



Prevalence of overweight/obesity, hypertension and its associated factors among women from Northeast India

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ARTICLE INFO

Article history:

Received 16 June 2021

Received in revised form

7 December 2021

Accepted 21 December 2021

Available online 24 December 2021

Keywords:

Hypertension

Nutritional status

Overweight/obesity

Women

Northeast

ABSTRACT

Objective: To assess prevalence of overweight/obesity, hypertension and its risk factors among women from North-eastern States of India.

Methods: A community based cross-sectional study was carried out in two north-eastern States. Information was collected on household's socio-economic & demographic particulars. Height (cm), weight (kg), waist and hip circumferences and blood pressure were measured on all the selected women. Association between overweight/obesity, hypertension with socio-demographic variables was tested using Chi-square and logistic regression was done. Total 1047 women were covered from both the states.

Results: The prevalence of chronic energy deficiency was 19% & 10%, overweight/obesity (BMI \geq 23) was 17.5% & 26% and hypertension was 15% & 17% (age adjusted 19.6% & 17%) respectively among women from Meghalaya & Nagaland. The prevalence of pre-hypertension was observed more among women from Nagaland (36.5%) as compared to Meghalaya (18.3%). Only 31% women were aware of hypertension and 6% had history of hypertension and 82% of them were on treatment. The prevalence of hypertension was observed high among 36–49 years and among overweight/obese women. On logistic regression, only age, BMI and use of additional salt was observed to be significantly associated with hypertension, while living in pucca house was associated with overweight/obesity.

Conclusions: The prevalence of hypertension was similar in both the states (15–17%) and pre-hypertension was high among women from Nagaland. This is warning sign for women in Nagaland. There is an urgent need to undertake more health & nutrition education sessions along with regular check-up for early diagnosis and treatment of hypertension.

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1. Introduction

Tribal communities constitute about 8.2% of the total population of India while, about 86% are tribal in the study areas and are isolated from general population and are socially and economically disadvantaged. Northeast India constitutes about 8% of India's size. Its population is approximately 40 million (2011 census), 3.1% of the total Indian population.¹

With the socio-demographic and nutrition transition, non-communicable diseases are the most important cause of

morbidity and mortality throughout the world and also in India. Studies showed that the prevalence of overweight/obesity and hypertension (HTN) is increasing in India over the past two decades. National Nutrition Monitoring Bureau (NNMB) study in 9 states of India in tribal areas during 2008–09 showed 9% prevalence of overweight/obesity (BMI \geq 25) as against 5% during 1997–98 while prevalence of hypertension was 17% among 20–49 years women.² National family health survey (NFHS) showed 5% prevalence of overweight/obesity during 2005–06 and has increased to 12% in 2015–16 among 15–49 years women in Meghalaya and from 6% to 16% in Nagaland.³

Nutrition transition has resulted in increasing prevalence of overweight/obesity which leads to increase in prevalence of other chronic diseases such as cardiovascular diseases (CVD), hypertension, diabetes, dyslipidaemia and some types of cancers. Hypertension is an important public health problem in India and is an

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important modifiable risk factor for CVD. Hypertension is responsible for at least 45% of deaths due to heart disease (total ischaemic heart disease mortality) and 51% of deaths due to stroke, whereas in India hypertension is directly responsible for 57% of deaths due to stroke and 24% of deaths from coronary heart diseases (CHD).⁴

North-East India is inhabited by various indigenous population groups whose culture and dietary patterns are distinct and closely associated with nature and the environment. This region has great biodiversity and rich in flora and fauna.⁵

The North-East has many varieties of wild foods and animals which are of vital importance for the sustenance of the local people. Over the period of time and also because of availability and accessibility to different foods in all parts of India, this traditional food practices are now vanishing in tribal areas and consumption of junk foods is increasing, leading to increasing prevalence of overweight/obesity.⁶

In West Khasi Hills district, Khasi tribe is predominant and women are the head of households (HHs) with matrilineal system while in Phek district of Nagaland, Chakesang tribe is predominant with patrilineal system. Very few studies are available from North East India on non-communicable diseases such as hypertension. The present study was undertaken to assess prevalence of overweight/obesity and hypertension among women and its associated socio-demographic and economic risk factors in two North-eastern states of India.

2. Methods

2.1. Ethical approval

The study was approved by the Institutional Ethical Review Board of ICMR-NIN, Hyderabad. Written informed consent in local language was obtained from the women participated in the study.

2.2. Study design

A community based cross-sectional study was carried out in two north-eastern states of Nagaland and Meghalaya. One district each from the states was selected (Phek district in Nagaland and West Khasi Hills district of Meghalaya) using random sampling. The study was carried out during May to Aug 2015.

The sample size was calculated by assuming an overall prevalence of hypertension as 24%² among adults, with 20% relative precision and 95% Confidence Interval (CI), a sample size of 438–500 adults was required.

The required sample was collected from 20 villages and 25 women from each village.

The Villages were selected using systematic sampling method and 20 villages were selected. In each selected village, first household was selected randomly and then 25 HHs were covered contiguously. In case the number was not sufficient, adjacent village was covered. An adult woman of 15–49 years of age present in the selected HH at the time of survey was included in the study.

2.3. Data collection

Data was collected on pre-designed and pretested proforma by trained graduate field Workers (Nutritionist/Anthropologist/Social worker) having proficiency in local language. The project staff was trained by scientist & technical staff of National Institute of Nutrition (NIN) in survey methodology and care was taken that there should not be much variation between project and NIN staff. Information on household socio-economic and demographic particulars such as age, sex, education, occupation, type of family, type of house and income of HHs, sanitary latrine etc. was collected from

all the selected households. History of use of added salt (table salt) during food intake was obtained from all the mothers involved in the study.

2.3.1. Anthropometric measurement

Such as height (up to nearest 1 mm using stadiometre) and weight (up to nearest 100 g using SECA weighing scale) was measured on all selected women using standard equipment and procedures.⁷ In addition, waist (WC) and hip circumference (HC) was measured for all women (excluding pregnant women) by the standard procedure using a fibre-re-in-forced non-elastic tape.⁸ Waist circumference (WC) was measured at a point midway between lower rib margin and iliac crest, while hip circumference was measured around the pelvis at the point of maximum protrusion of the buttocks.

2.3.2. Blood pressure measurements

Three measurements of blood pressure (BP) at 5-min interval in sitting position was taken using Omron Digital BP apparatus (Digital Arm BP Monitor HEM-8712, Omron Healthcare India, Pvt. Ltd, Gurgaon, India) on all the adult women covered for nutrition assessment. The women with high BP were referred to the nearest healthcare center or hospital for further investigation/management.

The average of the last two readings was used for classifying subject in different stages of hypertension as per the Joint National Committee (JNC) VII classification⁹ and American Society for hypertension.¹⁰ Information on knowledge and practices about hypertension was also collected.

Knowledge and practices about hypertension was obtained from all the women, its symptoms and signs and if hypertensive, whether they were taking any treatment. Compliance with treatment was also obtained from the women.

2.4. Quality control

NIN staff was present with the investigators throughout the study to check the quality of data collected. Random quality checks were conducted by revisiting HHs to ensure quality data collection.

2.5. Data analysis

Descriptive statistical analyses such as mean and standard deviation were carried out using IBM SPSS Statistics for Windows, Version 19.0 (Armonk, New York: IBM Corp). Association between hypertension as dependant variable and socioeconomic & demographic particulars, and obesity as independent variables were tested using Chi square test. Stepwise logistic regression was done with abdominal obesity and hypertension as dependant and socio-demographic factors as independent variable. Age-standardized prevalence estimates were weighted to the age distribution of the WHO's standard population.¹¹ Age-sex adjusted prevalence was estimated using Census 2011 population.¹

Body mass index (BMI) was calculated as [weight (kg)]/[height (m)²]. Nutritional status was categorized as per classification suggested for Asians.^{12,13} Waist circumference of ≥ 80 cm and waist hip ratio (WHR) ≥ 0.8 were considered for abdominal and truncal obesity.¹⁴

3. Results

3.1. Coverage particulars

A total of 1047 women were covered in the both the states out of which 501 women were from Meghalaya and 546 from Nagaland.

Mean age of the women was 29 ± 4.6 years. Majority (84%) were 18–35 years of age. About 1037 women responded for anthropometric measurements such as height & weight, 940 for waist circumference and 943 for hip circumference measurements.

3.2. Socio-demographic particulars of study subjects

Majority (62%) of women in Meghalaya were living in semi pucca houses, while half of women in Nagaland were living in kutcha house. Majority (90–97.6%) were living in nuclear families, with average family size of 5.1–5.2. Majority (76–80%) adult women were literate. About 61% women from Nagaland and 80% from Meghalaya were housewives. Majority of HH in Nagaland (97%) and Meghalaya (78%) had sanitary latrine facilities. Only 45% HHs in Meghalaya and 69% in Nagaland had access to safe drinking water (tap water), while majority (93–96%) HHs were using firewood for cooking purpose. The per capita income was less than national average (Table 1).

3.3. Food habits, perception about body size and use of additional salt

All the women were non-vegetarian, 40% were consuming non-veg weekly once, 30% were consuming 2–3 times weekly and 98% were eating pork or beef. About 94% were using mustard oil, while 10% each were using soya bean/sunflower oil for cooking. Less than 1% were engaged in physical activities. About 54% stated that they have normal body size and 78% of them want to be like that, while 20% wants to put on the weight. Among the overweight/obese women, 24% stated that they perceived it as normal, 65% stated overweight/obese and 28% had no idea. About 37% stated lean body and 76% wants to put on weight, while 5% stated to be overweight and of them 52% wanted to reduce their weight. About 25% were using additional salt while eating and all of them were aware of consequences of using additional salt.

Table 1
Distribution (%) of HHs according to physical facilities and nutritional status of women.

Particulars	Meghalaya (N = 501)	Nagaland (N = 546)	Pooled
Type of House			
Pucca	3.5	12.8	8.4
Semi pucca	61.7	36.9	48.4
Kutcha	35.6	50.3	43.2
Type of Family			
Nuclear	90.2	97.6	94.0
Extended Nuclear	6.7	2.2	4.4
Joint	3.1	0.2	1.6
Family Size			
1–4	50.5	43.7	47.0
5–8	44.8	52.1	48.6
≥ 9	4.7	4.2	4.5
Average Family Size	5.1	5.2	5.2
Literacy Status of Woman			
Illiterate	24.3	20.0	22.0
1–8 standard	50.7	46.4	48.5
9–12 Standard	25.0	33.6	29.5
Major Occupation of Woman			
Labour + Cultivator	15.4	32.5	24.3
Housewife	80.1	61.1	70.2
Service/business	4.5	6.4	5.5
Sanitary latrine			
Present and in use	77.7	97.1	87.7
Source of drinking water			
Tap/filtered tap water	44.8	69.3	57.5
Type of cooking fuel used			
Firewood	92.8	95.8	94.3
Aver. monthly per capita income Rs.	1051	1847	1554

HHs-households.

3.4. Mean ± SD levels of blood pressure

The mean systolic and diastolic blood pressure is provided in Table 2. The mean BP values were more among 36–49 years women as compared to 18–35 years women.

3.5. Nutritional status & prevalence of hypertension

The overall prevalence of CED was 14% and was more in Meghalaya (18.5%) compared to Nagaland. The prevalence of overweight/obesity (BMI ≥ 23) was 22% (CI = 19.4–24.4) and was more among women from Nagaland (25.9%). Abdominal obesity was observed among 13.5% (CI = 11.4–15.5) of women and was higher among women from Nagaland (16.9%) compared to Meghalaya (9.8%). Truncal obesity (WHR ≥ 0.8) was 65% among women. As per JNC-7 classification, about 28% (CI = 23.9–31.7) women were pre-hypertensive, 7% (CI = 5.8–9.0) had stage I and 4% (CI = 2.4–4.6) had stage II hypertension. The overall prevalence of hypertension was 16% (CI = 13.9–18.3) (Table 3). The age adjusted prevalence was of HTN 18%, while WHO standardized prevalence was 20% among women.

The prevalence of overweight/obesity, abdominal obesity and hypertension was observed high among 36–49 years as compared to younger women (Table 4).

3.6. Association between socioeconomic variables and overweight/obesity, abdominal obesity and hypertension

The prevalence of overweight/obesity was higher among women living in pucca houses, and among women belonging to high socio-economic group, while hypertension was significantly higher among women from with overweight/obesity, abdominal obesity and with truncal obesity. It was observed that the prevalence of HTN was higher (22%) among women using additional salt as compared to those not using additional salt (14%) (Table 4).

Table 2
Mean (SD) values for blood pressure.

Age group		N	Mean	SD	F value
Systolic BP	18-35 Yr	879	111.7	14.5	18.9, p < 0.001
	36-49 Yr	168	117.2	17.7	
	Pooled	1047	112.6	15.3	
Diastolic BP	18-35 Yr	879	76.4	10.4	12.7, p < 0.001
	36-49 Yr	168	79.5	11.5	
	Pooled	1047	76.9	10.6	

BP-blood pressure, SD–standard deviation.

Table 3
Prevalence of overweight/obesity, abdominal obesity and hypertension among women from two NE states.

Particulars	Meghalaya	Nagaland	Pooled
BMI (Asian criteria)			
<18.5 (CED)	18.5	10.0	14.0
18.5–22.99 (Normal)	64.0	64.1	64.1
≥23 (Overweight)	17.5 (14.2–20.8)	25.9 (22.2–29.6)	21.9 (19.4–24.4)
≥25	6.5	11.3	9
Chi-square, p value	21.6, 0.001		
Waist Circumference (cm)			
<80	90.2	83.1	86.5
≥80	9.8 (7.2–12.4)	16.9 (13.7–20.0)	13.5 (11.4–15.5)
Chi-square, p value	10.1, 0.002		
Waist hip ratio			
<0.8	33.9	36.0	35.0
≥0.8	66.1	64.0	65.0
Chi-square, p value	0.40, NS		
Blood pressure (JNC-7)			
Normal	75.3	48.4	61.3
Pre-hypertension	18.3	36.5	27.8
Stage 1 HTN	5.1	9.5	7.4
Stage 2 HTN	1.4	5.5	3.5
Chi-square, p value	20.8, 0.001		
Blood pressure (Old + New)			
Normal	85.1	82.8	83.9
HTN	14.9 (11.8–15.0)	17.2 (14.0–20.4)	16.1 (13.9–18.3)
Chi-square, p value	1.16, NS		
Age adjusted	19.6	17.0	18.2
WHO age standardized	21.3	18.4	19.8

CED-chronic energy deficiency, HTN-hypertension, BMI-body mass index, JNC-Joint National Committee, WHO-World Health Organization, NS-not significant.

3.7. Stepwise logistic regression analysis

It was observed that type of house were significantly associated with overweight/obesity with higher odds among those living in Pucca house (OR: 3.2; CI = 1.83–5.62). Similarly the risk of abdominal obesity was higher among 36–49 years women (OR: 2.2, CI = 1.35–3.46) and women living in pucca houses (OR 4; CI 2.24–7.30). The risk of abdominal obesity was higher among literate women (1–8th class) (OR 1.8; CI = 1.02–3.19) and those studied more than secondary education (2.26; CI = 1.25–4.09). The risk of hypertension was also higher among 36–49-year women (OR 2.7; CI = 1.80–4.02) as compared to the younger women and among women with overweight/obesity (OR 2.10, CI = 1.14–3.88). Use of additional (table) salt was observed to be associated with HTN with odds of 1.86 (CI = 1.27–2.72) among those using additional salt while eating.

3.8. Knowledge and practices about hypertension

It was observed that only 30.5% of adult women were aware of hypertension, and most of them were aware of symptoms of hypertension such as headache and giddiness. About 6% had history of hypertension and of them, 82% were on treatment and all of them

had controlled BP. About 17% women were using smokeless tobacco, and 1.4% were consuming alcohol. No association was observed between use of smokeless tobacco and prevalence of HTN (17% vs 16%).

4. Discussion

The present study was undertaken in two Northeastern states of India, to assess prevalence of overweight/obesity and its associated socio-economic & demographic risk factors. No difference in the prevalence of HTN was observed among women from these states. The prevalence of overweight/obesity (BMI≥23) and hypertension was 26% and 17% among women from Nagaland as compared to 18% & 15% in Meghalaya. The prevalence was more among 36–49 years women and hypertension was associated with obesity and use of additional salt (table) while overweight/obesity was associated with type of house and education of women.

National Family Health Survey (NFHS-4) in Phek district of Nagaland and West Khasi Hills district of Meghalaya showed that the prevalence of overweight/obesity was 12% & 8% (BMI>25) which is similar to our study (11% & 7% respectively as per BMI≥25), while hypertension was 21% in Phek district of Nagaland which is more than the present study, while it was 8% in West Khasi Hills

Table 4
Association of CED, overweight/obesity, abdominal obesity and hypertension with age groups and other socio-demographic variables.

Particulars	Age (Yrs)	N	CED BMI<18.5	Overweight BMI≥23	Abdominal obesity (>80 cm)	HTN
18-35		880	14.3	21.3	12.1	13.6
36-49		167	12.0	26.3	20.0	29.3
Pooled		1047	14.0	22.1	13.5	16.2
Chi-square, p value			2.38, NS		6.78, 0.001	26.4, 0.001
Type of house						
Pucca		88	8.0	43.2	32.5	13.5
Semi Pucca		506	14.6	20.1	12.3	14.8
Kutchra		453	14.6	19.9	10.8	18.4
Chi-square, p value			25.7, 0.001		27.0, 0.001	2.87, NS
Type of family						
Nuclear		985	14.3	21.8	13.6	16.4
Ext nuclear		45	10.9	26.1	10.0	13.0
Joint		17	5.9	17.6	0.0	11.8
Chi-square, p value			2.12, NS		2.38, NS	0.62, NS
Family Size						
1-4		490	14.5	19.4	12.0	13.5
5-8		511	13.5	23.9	14.1	18.0
≥ 9		46	15.2	28.3	18.2	25.5
Chi-square, p value			4.32, NS		1.74, NS	6.93, 0.03
Literacy status						
Illiterate		229	13.0	19.6	8.8	16.4
1-8th class		509	14.0	22.0	13.0	16.8
≥9th class		309	14.9	23.7	17.1	15.1
Chi-square, p value			2.11, NS		7.47, 0.02	0.45, NS
Occupation						
Cultivation		254	13.7	22.0	14.3	18.4
Service		58	13.8	25.9	21.1	22.0
HW		732	14.2	21.8	12.3	14.9
Chi-square, p value			0.55, NS		3.72, NS	3.22, NS
Per capita income (quartile)						
1st quartile		261	15.9	18.2	13.0	19.0
2nd quartile		280	17.3	18.1	10.4	16.0
3rd quartile		249	12.2	25.2	12.8	15.8
4th quartile		257	10.4	27.0	17.2	14.1
Chi-square, p value			13.96, 0.03		5.06, NS	2.41, NS
Use of additional salt (Table)						
Yes		262	18.9	17.4	11.9	21.7
No		785	12.3	23.7	13.9	14.4
Chi-square, p value			9.64, 0.01		0.60, NS	7.98, 0.005
Nutritional status					Normal	HTN
BMI		N		%		
<18.5		142		88.2		11.8
18.5–22.9		655		84.5		15.5
≥23.0		226		79.0		21.0
Chi-square, p value						6.08, 0.05*
WC						
Normal		806		84.0		16.0
Abdominal obesity		126		74.6		25.4
Chi-square, p value						6.72, 0.01*
WHR						
Normal		323		85.9		14.1
Obesity		606		80.9		19.1
Chi-square, p value						3.74, 0.05*

CED-chronic energy deficiency, HTN-hypertension, BMI-body mass index, NS-not significant.

CED-chronic energy deficiency, HW: Housewife, BMI-body mass index, WC-waist circumference WHR-waist hip ratio.

HTN-hypertension, *p < 0.05.

district of Meghalaya which is lower than the present study.¹⁵ Study carried out by Borah et al among Hill tribe of Mizoram reported 12% prevalence of HTN (JNC 7 criteria) which is similar to our study.¹⁶

Meshram et al reported 28% (BMI ≥ 23) prevalence of overweight/obesity (15% among 18–49 years as per WHO) which is higher and 18% prevalence of hypertension among women from rural North-East India (14% among 18–49 years) (Arunachal & Meghalaya) which is similar to present study.¹⁷ Although high BMI is considered as risk factor for HTN, however 12% undernourished women had HTN and may be due to increased oxidative stress¹⁸ due to reduced bioavailability of nitric oxide as a result of chronic

micronutrient deficiency. Similar findings were also reported by others.^{19,20}

Study carried out by National Nutrition Monitoring Bureau survey (NNMB) (2009)² in tribal areas in 9 states of India reported 9% prevalence of overweight/obesity (BMI≥25), 22% (as per BMI≥23), while prevalence of hypertension was 17% among tribal women aged 20–49 years which is similar to present study. The prevalence of hypertension observed in this study is low as compared to rural areas (23%) of India (NNMB 2012)²¹ due to elderly women being involved in analysis.

Chakma et al in their study among Tribal population of Mandla district, Madhya Pradesh reported 23.6% prevalence of

hypertension among women.²² This high prevalence may be due to inclusion of elderly women and also urban areas in the study. A study by Raina SK et al among tribal of Himachal Pradesh observed 6% prevalence of hypertension among women which is lower than the present study.²³

Bhardwaj et al in tribal village of Himachal Pradesh observed 18% prevalence of HTN among tribal (17% among women) which is similar to present study.²⁴ About 23% were aware of HTN and only 0.8% were controlled for HTN.

The prevalence observed in the present study is lower than that observed in urban areas and rural areas of India.²⁵

The prevalence of Pre-hypertension observed in the present study was lower than that reported in NNMB study (40.5%) among 20–49 years women, while it is more than other studies.^{18,22}

It was observed that blood pressure increases as the age advances and is higher among middle aged women, which is similar to other studies.^{15–17,25} As age advances, blood vessels become stiff and thus increases blood pressure with advancing age. Therefore, regular check-up of blood pressure is recommended after 40 years of age for early detection and prompt treatment to prevent further complications.

The odds of HTN was more among 36–49 years women, women with overweight/obesity and those using additional salt, which is similar to other studies.^{15,16,26} Chakma et al observed 1.5 times higher odds of hypertension among those using table salt.²²

Kandpal et al in their study observed higher risk of hypertension, overweight and abdominal obesity among >35 years of individual compared to 20–34 years.²⁷

The awareness about hypertension was observed low among women although 18% were suffering from hypertension. Also, treatment seeking behavior was observed only in half of the known hypertensive. This shows that education about symptoms/signs of hypertension and for early detection & regular treatment needs to be improved through health education to the population. Hypertension is one of the important causes for cardiovascular diseases and mortality, its early detection, lifestyle modification through behavior change communication and prompt treatment top control further complication is very important.

5. Conclusion & recommendation

The prevalence of overweight and hypertension although low than national average, but is increasing among women from North-east India and immediate intervention is needed to improve awareness about the disease and for early diagnosis and treatment. Program should be focused on information, education and communication (IEC) about change in behavior and increased health seeking behavior in order to control further complications.

Authors contribution

IIM was involved in study design, drafting the manuscript, Naveen kumar helped in analysing data and Mr. Longvah & Naveenkumar critically reviewed the manuscript.

Funding

The study was funded by Bio-varsity International, ROME & North East Slow Food & Agro-biodiversity society, Shillong.

Declaration of competing interest

There is no conflict of interest.

Acknowledgments

The authors are thankful to Director, NIN Hyderabad for support during the study. We would like to thank all technical staff of Division for the technical support. We are thankful to Mr. Bhaskar for his help in analysing data. Our sincere thanks to all the field staff involved in data collection for their sincere efforts.

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