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Journal of Preventive Medicine and Holistic Health

Journal homepage: <https://www.jpmmh.org/>

Original Research Article

The prevalence and risk factors of hypertension among adult population of four major states in India: An exploratory study

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ARTICLE INFO

Article history:

Received 15-05-2021

Accepted 01-07-2021

Available online 29-11-2021

Keywords:

Hypertension

NFHS-4

Risk factors

Adult population

Co morbidity

ABSTRACT

Background: Hypertension is one of the major non-communicable lifestyle disorders which has taken the form of modern-day epidemic affecting almost two times in 2019 than in 1990. Hypertension is also a major important risk factor for the occurrence of ischemic heart diseases and stroke in later life which stands to be the most important cause of morbidity and mortality according to the Global Burden of Disease studies. The incidence of hypertension in an individual depends on multiple inter related and unrelated factors which leads to the structural changes of the blood vessels and increases the turbulence of flow of blood and in the end leads to hypertension. Though there have been a number of studies done to find out the associations of different risk factors with the incidence of hypertension, they were focused upon the affect of those risk factors as a whole and not on specific adult age group. This study tried to shed some light on the different risk factors which specifically affect the men and women in reproductive age 30 years and more and give recommendations about factors on which special attention is needed to be given to prevent them.

Materials and Method: The National Family Health Survey 4 (NFHS-4) was conducted countrywide in 2015-16 among men and women of 15-54 years and 15-49 years respectively. The unit level data was used in this study to find prevalence of hypertension of men (30-54 age group) and women 30-49 age years for the four major states of Delhi (North), Odisha (East), Kerala (South), Maharashtra (West) and also analysed association with various socio demographic and others related variables using standard statistical tools of SPSS 23 and MS EXCEL.

Findings: The most important factors leading to occurrence of hypertension in an individual of 30 years or more were found to be age, smoking and alcoholism, diabetes and unhealthy diet. But some socio and economic factors having an indirect association with prevention of hypertension were found to be female literacy and insurance coverage. The health seeking behaviour of hypertensives and the screening of people for hypertension were also not found up to the mark.

Conclusion: Hypertension is preventable and treatable by proper lifestyle modification and medication. The screening of the adult population of 30 years and more needs to be strengthened, advocacy against smoking and alcoholism, stress management, and penetration of health insurance coverage needs to be increased.

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1. Introduction

The prevalence of non-communicable diseases was reaching epidemic proportions both in developed and developing

nations. Non-communicable diseases (NCDs) kill 40 million people each year, equivalent to 70% of all deaths globally. These NCD's mainly manifest in the form of cardiovascular diseases, cancers, chronic respiratory diseases and diabetes.¹ According to the Global Burden of Diseases (GBD) studies 2020, the prevalence of

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cardiovascular diseases (CVDs) has nearly doubled up from 271 million in 1990 to 523 million in 2019, and number of CVD deaths steadily increased from 12.1 million in 1990 to 18.6 million in 2019.² In India, nearly 5.8 million people die from NCDs (heart and lung diseases, stroke, cancer and diabetes) every year or in other words 1 in 4 Indians has a risk of dying from an NCD before they reach the age of 70.³ Cardiovascular diseases (coronary heart disease, stroke, and hypertension) contribute to 45% of all NCD deaths followed by chronic respiratory disease (22 %), cancers (12 %) and diabetes (3%). Hypertension was a chronic condition of concern because of its role in the causation of coronary heart disease (CHD), stroke, and other vascular complications which poses a major public health challenge to a population undergoing socioeconomic evolution. GBD also reported that hypertension led to 1.63 million deaths in India in 2016 as compared to 0.78 million in 1990. The disease burden (DALYs) attributable to hypertension increased from 21 million in 1990 to 39 million in 2016.⁴

The SDG goal 3.4 has recommended reduction in non-communicable disease related mortality by one-third through prevention and treatment strategies by 2030.⁵ The treatment and control of hypertension needs to be strengthened more to achieve the SDG goals or even reach close to achieving them in time. Intensive public health efforts were required to increase the treatment compliance, awareness about hypertension and its effects, control of disease and improving health seeking behaviour. High blood pressure (HBP) means the pressure in your arteries was higher than it should be. Normal adult blood pressure was defined as a systolic blood pressure of less than 120 mmHg and a diastolic blood pressure of less than 80 mmHg. In accordance with most guidelines, it was recommended that hypertension be diagnosed when a person's systolic blood pressure (SBP) in the office or clinic was ≥ 140 mmHg and/or their diastolic blood pressure (DBP) was ≥ 90 mmHg following repeated examination.⁶ But with the recent change in guidelines by the American Heart Association in November 2017, the cut off value of the stage 1 of hypertension has been changed to systolic blood pressure of 130 mmHg and diastolic of 80 mmHg.⁷ The aetiology of hypertension cannot be pointed out to be a single one as this is a multi-factorial disease and depends on a variety of modifiable and non-modifiable risk factors. The factors like age, heredity, race, sex etc. are considered to be non-modifiable risk factors and the modifiable factors include physical inactivity, overweight and obesity, tobacco and alcohol use, unhealthy diet, comorbidities, psychological stress etc.⁸

Various studies reported that due to low awareness and control, hypertension was increasing. High blood pressure is largely preventable by adopting lifestyle modifications at early stages. Eating a healthy diet consisting of fresh fruits and vegetables, whole grains and lean proteins prevent

hypertension. Maintaining a healthy weight, limiting the intake of saturated fats, being physically active can help lower the blood pressure. In this article the authors have computed the prevalence of hypertension and find out the major risk factors among the adult men and women of age 30 years or more in four major states of India so as to give recommendations to decrease the prevalence.

2. Materials and Methods

The National Family Health Survey 4 (NFHS-4) was conducted In 2015-2016 under the stewardship of Ministry of Health and Family Welfare (MoHFW), was managed by the International Institute for Population Sciences (IIPS), Mumbai and technical assistance was provided by the ICF International. Data collection was done from all the states and union territories of India by a two-staged cluster random sampling approach.⁹

A total of 799, 288 men and women were interviewed using a structured and pre tested questionnaire. The National Family Health Survey took into account the population of reproductive age group i.e., 15-49 years for females and 15-54 years for males for their demographic characteristics and various aspects of health and related events. In addition, clinical, anthropometric and biomedical (CAB) components such as height, weight, haemoglobin level, sugar levels and also three readings of blood pressure levels at a specific interval were collected through blood pressure measurement from each sample participant following the recommended guidelines.

For this article, the unit level data¹⁰ was used from National family Health Survey (Round 4) to compute prevalence of hypertension of the males aged 30 to 54 years and females 30 to 49 years and find out the association and risk factors of the hypertension prevalence with different lifestyle and demographic factors for the four states of Delhi (North), Odisha (East), Kerala (South), Maharashtra (West). Analysis was done using standard statistical tools of SPSS 23 version and MS EXCEL.

We have considered the average of three readings of hypertension levels measured by NFHS 4. The individual was marked as hypertensive only if systolic more than 130 mm Hg and diastolic more than 80 mmHg under the recommended testing conditions. Those individuals did not fall into the criteria were considered normal

The independent variables included in the study are age, sex, religion, food habits (obesity/BMI), occupation, wealth index, education, insurance coverage, tobacco use, alcohol consumption, co — morbidity (diabetes, thyroid disorder, cardiovascular diseases) and hypertension (dependant variable)

The specific 30 plus age group was screened as the primary prevention of the non-communicable disease like hypertension, diabetes etc. at all the level of health care delivery points in India like subcentre levels, primary health

centre etc. under the guidelines of the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS).

As the NFHS 4 doesn't take into account the men and women of aged more than 54 and 49 years respectively, this study had the limitation of not able to calculate the risk factors and prevalence of hypertension and the social and demographic factors in the elderly age.

3. Results

The prevalence of hypertension for men and women sample in four major states in India for socio demographic characteristics computed is given in Tables 1 and 2. The highest prevalence of hypertension was noticed in Maharashtra (25.1%) followed by Kerala (22.7%) among men whereas the prevalence was higher in Odisha (17.3%) followed by Kerala (15.0%) among women.

Increase in age was seen to be one of the key significant variables for the advent of hypertension. From Charts 1 and 2, it was seen that In the states of Delhi, Maharashtra, Kerala and Odisha as age increases the prevalence of hypertension increases for both males and females ($p < 0.001$) except in the state of Odisha, where among males the similar pattern not noticed ($p = 0.879$). In Maharashtra and Kerala, more than 30 percent prevalence of hypertension was seen in age groups of 50 to 54 as compared to Delhi and Odisha in the same age group. In Odisha, Kerala and Maharashtra, prevalence of hypertension is more than 20 percent in age group of 40 to 49 among women. The prevalence of hypertension was higher among women than of men in the state of Odisha.

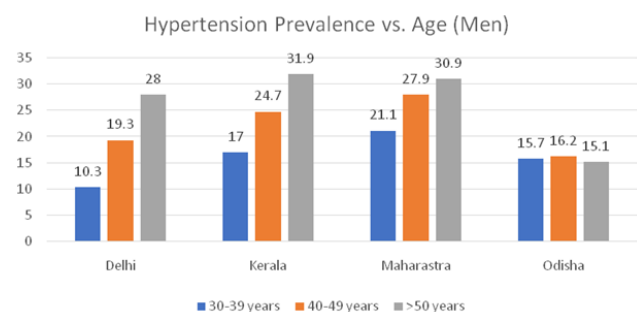


Chart 1: Prevalence of hypertension with age among men (percentage)

As it was evident that education status helps a person to stay more informed about the preventions and effects of hypertension, in reality it doesn't seem to matter much among men in any of the states (Table 1). But when it comes to female education in particular, the prevalence of hypertension was seen to be inversely related with the level of education attained in all states except Odisha (Chart 3)

More than 60% of the country was rural areas and about 65% of the population in India lives at the rural areas than in

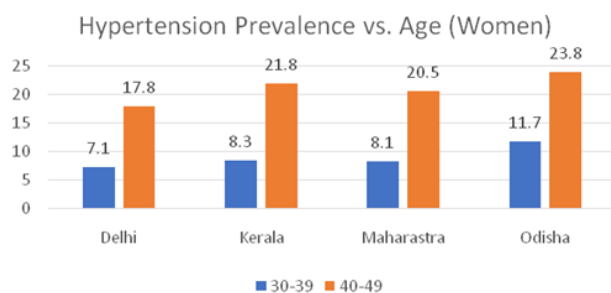


Chart 2: Prevalence of hypertension with age among women (percentage)

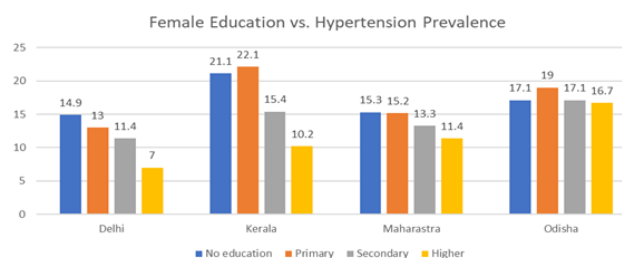


Chart 3: Hypertension prevalence with female education (percentage)

the urban areas. Though the lifestyle, food habits and other factors may differ greatly among the urban and rural areas people, but no significant difference on the hypertension status for the men was noticed (Table 3). Hypertension can no longer be denoted as a rich or poor person's disease, the lower- and middle-income group people were seen to be more affected by it (Tables 3 and 4).

Evidences show that using of tobacco products was directly related to the higher prevalence of hypertension in the population(11)(12). From theChart 4, it shows that among men in four states, prevalence of hypertension was higher among tobacco users than non-tobacco users. The overall consumption of tobacco was found to be quite low among women of all the four states under study.

Alcohol was one of the direct and proven risk factors for obesity and dyslipidaemia, which in turn were significant factors leading to hypertension.^{11–13} So, the consumption of alcoholic beverages was another significant factor for the increase in hypertension prevalence. The ones who consume alcohol were always at higher risk of having hypertension than the ones who doesn't as it is seen inChart 5.

The consumption of alcohol was quite low overall in all the four states among the women aged 30 to 45 years. No direct causal association was established between hypertension and alcohol intake as consumption of alcohol in limited quantities might not lead to hypertension.^{13–15}

Although health insurance is not very popular in India, but the men who were covered under some kind of

Table 1: Hypertension prevalence among men by= demographic factors in four states in India

| Variables | Hypertension prevalence (%) | | | | |
|-------------------|-----------------------------|--------|-------------|--------|------|
| | Delhi | Kerala | Maharashtra | Odisha | |
| n = | 316 | 6962 | 4811 | 6962 | |
| Age | 30-39 years | 10.3 | 17.0 | 21.1 | 15.7 |
| | 40-49 years | 19.3 | 24.7 | 27.9 | 16.2 |
| | >50 years | 28 | 31.9 | 30.9 | 15.1 |
| Religion | Hindu | 15.8 | 24.0 | 24.6 | 15.7 |
| | Muslim | 18.9 | 19.4 | 27.3 | 17.9 |
| | Christian | 0 | 22.9 | 28.6 | 17.7 |
| | Others | 25 | 0 | 26.8 | 0 |
| Marital Status | Unmarried | 11.1 | 22.4 | 24.0 | 15.1 |
| | Married | 16.9 | 23 | 25.7 | 16.1 |
| Educational level | No education | 13.3 | 21.4 | 25.9 | 17.3 |
| | Primary | 11.4 | 33.3 | 23.0 | 20.6 |
| | Secondary | 19.2 | 22.3 | 24.7 | 13.7 |
| | Higher | 12.0 | 18.1 | 28.1 | 17.3 |
| | None | 11.6 | 24.0 | 24.3 | 17.4 |
| Occupation | Managerial | 18.2 | 20.4 | 20.9 | 16.5 |
| | Clerical | 0 | 15.6 | 24.6 | 20 |
| | Sales | 14.3 | 22.3 | 27.1 | 13.6 |
| | Agricultural | 0 | 20.4 | 27.5 | 15 |
| | Services | 26.1 | 27.4 | 21.8 | 18.6 |
| | Manual | 16.9 | 22.8 | 22.9 | 15.6 |
| Total | 16.5 | 22.7 | 25.1 | 15.8 | |

Table 2: Hypertension prevalence association with demographic factors (women)

| Variables | Hypertension prevalence (%) | | | | |
|-------------------|-----------------------------|-------------|-------------|-------------|------|
| | Delhi | Kerala | Maharashtra | Odisha | |
| Total | 11.6 | 15.0 | 14.0 | 17.3 | |
| n = | 2093 | 6108 | 14102 | 13755 | |
| Age | 30-39 | 7.1 | 8.3 | 8.1 | 11.7 |
| | 40-49 | 17.8 | 21.8 | 20.5 | 23.8 |
| | Hindu | 11.8 | 14.3 | 13.6 | 17.3 |
| Religion | Muslim | 11.3 | 14.5 | 16.5 | 21.1 |
| | Christian | 30 | 18.1 | 20 | 16.1 |
| | Others | 6.2 | 0 | 14.2 | 22.7 |
| Marital Status | Unmarried | 10 | 14.1 | 15.2 | 17.4 |
| | Married | 12.5 | 15.4 | 13.7 | 17.3 |
| Educational level | No education | 14.9 | 21.1 | 15.3 | 17.1 |
| | Primary | 13.0 | 22.1 | 15.2 | 19.0 |
| | Secondary | 11.4 | 15.4 | 13.3 | 17.1 |
| | Higher | 7.0 | 10.2 | 11.4 | 16.7 |

Table 3: Hypertension prevalence association with wealth index and residence (Men)

| Variables | Hypertension prevalence (%) among men | | | | |
|----------------------------|---------------------------------------|--------|-------------|--------|------|
| | Delhi | Kerala | Maharashtra | Odisha | |
| Wealth index | Poorest | 0 | 22.2 | 21.5 | 14.4 |
| | Poorer | 22.2 | 25 | 21.8 | 12.4 |
| | Middle | 12 | 24.4 | 20.8 | 19.7 |
| | Richer | 17.4 | 22.1 | 29.8 | 18.6 |
| | Richest | 16.9 | 22.4 | 28.6 | 19.4 |
| Type of place of residence | Urban | 12.9 | 23.5 | 24.2 | 15.4 |
| | Rural | 13 | 22.2 | 25.7 | 16 |

Table 4: Hypertension prevalence association with wealth index and residence (Women)

| Variables | | Hypertension prevalence (%) among women | | | |
|----------------------------|---------|---|--------|-------------|--------|
| | | Delhi | Kerala | Maharashtra | Odisha |
| Wealth index | Poorest | 0 | 17.4 | 11.8 | 16.9 |
| | Poorer | 3.2 | 16.6 | 12.5 | 16.9 |
| | Middle | 12.5 | 17 | 13.7 | 17.6 |
| | Richer | 10.3 | 15.3 | 15.1 | 17.3 |
| | Richest | 12.1 | 13.9 | 15.3 | 19.5 |
| Type of place of residence | Urban | 17 | 13.3 | 14.1 | 18.1 |
| | Rural | 11.3 | 16 | 14 | 17.1 |

Tobacco Use vs Hypertension Prevalence (Men)

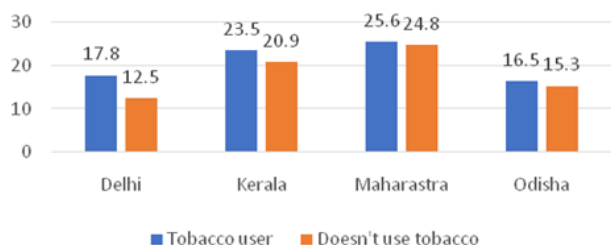


Chart 4: Hypertension prevalence with tobacco use among men (percentage)

Hypertension Prevalence vs Alcohol Consumption (Men)

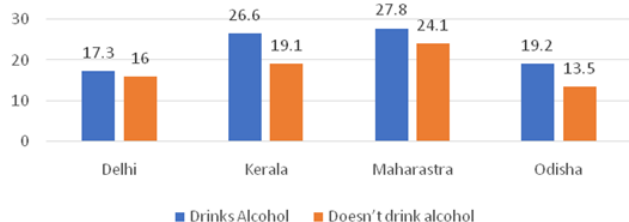


Chart 5: Hypertension prevalence with alcohol consumption among men (percentage)

health insurance scheme were found to be less affected by hypertension than who were not (Charts 6 and 7). Since the time the NFHS in 2015-16, the overall penetration of the health insurance has covered 35% population in 2018.¹⁶ At the time of the survey, the health insurance coverage was found to be very much prevalent in the states of Odisha and Kerala whereas in the states of Delhi and Maharashtra the health insurance coverage was less. Increase in health insurance coverage can definitely help to bring down of the hypertension prevalence, with the regular health check-ups which can be both prophylactic and therapeutic. The government and company sponsored health insurances in many cases also covers the treatment cost and hence, the health seeking behaviour of the population may be improved

as the out-of-pocket expenditure will be minimized.

Hypertension Prevalence vs Insurance covered (Men)

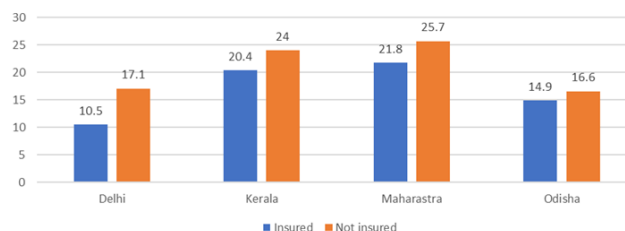


Chart 6: Hypertension prevalence association with insurance coverage among men (percentage)

Hypertension Prevalence vs Insurance Coverage (Women)

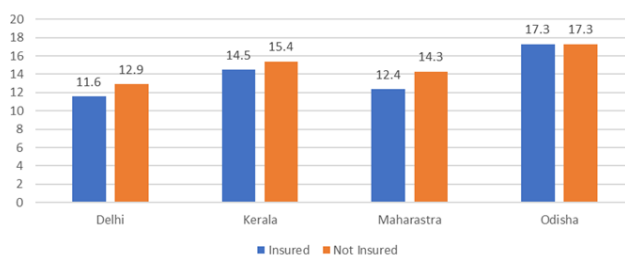


Chart 7: Hypertension prevalence association with insurance coverage among women (percentage)

One of the major factors for the increase in hypertension prevalence and late detection was due to the silent features of the hypertension itself. Often this disease gets detected when it accompanies other deadly diseases or show some end organ damage or symptoms of that. Three diseases, viz. diabetes mellitus, thyroid disorders and heart disease which were directly related to the hypertension were included in the analysis. The diseases like hypothyroidism^{17,18} and other structural and functional heart diseases were proven to be associated with the hypertension prevalence, but diabetes^{19,20} was seen to be most relatable.

As in case of women, the risk of prevalence of hypertension in patients of diabetes was found to be consistently high in all the states under consideration. The hypertension prevalence was also noted bit higher among

the patients with hypothyroidism. The already prevailing structural heart diseases seem to have direct association with hypertension prevalence in all the states (Charts 8 and 9).

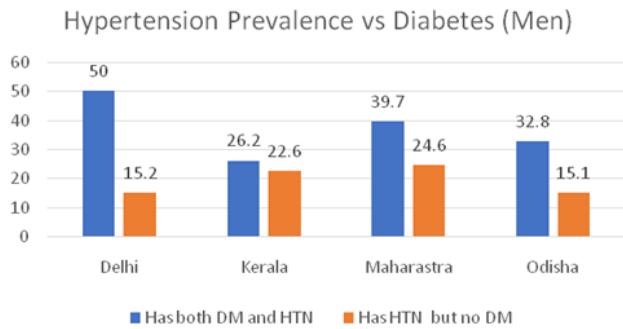


Chart 8: Hypertension (HTN) prevalence association with diabetes (DM) among men (percentage)

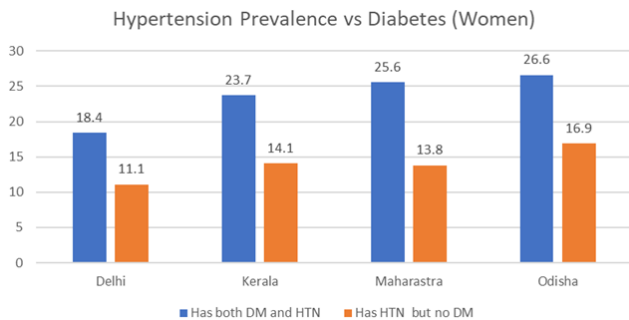


Chart 9: Hypertension (HTN) prevalence with diabetes (DM) prevalence among women (percentage)

The disease of hypothyroidism itself was a proven cause of hypertension and many times coexists in the patient body.²¹ But hypertension was more of a diastolic type and many times gets subsided with oral thyroid hormone treatment itself.^{17–43} Hyperthyroidism on the other hand was considered as an isolated cause of secondary systolic hypertension. In the current study, the prevalence of thyroid disorders was found to be associated with more prevalence of hypertension but the scenario was not similar at all the four states (Charts 10 and 11).

The association between hypertension prevalence with other cardio vascular diseases was important to know as the onset of hypertension on an already damaged or injured heart may prove fatal. In the current study, the presence of cardio vascular diseases was found to be accompanying with hypertension incidence, though statistically insignificant (Charts 12 and 13).

The diet of a person has direct association with his BMI / physical status which was a proxy measure of whether the person has obesity, and deranged lipid profile. Obesity and deranged lipid profile on the other hand leads

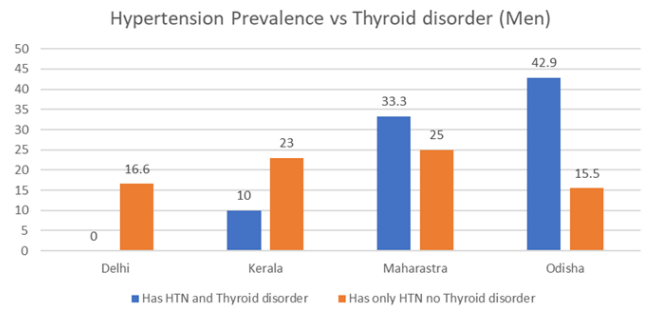


Chart 10: Hypertension (HTN) prevalence with thyroid disorder prevalence among men (percentage)

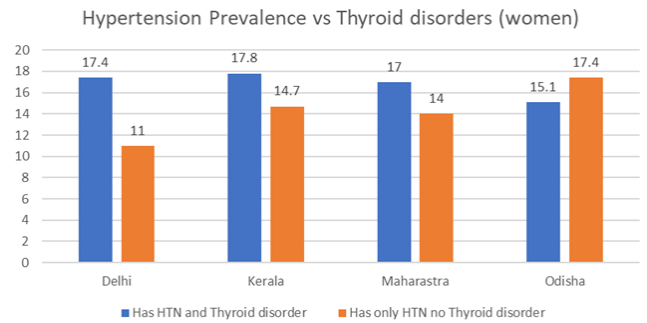


Chart 11: Hypertension (HTN) prevalence with thyroid disorder prevalence among women (percentage)

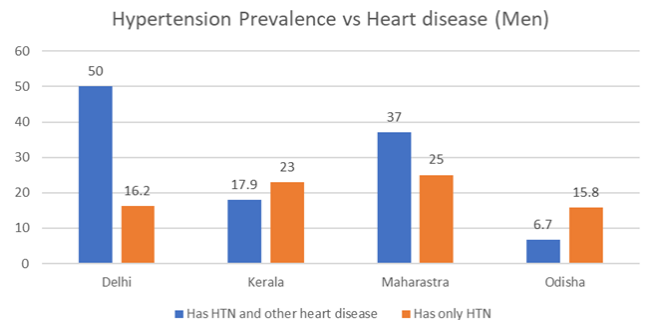


Chart 12: Hypertension (HTN) prevalence with other heart diseases prevalence among men (percentage)

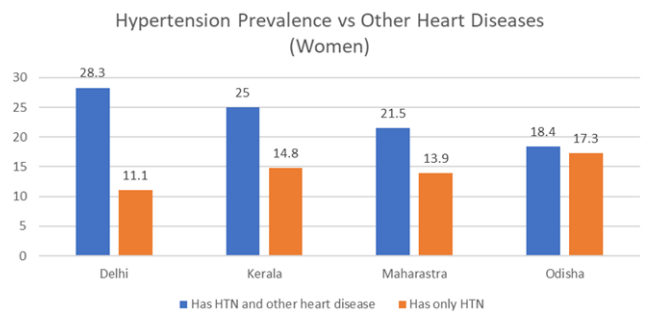


Chart 13: Hypertension (HTN) prevalence with other heart diseases prevalence among women (percentage)

to atherosclerosis of the blood vessels causing them to constrict and increase the turbulence of the flow of blood causing the blood pressure to rise. The consumption of fried food, aerated drinks lead to increase in the blood cholesterol and sugar levels which in turn lead to obesity and deranged lipid profile.

The consumption of green leafy vegetables and fruits in regular basis was considered to be nutritious diet with lots of essential minerals and vitamins required for the proper functioning of the body. People who were found to eat fried food daily in their diet were comparatively more in risk of getting hypertension later in life than who takes it occasionally. Same can be said for the consuming aerated drinks. But eating dark green leafy vegetables or fruits daily cannot be established to be protective against the hypertension incidence. The high consumption of meat, poultry or fish grilled, broiled or cooked at a high temperature was associated with an increased risk for hypertension, independent of the overall amount consumed, and the risk was also increased with higher intake of well-done meat.^{22,23}

4. Discussions

One of the major finding of the study was the differential prevalence of hypertension in the states, both in males and females. In the states of Delhi, Maharashtra and Kerala it was noted that the hypertension was more prevalent among the men than in the women in all states except in Odisha. This statement was supported by the study conducted by Ghosh S. and Kumar M²⁴ where they estimated that the overall prevalence of hypertension in India were more in males than in females. An opposite trend was seen in Odisha, where the prevalence of hypertension was more prevalent in females than in males.

Hypertension is fast spreading non-communicable diseases and with the increasing age the prevalence of hypertension is increasing. According to an epidemiological study conducted in USA by Kwok L.O. et al.²⁵, the prevalence of hypertension was twice as much in elders than in young adults. As the age of the person increases the tissues of the body gets old and age-related decline of the tissues start which includes stiffening of the vessels. Several epidemiological studies have indicated that the risk of prevalence of arterial stiffness and hypertension and other cardiovascular diseases increases with age.^{26–30} Hence the age-related hypertension was characterised by increase in systolic and pulse pressure, without even affecting the diastolic pressure. In the longitudinal community based cohort study conducted by Framingham et al.³¹ it showed that increased arterial stiffness was associated with higher risk of hypertension incidence. Arterial stiffness predicts an increase in systolic blood pressure and incident hypertension.³¹

Female literacy showed to have a protective factor against risk of hypertension, as more the women were educated, there was less chance of them getting hypertension in later life. In the National capital of Delhi, the women who were illiterate were having significantly high chance of having hypertension (14.9%) than ones who completed higher education (7%) with $p=0.006$. In the states of Maharashtra and Kerala also the same trend can be seen with the literacy rate being inversely related with the hypertension status. In the study conducted by Pandit A.U. et al. to determine whether the literacy mediates the association between education and hypertension knowledge and control, they concluded that literacy was found to be a significant independent predictor of blood pressure control but the relationship between the education and blood pressure can only be minimally explained.³²

In the study by Levenson J. et al. done in 1987, it was concluded that the smoking affects the flow properties of blood and arterial wall behaviour leading to several hemorrhoidal abnormalities and arterial stiffness.³³

The smoking of tobacco was an independent risk factor which may lead to hypertension. In the current study also, similar scenario was seen as the increase in tobacco consumption was found to increase the prevalence of hypertension in both the male and female population. Though the habit of smoking tobacco or related products was found to be much less prevalent among the women population across country, however, the prevalence of hypertension was found to be higher among smoker women than non-smoker women (Chart 4).

In this current study the consumption of alcohol has been found to be a potent risk factor for the prevalence of hypertension among men in all the four states. Though the overall consumption of alcohol was found to be quite high in all the four states, the prevalence of alcohol consumers was highest in Kerala (47.4%) followed by Odisha (41.8%) and Delhi (38.9%). The consumption of alcohol was not found much wide spread among the women of any of the states with Odisha records the maximum with 3.3%. Hence, the consumption of alcohol could not be established as a major independent risk factor for prevalence of hypertension among women. The study conducted by Stranges S. et al. the author established that the amount of drinking also acts as a factor for the increase of hypertension risk factor (8) (Chart 5).

The health insurance coverage has shown to decrease the prevalence of hypertension, though no statistical significance could be established. Health insurance coverage affects total out-of-pocket expenses through two separate mechanisms — lower out-of-pocket expenses per unit of service and increased utilization of health services.³⁴ The improved of health seeking behaviour helps in the prevention and early detection of hypertension (Charts 6 and 7).

Table 5: Prevention and treatment compliance of hypertensives (men)

| Variables | | Hypertension prevalence (%) among men | | | |
|--|-----|---------------------------------------|--------|-------------|--------|
| | | Delhi | Kerala | Maharashtra | Odisha |
| Blood pressure ever checked previously | Yes | 14.6 | 22.5 | 46.1 | 30.5 |
| | No | 23.8 | 23.8 | 23.6 | 14.8 |
| Previously diagnosed hypertensive | Yes | 40.8 | 60.7 | 23.6 | 19.6 |
| | No | 26.7 | 18.2 | 26.3 | 14 |
| Known hypertensives on medication | Yes | 33.3 | 48.5 | 43.6 | 34.1 |
| | No | 15.7 | 21.1 | 25.1 | 15.8 |

Table 6: Prevention and treatment compliance of hypertensives (women)

| Variables | | Hypertension prevalence (%) among women | | | |
|--|-----|---|--------|-------------|--------|
| | | Delhi | Kerala | Maharashtra | Odisha |
| Blood pressure ever checked previously | Yes | 11.6 | 15.1 | 14.6 | 17.4 |
| | No | 11.7 | 14.1 | 12.6 | 17.1 |
| Previously diagnosed hypertensive | Yes | 26.7 | 46.3 | 31.5 | 31.4 |
| | No | 9 | 11.7 | 12.4 | 15.3 |
| Known hypertensives on medication | Yes | 43.2 | 43.3 | 37.8 | 40.5 |
| | No | 9.6 | 13.3 | 12.7 | 15.9 |

The disease hypertension was mostly associated with the presence of diabetes. The prevalence of hypertension in a diabetic population was two folds higher than in a non-diabetic. Although diabetes mellitus was associated with a considerably increased cardiovascular risk, the presence of hypertension in the diabetic individual markedly increases morbidity and mortality.³⁵ In a meta-analysis published in Journal of American college in 2015, Emdin C.A. et al. established that the people with hypertension were also at increased risk of diabetes.³⁶ The current study shows a similar result with the presence of diabetes was found to be an absolute risk factor for the hypertension prevalence with statistical significance both in male and female. The controlling of both the diseases gets necessary as both of them independently may lead to a number of other systemic diseases by multiple end organ damages³⁷ and when they affect a person together the process of end organ damage gets faster. The end organ damages may be prevented, diagnosed early and reversed with specific treatments and an improvement in the health seeking behaviour of the population might be helpful (Charts 8 and 9).

The Basal metabolic index or BMI of a person was often used as an indicator for overweight or obesity of an individual. In a study conducted by Hossain F.B. et al. the authors established a strong association of BMI with prevalence of hypertension.⁴⁰ In a study conducted by Appel L.J. et al. the authors concluded that a diet rich in fruits, vegetables and low fat dairy foods with reduced saturated and total fat can substantially lower blood pressure.⁴¹ Too much consumption of red meat was also identified to be directly associated with higher blood pressure.⁴² Though in the current study a diet rich

in green leafy vegetables and fruits was not proved to be protective against hypertension, the consumption of meat daily has seen to cause increased prevalence of hypertension. Consumption of fried food in excess can be directly related with the increase in BMI and predisposition of obesity.⁴³ The drinking of too much aerated drinks was also found to be one of the major modifiable risk factor for the obesity predisposition.⁴⁴ But both the fried food⁴⁵ and aerated drinks could not be established as to independently cause hypertension. In the current study also the causal association between the consumption of the above items and hypertension prevalence could not be established and all these were seen to have varying effect on different parts of the country.

The finding shows that the compliance with the hypertension management was not found up to the desired level as in Delhi only 33.3%, in Odisha 34.1%, in Maharashtra 43.6% and Kerala only 48.5% of men who were already diagnosed as hypertensive were taking the prescribed antihypertensives. Among women also the numbers were almost similar with 37.8% in Maharashtra, 40.5% in Odisha, 43.2% in Delhi, and 43.3% in Kerala were taking the medicines prescribed to them. It can be safely said that the compliance with the treatment was by large associated with health seeking behaviour of the population. The health seeking behaviour in turn was to a large extent dependant on the education level of the individual.³⁸ Though the overall compliance of the treatment was quite low in all the four states, it may be noted that both the men and women of Kerala were showing the best compliance towards the antihypertensives prescribed to them, which may be influenced by the higher literacy rate of Kerala³⁹ compared to the other states in consideration.

5. Conclusion & Recommendations

The prevalence of hypertension observed in the studied states among men and women and increased with age. Also, high prevalence of hypertension observed among users of tobacco and alcohol as well as having co-morbidities. Healthy life style with healthy food habits and reduced stress halt the disease of hypertension and improve the health of men and women in India. The screening program for the hypertension needs to be strengthened at early age of 30 for both men and women for prevention and early detection of hypertension. Monitoring of the NPCDCS programme needs to be strengthened. A strong advocacy against cigarette smoking and alcoholism, especially among younger men is needed. IEC should be started to make the community aware of the ways of stress management, importance of regular health check-up and having a healthy life style.

More emphasis should be given to the female education as it has shown to be having an effect against hypertension prevalence and compliance with the hypertension management. Penetration of health insurance coverage needs to be increased in all parts of India, especially among men as the people covered under health insurance was found to be less chance of suffering from hypertension.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Cite this article: Banerjee D, Swain P. The prevalence and risk factors of hypertension among adult population of four major states in India: An exploratory study. *J Prev Med Holistic Health* 2021;7(2):121-130.