Units.

Study Population:

This study included women aged above 15 – 49 years in India, who are current tobacco consumption tobacco consumers who either smoked or used a smokeless form of tobacco for at least 6 months at the time of the survey. Out of 724115 women aged 15 to 49 in women in India, 28408 pregnant women and 70591 cases with missing values were removed from data analysis. The remaining 625116 cases were included in the data analysis of the present study.

Measurement of blood pressure and anthropometric measures:

'Blood pressure' was measured for eligible women using an Omron 'blood pressure' monitor. Each respondent had their 'blood pressure' checked three times, with a five-minute interval between each reading, which aids in preventing upward bias brought on by anxiousness or nervousness during the very first reading. The average of the second and third readings of hypertension was considered to define hypertension, prehypertension, Isolated systolic hypertension (ISH), Isolated diastolic hypertension (IDH), MAP, and PP.

Anthropometric measurements such as height and weight were measured to assess the BMI of the patient.

Study Variables:

The term current 'tobacco consumer' refers to a respondent who indicated they smoked (cigarettes, cigars, pipes, bidis, or hookah) or used any smokeless tobacco (khaini, gutkha, paan masala-tobacco, or paan-tobacco) product daily or less frequently for at least 6 months during the survey.

Socioeconomic and risk factor variables considered in this study were age, education, marital status, occupation, economic status (wealth index, i.e., wealth quintiles), place of residence, tobacco and alcohol history, history of diabetes, and body mass index (BMI).

Operational Definitions:

- The age of the current women tobacco consumption tobacco consumers was broadly divided into three categories, viz a viz 15 to 25 years, 26 to 35 years, and 36 to 49 years.
- The education status of women ranged from illiterate to graduate, illiterate to high school was considered as "Up to higher secondary school" and Education level above high school was termed as "Above high school education".
- Occupation was classified as unemployed & homemakers, skilled and unskilled, and professionals.
- Marital status was classified as unmarried, married, and others, which included categories like widow, divorcee, and separated.
- For assessing the economic status, the wealth quintile was used, and the categories used for analysis were poor which included poorest and poorer, and middle and rich which included richer and richest respectively.
- Body mass index (BMI) was calculated as weight (kg) divided by the height squared (meters). Participants were classified as lean or healthy, overweight, and obese according to the WHO criteria[17]. Body mass index classification was done as obese and not obese, wherein not obese included lean, normal, and overweighted.

Outcome Variables:

Current women tobacco consumers were classified into hypertensives, pre-hypertensives, and normotensives according to the Joint National Committee (JNC) 7 Classification[18].

- Respondents were termed "hypertensive" if they had "observer recorded hypertension," which was defined as SBP of more than 140 mmHg and/or DBP of more than 90 mm Hg.
- 'Prehypertension' is defined as a systolic pressure from 120-139 mmHg or a diastolic pressure from 80- 89 mmHg.
- Normotensive state is defined as an SBP between 90-120 mmHg or a DBP between 60-80 mm Hg.
- ISH is defined as an SBP of more than 140 mmHg irrespective of DBP.
- Isolated diastolic hypertension IDH is defined as a DBP of more than 90mmHg irrespective of SBP.
- MAP will be calculated as (SBP + 2DBP)/3, while PP will be calculated as SBP-DBP.
- Uncontrolled hypertension: With a history of hypertension and consumption of medications, women with estimated SBP, equal to or above 140 mm Hg and/or DBP above 90 mm hg.

Data Analysis:

Descriptive analysis was carried out by frequency and proportion. For all of the cross-tabulations, the weighted proportion was computed with 95% CI. Multivariable logistic regression was applied to assess the factors associated with hypertension, high MAP, and wide PP.

The strength of association was examined by approximating adjusted odds ratios (OR) with their 95%

CI. P value < 0.05 was considered statistically significant. RStudio Desktop Version 2022.07.0+492 was used for statistical analysis

3. Result and Discussion

A total of 625116 women aged 15 to 49 were included in the study. Out of them, 41181 (6.6%) were tobacco consumers, 36702 (5.9%) used the smokeless form, and 5243 (0.8%) used the smoked form. Among 1216 cigarette smokers, 980 (80.6%) used to smoke <5 cigarettes per day, and 236 (19.4%) used to smoke ≥5 cigarettes per day. Beedi-smoking women were 1562 in number; among them, 985 (63.1%) used to smoke <5 beedis per day, and 577 (36.9%) used to smoke ≥5 beedis per day.

Out of 41181 women tobacco consumers, 6% had hypertension, 20.2% had high MAP, and 3.4% had wide PP. In this study, 56.7% of the 1487 smokers who had previously taken medication for hypertension had their 'blood pressure' under control, whereas 43.3% were uncontrolled. The percentage of normotensives, pre-hypertensives, and hypertensives among 39694 tobacco consumers who had never used hypertension medication was 84.7%, 10.1%, and 5.2%, respectively. (Table 1).

Tobacco consumers have 1.11 times more odds of developing hypertension than those who didn't use tobacco (aOR=1.11; 95% CI: 1.03-1.20), (p<0.01). Smokeless tobacco consumers had 1.12 times more odds of developing hypertension than those who didn't use smokeless tobacco (aOR=1.12; 95% CI: 1.04-1.21) (p<0.01). (Table 2)

Tobacco consumers (aOR=1.09; 95% CI: (1.05-1.14)) had higher odds of having high MAP as compared to those who didn't use tobacco (p<0.001). Smokeless tobacco consumers were (aOR=1.10; 95% CI: 1.05- 1.15) more likely to have high MAP as compared to those who didn't use smokeless tobacco (p<0.001). (Table 3)

Multinomial logistic regression predicted the presence of factors in current women tobacco consumers belonging to the age group of 26-35 and 36-49 years, consumption of vegetarian diet, obesity, history of alcohol consumption, and history of hypertensive medication as independent risk factors for having hypertension. (Table 4)

Multinomial logistic regression predicted that being in the age categories of 26–35 years and 36–49 years, Above high school education, vegetarian diet, obesity, history of consuming alcohol, having a history of taking hypertensive medication, and alcohol use, being in the 26–35 and 36–49 age categories, and history of taking hypertension medicine in the past can act as independent risk factors for having high MAP and wide PP respectively. (Table 5).

Discussion

This study examined the relationship between tobacco consumption and hypertension and BP indices among women tobacco consumers in India. The study found that tobacco consumption increases the risk of hypertension by 1.11 times when compared with non-tobacco consumers. Smokeless tobacco consumers had more risk of developing hypertension with an odds of 1.12 compared to the smoking form of tobacco consumers. Tobacco consumption increases the risk of high MAP by 1.09 times. The present study found risk predictors for hypertension. Older age, obesity, and mixed diet consumers were predicted to be the risk factors for hypertension. A significant relationship between MAP and current tobacco usage, especially among smokeless tobacco consumers was established. Mixed diet consumers, obesity, older age, and alcohol use were predicted as risk factors for high MAP and wide PP.

The current study reported a prevalence of 6% hypertension among women in the 15-49 age group. This is lesser compared to the 10.9% prevalence of hypertension in an NFHS-4 study done among Indian women by Ghosh et al19. This decrease in prevalence may be due to the launch of the Global HEARTS initiative by WHO (2016) which provides a strategic approach by promoting Healthy-lifestyle counselling, evidence-based treatment protocols, access to essential medicines and technology, risk-based management, team-based care, and systems for monitoring20. On the other

hand, the USA has a prevalence of 28%, which is very high compared to the present study's prevalence, similarly, the Australian population also has a high 43% prevalence of hypertension, which is high compared to this study21. In Uganda, the prevalence of hypertension was found to be 31.5%, while in Iran, the prevalence of hypertension among the population was found to be 31.6%; this is attributed to the fact sedentary lifestyle behaviour, higher tobacco consumption, and junk eating habits of its population22, 23.

This study established the association among current tobacco consumers to have 1.02 and 1.11 times more risk of developing pre-hypertension and hypertension respectively compared to non-consumers. Findings are in concurrence with the study in India by Datta et.al.24, 1.1 times which uses the NFHS-4 data. Hence, the predicted risk in this study gives enough cause for concern, tobacco cessation programs, and control measures should be expanded to attain wider coverage.

BP indices have a symbiotic relationship with 'Blood pressure'. MAP indicates the perfusion of vital organs; A minimum MAP of 60 mmHg must be maintained to perfuse essential organs. A large drop in MAP will prevent blood from perfusing cerebral tissues, cause unconsciousness, and swiftly result in neuronal death25. The development of cardiac disease is significantly influenced by PP. It has even been demonstrated to be a stronger predictor than MAP. The risk of cardiovascular disease rises by 20% with a mere 10 mmHg increase in PP. The narrowing of PP should be targeted by the management modules for hypertension26, 27. Thus, BP indices are important in the context of treatment for hypertension28. Current tobacco consumers have 1.09 times the odds of having high MAP, while smokeless tobacco consumers have 1.1 times the odds of having high MAP in the current study. This is comparable to a study that found MAP to be high in Swedish women tobacco consumers as compared to no tobacco consumers29. Therefore, it is very important that tobacco consumption must be regulated and brought down through cessation and awareness programmes and that BP indices be included in the diagnosis and control of hypertension.

Among Current tobacco consumers, women aged 26-35 years OR: 2.23 (hypertensive) and 2.82 (prehypertensive) and 36-49 years (OR: 5.16 (hypertensive) and 9.38 (prehypertensive) compared to women aged 15-25 years.

Obese women tobacco consumers had OR 1.39 and OR 2.05 times higher odds of developing prehypertension and hypertension respectively, compared to non-tobacco consumers. Obesity is a controllable risk factor for hypertension and its consequences. This finding is consistent with Indian studies as seen in Bhise et.al.,30 (OR = 3.71) conducted using DLHS-4 (2012-13) data and Rajkumar et.al., OR = 1.85 in southwestern India31. Alcoholic women tobacco consumers had OR 1.45 and OR 1.73 times more risk of developing pre-hypertension and hypertension respectively. Similar findings were also found in New York and Japanese women in studies by Briasoulis et.al., 1.15;32 and Ohmori et.al., 2.24; 95% CI, 1.26-3.9933. Present study has predicted, obesity OR 1.96 and alcohol OR 1.55 likely to cause an increase in MAP among women tobacco consumers. Alcohol consumption showed increased odds of widening PP OR 1.54, which was in parallel to a Japanese study31. Both these factors are modifiable and pertinent steps need to be taken to control them to prevent morbidity and mortality due to complications from hypertension and tobacco consumption.

Historically prevalence of hypertension in the northeastern states such as Sikkim is high as seen in studies by Soumitra et.al., 20.3%35. Although Goa reported no prevalence of hypertension among women tobacco consumers 13% of women between the age of 15-49 years have hypertension, and 2.6% of women consumed any kind of tobacco, it might be a case of underreporting of data or underestimation as seen in NFHS 5 data related studies36.

Policy Implications

India is the world's second-largest producer of tobacco and a significant exporter, but since the enactment of the Cigarettes Act in 1975 to cigarettes and alternative tobacco products (prohibition of publicity and regulation of trade and commerce, production, offer and distribution) act, 2003 (COTPA)

to the present which became law, tobacco control measures in India have always been at least as strict as those in many developed nations35. These measures have brought control of cigarette distribution in the legal sector. However, unlawful cigarette distribution is still a menace, India is presently the fourth biggest market on earth as per Euromonitor international analysis37.

The National Health Policy of 2017 lists coordinated action on "addressing tobacco, alcohol and drug addiction" as one of the seven priority areas for enhancing the environment for health, according to a report given by the Government of India in 2020 about the WHO framework convention on tobacco control (WHO FCTC)38. Per this, the government of India brought in various measures such as bringing tobacco products including beedi into the highest tax bracket of 28% in goods and services tax. Few state governments have stopped the manufacture distribution and sale of electronic nicotine delivery systems. Efforts have been directed to mainstream compliance with the COTPA Act. Besides government interventions, the healthcare community needs to put efforts into educating and creating awareness to control tobacco consumption, this will help in achieving the planned reduction of the prevalence of tobacco consumption by 15% by 2020 and 30% by 202539.

Strengths of our study

This research paper is one of its kind wherein, the relationship between tobacco usage and hypertension along with BP indices in Indian women has been explored, thus throwing light on the importance of BP indices in the treatment and control of hypertension. This study also focused on Pre-hypertension, control of prehypertension prevents individuals from developing further complications. Previous studies on women's tobacco consumers have been limited to a specific state, this is a nationwide study. We have studied the impact of consumption of both smokeless and smoking forms of tobacco, but many studies have failed to do so.

Limitations of our study

This study witnessed a few limitations, one of which is it was able to predict the risk factors for hypertension, however, it was not able to establish a causal relationship. The study also suffers from recall and social-desirability biases (self-reporting of factors like tobacco consumption, and alcohol consumption).

4. Conclusion and future scope

The study underscores a potential link between BP indices and hypertension, indicating that further research, especially prospective studies, is essential to assess the effectiveness and use of PP and MAP in managing hypertension, particularly among women in India.

Availability of data and materials

The data collected from the NFHS-5, India's equivalent of the Demographic and Health Survey conducted in 2019-21 by the International Institute for Population Sciences, Mumbai, a designated nodal agency under the Ministry of Health and Family Welfare, India. https://www.iipsindia.ac.in/

Acknowledgements

Not applicable.

Funding

There is no funding received for the study.

Ethics approval and consent to participate

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author contributions

Conception and design of the study: Nisha B., Koushik.M., Sonu Goel. **Collection, analysis and interpretation of the data**: Nisha B., Sonu Goel, Koushik M. **Writing and editing the manuscript:** Nisha B, Koushik.M Suresh Kumar Sharma, Sonu Goel, Ruma Dutta, Gomathy Parasuraman. **Reviewing and editing the manuscript:** Sonu Goel, Mohammad Fareed. All authors reviewed and approved the final manuscript

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