Original Article

Prevalence and Associated Risk Factors of Hypertension among the Adult Nepali Women of Tea Estate, Darjeeling, West Bengal, India

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Abstract

Background: Hypertension (high blood pressure) is the most prevalent chronic disease in India. Out of the top-ten associated risk factors with death and disabilities in India, hypertension ranked third. Over the past few decades, the prevalence of high blood pressure has risen due to rapid changes in lifestyle. Women are found to be vulnerable to hypertension. **Objective:** The study was conducted to estimate the prevalence of hypertension among adult Nepali women and to find the associated risk factors of hypertension among them. **Materials and Methods:** A present cross-sectional study was conducted among 300 adult Nepali women (aged 19–59 years) of the Darjeeling tea estate area. A structured schedule was used to collect different socioeconomic and demographic variables. Height and weight were taken to calculate the body mass index (BMI). Chi-square and logistic regression were performed to find the association. **Results:** The prevalence of hypertension was 42% among the studied participants. Significant association was observed between BMI and blood pressure variables ($r = 0.204$ at $P < 0.01$ for systolic blood pressure and $r = 0.119$ at $P < 0.05$ for diastolic blood pressure). Both Chi-square and logistic regression confirmed age, caste, and BMI as strongly associated risk factors for hypertension. **Conclusion:** A high prevalence of hypertension was found among the studied participants. Preventive strategies focusing on adult women of the tea garden area of different socioeconomic status could aid in addressing the issues of hypertension.

Keywords: Body mass index, Darjeeling, hypertension, Nepali women, tea estate

Introduction

High blood pressure or hypertension is a condition, when the pressure in blood vessels is too high. It is considered a global public health issue, and the most prevalent chronic disease in India.[1,2] About 639 million hypertensive people live in developing countries with low awareness and inadequate healthcare facilities.[3] The risk of hypertension increases with age, and the pathogenesis is multi-factorial, including environmental, behavioral, and/or genetic.[1,4] Among the top-ten risk factors accounting for most of the deaths and disabilities in India (in 2019), high blood pressure ranked third.[5] Mental ill-health and noncommunicable diseases are considered the important causes for mortality and morbidity among women; ischemic heart disease and stroke are two of them that lead to death for women, which are found to be associated with hypertension.[5,6] Global Burden of Disease Report (2019) found that elevated blood pressure is the leading cause of metabolic risk factors, which lead to 19% of global deaths.[7] The percentage increased to 21.2% according to the National Family Health Survey (NFHS)-5 with an overall percentage of 22.6 among the Indian population.[7] Over the last few decades (from 1980 to 2015), the prevalence of hypertension is increased in India from 24% to 26% in comparison to the United States, where the prevalence declined to 23% to 12%, and NFHS-4 data revealed 11.3% Indian women in the reproductive-age group (15–45 years) were hypertensive.[6]

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Many researchers have conducted studies to assess the prevalence of hypertension among the adult population of the Darjeeling district in different time periods. Those studies mainly focused on either finding the prevalence of hypertension among the tea-estate residents,[8-11] tribal adults,[12] males from specific communities,[13-15] both men and women[16,17] or from a disease perspective.[18] As per our search strategy, we found only one study that was conducted on women with respect to hypertension prevalence[19] in the selected district. Very few studies have attempted to describe the risk factors associated with hypertension among the population living in Darjeeling.[8,9,12] With this background in mind, a gender-specific, community-based (other than only tribal) study was carried out among the Nepali tea-garden resident women of Darjeeling district to assess the prevalence as well as the risk factors of hypertension among them.

Materials and Methods

Area and population

Darjeeling is the northernmost hilly area of West Bengal. Present cross-sectional study has been carried out among the Nepali adult women living in the area of Tongsong and Pussimbang Tea Estate of Darjeeling district, West Bengal (India). Only adult women who completed 18 years were selected for this study. Finally, a total of 300 women were selected randomly for this study (aged 19–59 years) by door-to-door visit in the mentioned area. The period of data collection was March 1, 2024 to March 25, 2024. The sample size was calculated based on previous study using the formula = (Z^2Pq/d^2) (where $Z = 1.96$ at 95% confidence interval; $P = 10\%$ $q = (1 - P)$ and d = precision).[20] Thus, the minimum sample size obtained was approximately 138. Finally 300 samples were considered for final estimation.

Inclusion and exclusion criteria

Apparently healthy participants under the age group of 19–59 years were included in the study. Women who were below or above the age groups, absent at the day of data collection, or sick were excluded from the study.

Data collection procedure

Data for all the demographic, socioeconomic and life style factors as described in Table 1 were collected using a structured and pretested schedule. The anthropometric measurements (height and weight) were taken using the standard method[21] and instruments. Height was measured to the nearest 0.1 cm with the help of an anthropometer rod, and weight to the nearest 0.1 kg by a portable digital weighing machine. BMI was calculated using the standard formula.[22] BMI value (in kg/m^2) of 18.5–24.99 is classified as normal, <18.5 as underweight, 25–29.99 as overweight, and ≥30 as obese. The systolic blood pressure (SBP) and diastolic blood pressure (DBP) were estimated using a digital sphygmomanometer on left upper arm, approximately 2–3 cm above the bend of the elbow of participants, in a sitting posture. Hypertension was classified according to the classification given by JNC-7 classification (SBP/DBP is classified normal at >120 and >80 mmHg of blood pressure and between 140–159 and 90–99 mmHg as hypertensive).[23] All the measurements (including blood pressure) were taken twice by the first author (Chewang Dolma Tamang) (between 10.00 a.m. and 3.00 p.m.) and the average of all measurements were utilized.

The study was conducted in accordance with the ethical guidelines for human experiments, laid by the Helsinki Declaration of 2000.[24] Verbal consent was obtained from each participant for data collection after explaining the study purpose to them.

Operational definitions

Different demographic variables like age, caste, marital status, family type and house type were considered for present study. Age was categorized into four categories such as-19–29, 30–39, 40–49, and 50–59 years respectively. Caste was categorized into general/unreserved category, other backward class (OBC), schedule caste, and schedule tribe. Marital status was sub-grouped as unmarried, married and widow. Family was categorized as nuclear and joint family. House type was categorized as kutcha (made by wood), semi-pucca (brick wall with tin shed), and pucca (roofed house). Socioeconomic variables like education, occupation and monthly family income were included. Educational status was denoted by the overall schooling years of the participants. Those who never went to school or cannot sign were grouped as Illiterate, Primary (Class I to IV), Secondary (Class V to VIII), higher secondary (HS) (CLASS IX-XII), and graduation or above for those who went to college or university. Hundred percent of the women were working women and categorized as tea plucker and factory/other workers. Monthly income was grouped into <10,000, 10,000–25,000, and ≥25,001 Indian rupees. Consumption of alcohol and tobacco was categorized as yes/no to denote if the participants regularly consumed or not. BMI was categorized into underweight, normal, overweight, and obese depending on the cut-off values given by the World Health Organization.[22]

Statistical analysis

All the statistical analyses were performed with SPSS (v. 26, IBM Corporation, New York, United States). Frequency distribution (%) of the participants according to various socioeconomic, demographic and lifestyle factors was determined. Hypertension was regarded as the dependent variable, and all the variables related to socioeconomic, demographic, and life-style factors were considered as independent variables. Chi-square and logistic regression were also performed to determine the association as well as the influence of various factors on hypertension. A $P < 0.05$ was set to be statistically significant.

Results

The mean age of the adult women was 42.45 ± 11.06 years. Table 1 represents the frequency distribution of the background characteristics of the studied participants, as well as the

Table 1: Percentage distribution and association (Chi-square) of various demographic, socioeconomic, and life style factors and hypertension among the participants

Variables	Total (n=300), n (%)	Category		χ^2 (P)
		Normal (n=174, 58%), n (%)	Hypertension (n=126, 42%), n (%)	
Age (years)	19–29 (16.3)	42 (24.14)	7 (5.55)	27.49*** (<0.001)
	30–39 (22.0)	42 (24.14)	24 (19.05)	
	40–49 (27.3)	47 (27.01)	35 (27.78)	
	50–59 (34.3)	43 (24.71)	60 (47.62)	
Caste	General (16.0)	35 (20.11)	13 (10.32)	10.95* (<0.05)
	OBC (53.0)	83 (47.70)	76 (60.32)	
	SC (5.7)	14 (8.05)	3 (2.38)	
	ST (25.3)	42 (24.14)	34 (26.98)	
Marital status	Unmarried (10.3)	26 (14.9)	5 (4.0)	14.74** (<0.01)
	Married (84.7)	144 (82.8)	110 (87.3)	
	Widow (5.0)	4 (2.3)	11 (8.7)	
Family type	Nuclear (55.0)	86 (49.43)	79 (62.70)	5.20* (<0.05)
	Joint (45.0)	88 (50.57)	47 (37.30)	
House type	Kutcha (0.7)	1 (0.57)	1 (0.79)	0.105 (>0.05)
	SemiPucca (84.0)	147 (84.48)	105 (83.33)	
	Pucca (15.3)	26 (14.95)	20 (15.88)	
Education level	Illiterate/sign (10.0)	10 (5.75)	20 (15.87)	14.51** (<0.01)
	Primary (2.3)	2 (1.15)	5 (3.97)	
	Secondary (10.7)	18 (10.34)	14 (11.11)	
	HS (74.0)	136 (78.17)	86 (68.26)	
	≥Graduation (3.0)	8 (4.59)	1 (0.79)	
Occupation	Tea plucking (96.7)	166 (95.41)	124 (98.41)	2.05 (>0.05)
	Factory/others (3.3)	8 (4.59)	2 (1.59)	
Income (Rs)	<10,000 (17.7)	28 (16.09)	25 (19.84)	0.70 (>0.05)
	10,000–25,000 (61.0)	108 (62.07)	75 (59.53)	
	≥25,001 (21.3)	38 (21.84)	26 (20.63)	
Tobacco use	No (67.7)	130 (74.71)	73 (57.94)	9.40** (<0.01)
	Yes (32.3)	44 (25.29)	53 (42.06)	
Alcohol consumption	No (81.3)	153 (87.93)	91 (72.23)	11.87** (<0.01)
	Yes (18.7)	21 (12.07)	35 (27.77)	
BMI	Underweight (21.0)	39 (22.41)	24 (19.05)	12.79** (<0.01)
	Normal (52.3)	102 (58.63)	55 (43.65)	
	Overweight (20.7)	26 (14.94)	36 (28.57)	
	Obese (6.0)	7 (4.02)	11 (8.73)	

*P<0.05, **P<0.01, ***P<0.001. BMI: Body mass index

distribution of the women based on hypertension prevalence. It was found that most of the women were from 50 to 59 years, OBC category, and married. High frequency was observed for the nuclear family. The literacy rate was higher in HS group and they were associated with tea plucking (96.7%). The monthly income was Rs. 10,000–25,000 for majority (62.07%) of the participants. Nearly 32.3% and 18.7% women consumed tobacco and alcohol, respectively. Half of the participants were from the normal BMI category. The prevalence of hypertension among the women was found to be 42%. Most of the participants were from nuclear family, semi pucca house, HS level of education, 10,000–25,000 income group, nontobacco and nonalcoholic groups, and normal BMI category; a high prevalence of hypertension was found from these groups.

Table 1 also depicts the findings from the Chi-square analysis. Age, caste, marital status, family type, tobacco and alcohol consumption, and BMI were found strongly associated with hypertension (at $P < 0.05$, <0.01, and <0.001).

Figures 1 and 2 show the age-specific mean values of BMI (kg/m^2) and SBP and DBP, respectively. It is seen that with the advancement of age, both SBP and DBP increased. But BMI gradually decreased after the age of 39 years. BMI showed a weak but significant correlation with SBP ($r = 0.204$ at $P < 0.01$) and DBP ($r = 0.119$ at $P < 0.01$) among the studied women.

Binary logistic regression was used to examine how different factors influence the prevalence of hypertension among the adult Nepali women. Table 2 represents both crude and adjusted odds ratio (AOR) for different variables. The result depicts that the crude odds ratio (COR) for women of 30–39, 40–49 and 50–59 years were 3.429, 4.468, and 8.372 times

more likely to be hypertensive whereas, the AOR were found to be 3.066, 4.671, and 5.594 times higher for being hypertensive for the said age-groups. Age is found to be a significant associated factor for hypertension. The bivariate analysis (COR) also revealed that marital status, joint family, education, tobacco/alcohol consumption, and BMI were significantly associated with hypertension among the Nepali women. The AOR of Multivariate analysis confirmed age, general caste and BMI as the strongly associated factors for hypertension.

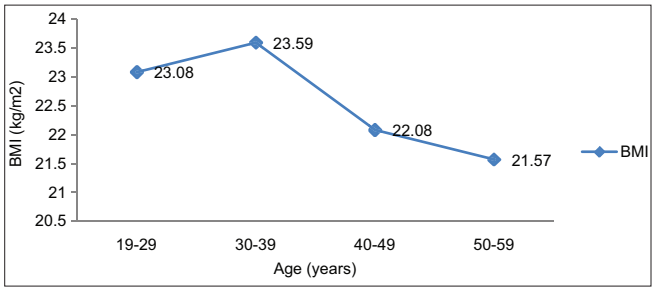

Figure 1: Age-specific body mass index (kg/m^2) among the studied participants. BMI: Body mass index

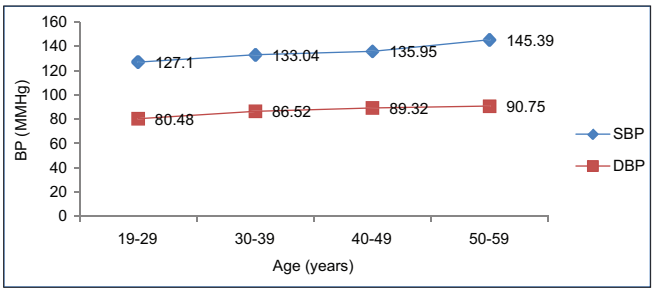

Figure 2: Age-specific systolic blood pressure and diastolic blood pressure (mmHg) among the studied participants. SBP: Systolic blood pressure, DBP: Diastolic blood pressure

Table 2: Binary logistic regression showing the association of different socioeconomic, demographic, and lifestyle variables with hypertension

Variables	Category	COR	95% CI	AOR	95% CI
Age (years)	19–29 (Reference)	1	-	1	-
	30–39	3.42*	1.33–8.81	3.06	0.89–10.53
	40–49	4.46**	1.79–11.12	4.67*	1.33–16.40
	50–59	8.37***	3.43–20.40	5.59*	1.47–21.26
Caste	General	0.45	0.21–1.00	0.37*	0.15–0.91
	OBC	1.13	0.65–1.95	0.99	0.51–1.90
	SC	0.20	0.07–0.99	0.22	0.04–1.02
	ST (Reference)	1	-	1	-
Marital status	Unmarried (Reference)	1	-	1	-
	Married	3.97**	1.47–10.67	0.96	0.23–4.08
	Widow	14.30***	3.21–63.56	3.14	0.44–22.15
Family type	Nuclear (Reference)	1	-	1	-
	Joint	0.58*	0.36–0.92	0.79	0.43–1.46
House type	Kutcha (Reference)	1	-	1	-
	Semi Pucca	0.71	0.04–11.54	0.96	0.04–20.67
	Pucca	0.76	0.04–13.06		0.04–21.55
Education	Illiterate/sign (Reference)	1	-	1	-
	Primary	1.25	0.20–7.61	1.35	0.18–10.09
	Secondary	0.38	0.13–1.09	0.45	0.14–1.48
	HS	0.31**	0.14–0.70	0.59	0.22–1.58
	≥Graduation	0.06*	0.007–0.57	0.13	0.01–1.72
Occupation	Tea Plucking	2.98	0.62–14.31	2.17	0.41–11.43
	Factory/Others (Reference)	1	-	1	-
Income	<10,000 (Reference)	1	-	1	-
	10,000–25,000	0.77	0.42–1.43	1.01	0.48–2.15
	≥25,001	0.76	0.36–1.59	1.03	0.40–2.64
Tobacco use	No (Reference)	1	-	1	-
	Yes	2.14**	1.31–3.50	1.20	0.59–2.44
Alcohol consumption	No (Reference)	1	-	1	-
	Yes	2.80**	1.53–5.10	1.61	0.74–3.50
BMI	Underweight (Reference)	1	-	1	-
	Normal	0.87	0.47–1.60	1.02	0.50–2.10
	Overweight	2.25*	1.09–4.60	3.58**	1.53–8.36
	Obese	2.55	0.87–7.48	5.91**	1.59–21.95

*P<0.05, **P<0.01, ***P<0.001. CI: Confidence interval, BMI: Body mass index, COR: Crude odds ratio, AOR: Adjusted odds ratio

Discussion

The research was conducted to examine community-level risk factors for hypertension among the adult Nepali women (19–59 years) residing in two tea estate areas of Darjeeling. Table 3 represents the comparison of the hypertension prevalence of the present study's women with other adult women from different regions of West Bengal and Darjeeling. The present study reported a higher prevalence of hypertension than the women from Nadia,[25] North-24-Parganas,[26] Burdwan,[8] Hoogly,[27] Birbhum,[30] and Kolkata,[32] but higher prevalence was reported from the women of North-24-Parganas,[28] PaschimMedinipur,[29] and Birbhum.[31] Our study reported a high prevalence of hypertension (42%) among the studied group, which was less than the women of Rohini and Matigara tea estate (49.68%) but much more higher than the women of Central Dooarstea estate women (7.78%) of the same district.

The prevalence of hypertension found in different parts of Indian women was 34.7% in Orissa,[33] 14.3% in Delhi,[34] 26% in Varanasi,[35] 22.8% in Tamil Nadu,[36] 23.6% in Maharashtra,[37] 44.4% to 53.9% in Gujarat,[38] respectively. The reason of the varied prevalence in different population may be due to some factors such as genetics, lifestyle, environment, socioeconomic condition, demography, or the methodology involved. Factors that were associated with hypertension among Indian women as found from various studies were age, BMI, family history, education, marital status, raised cholesterol level, obesity, diabetes, chronic kidney diseases, sedimentary life styles, low physical activity, smoking, alcohol or tobacco consumption.[5,6] Study revealed that increasing age, increasing weight, urban areas, alcohol, and tobacco consumption are the risk factors for women to be hypertensive.[6] Furthermore, higher education, higher socioeconomic positions are found to have lower odds for hypertension among Indian women.[5] Our study also reported the same observations. The older age group was found to be associated with hypertension and the general caste was associated with hypertension among the study participants. Marital status (both married women and widow) was also an associated factor for hypertension, which may be associated with family conflict and stress arouse due to living in a joint family or less income. Both bivariate and multivariate analyses confirmed that older age groups and BMI (overweight) are the most important risk factors for hypertension among the adult Nepali women. Hence, from the present findings, it can be stated that their demographic (age, caste, marital status, family type), socioeconomic (educational level), and lifestyle factors (tobacco and alcohol consumption, BMI) are together responsible for the high prevalence of hypertension. The possible reason may be due to their lower socioeconomic status, which in turn effect the nutrition and education, as they were mostly associated with the tea-plucking job as the source of living.

Limitations

This study has few limitations also, such as, the small sample size and cross-sectional design, and missing of some important factors like religion, dietary intakes, information regarding their reproductive health (age at menarche, age at marriage, age at first birth etc.), number of family members and children, salt intake or history of medication, family conflict, stress etc., due to short duration of field survey. These factors may have an impact on their overall health situation and can be a mediator for hypertension as well among them.

Conclusion

From the findings of the study, it can be concluded that the prevalence of hypertension among women was very high, which can make women vulnerable to other chronic diseases. Proper awareness and intervention strategies need to be implemented these tea estate areas. Along with that, proper healthy diet, physical activity, and reduction in the use of any kind of tobacco or alcohol may be helpful to reduce the prevalence of hypertension among these adult women. Various public health interventions, lifestyle modifications, and early diagnosis through treatment can be helpful to reduce

Table 3: Comparison of the prevalence of hypertension of the studied women with different studies from West Bengal

Study area	Sample size (female)	Age group (years)	Prevalence, *n* (%)	Reference
West Bengal				
Nadia[25]	570	20–70	16.66	Biswas and Manna, 2011
North 24 Parganas[26]	524	25–64	33.0	Acharyya *et al*., 2014
Burdwan[8]	92	20.01 ± 2.02 (mean)	33.0	Pramanik, 2015
Hoogly[27]	344	20–60+	29.9	Karmakar *et al*., 2017
North 24 Parganas[28]	100	20–59	50.5	Chakraborty and Mandal, 2018
Paschim Medinipur[29]	156	≥18–50+	52.5	Chanak and Bose, 2019
Birbhum[30]	3547	18–75	6.2	Kundu *et al*., 2022
Birbhum[31]	524	18–80	46.76	Majumder and Gorain, 2023
Kolkata[32]	64	45–59	14	Patra *et al*., 2024
Darjeeling				
Central Dooars Tea Estate[9]	180	18–60+	7.78	Mitra *et al*., 2020
Rohini and Matigara Tea Estate[10]	318	19–57	49.68	Chhetri and Khatun, 2021
Tongsong and Pussimbang Tea Estate	300	19–59	42.0	Present Study

the mortality rates and will also be helpful for the economic development of the country.

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Ethical consideration

Present work is based on the data collected by the first author as a part of their dissertation data required in Master's degree. Hence, permission was taken from the supervisor approved by the Department of Anthropology, University of North Bengal. Before data collection verbal consent was taken from each participant as the first author belongs to the same community and area. The study was conducted in accordance with the ethical guidelines for human experiments, as enacted in the Helsinki Declaration of 2000.

Author's contribution statement

CDT, MD and AK: Concepts, design, definition of intellectual content. CDT: Data collection. MD: Statistical analysis. CDT, MD and AK: Manuscript preparation, editing and review.

Data availability statement

Data will be available only upon request to the corresponding author.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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