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Original Article

Behavioural risk factors distribution of cardiovascular diseases and its association with normotension, prehypertension and hypertension amongst tea garden population in Dibrugarh district of Assam

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ABSTRACT

Problem considered: The burden of cardiovascular diseases (CVD) in India is increasing at an alarming rate for the last few decades.

Aims: To assess the distribution of behavioural risk factors of CVDs and its association with normotension, prehypertension and hypertension among tea garden population in Dibrugarh District of Assam.

Methods: A community-based cross-sectional study using the World Health Organizations (WHO) Stepwise methodology. A multistep random sampling was done to include adults aged 35 years and above. Data was collected using a pretested and predesigned questionnaire and blood pressure was recorded. Statistical analysis was done using proportions, chi-square test and multiple logistic regression (MLR) analysis.

Results: Prevalence of hypertension was 44.8% (551) with 481 (39.1%) being pre hypertensive. Prevalence of tobacco use was 1107 (89.9%) with 1049 (85.2%) being current users while alcohol use was 858 (69.7%). Inadequate intake of green leafy vegetables (≤ 3 servings/week) was found in 807 (65.6%) and fruits in 1210 (98.3%). Weekly intake of high energy food was found in 176 (58.66%) while added salt intake in 758 (61.6%), Physical inactivity (mainly sedentary) in 339 (27.5%). MLR analysis showing significant association between educational status, stress, high energy food, tobacco use, alcohol, overweight/obesity and diabetes with prehypertension and physical activity, high energy food, tobacco use, alcohol, extra salt and diabetes with hypertension.

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Conclusions: The study revealed high prevalence of various risk factors. There is a need to reduce the risk factor prevalence of CVD to address the future epidemic of non-communicable disease amongst this group.

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1. Introduction

Cardiovascular diseases (CVDs) is predicted to increase substantially by year 2020 due to rising rates of hypertension, dyslipidemia, diabetes, obesity, physical inactivity and tobacco use.^{1,2} In India CVD is projected to be largest cause of death and disability by 2020.³ Earlier, increased prevalence of CVDs was experienced in developed countries but now it is increasing in developing countries like India because of the epidemiological transition and adoption of western life-style like low physical activity, high energy food and substance abuse like tobacco and alcohol.⁴ The focus of epidemiologists and clinicians involved in hypertension has so far been on individuals with increased BP. Population-based, prospective observational studies have reported a continuous and graded relationship of BP with cardiovascular events and mortality.⁵ A systolic BP <120 mm Hg is considered ideal, with each 10 mm Hg increase in BP above this being accompanied by a 10% greater risk of cardiovascular events and mortality.⁵

Environmental, lifestyle, and clinical determinants of prehypertension (systolic/diastolic BP 120–139/80–89 mm Hg), stage I hypertension (BP 140–159/90–99 mm Hg), and stage II hypertension (>160/>100 mm Hg) have been identified. Clinicians have developed management strategies to decrease elevated BP through population-based interventions, as well as lifestyle modifications at the individual level and pharmacological methods.^{6,7}

Tea-garden workers are a distinct occupational group who migrated to Assam about a century ago from different states of India to work as tea leaf pickers and have been residing within tea-estates. They are known to have more predictable incomes and a high CVD risk factor prevalence (tobacco use 83.3%; hypertension varies from 27.7% to 63.3%; diabetes 2.3%; obesity 0.39%).^{8,9} Further, they are also known for their higher daily salt consumption (dietary salt intake 20 g or more), believed to be a key reason for hypertension in this community.¹⁰ Although many previous studies have suggested tea-garden workers to be a special population “sub-group” at high CVD risk, while it is likely that tea-garden workers continue to have high risk factor levels or lifestyle changes might have bridged epidemiologic differences. There is a need to assess CVD risk and its associations with diet, body fat and physical activity to know the current status amongst tea garden population. Hence this study was conducted with the objective of assessing the prevalence of behavioural risk factors of CVDs and its association with hypertension and prehypertension.

2. Materials and methods

2.1. Setting

This study was carried out in Dibrugarh district, of Assam, north-eastern India. The district is spread over more than 3000 square km and is populated by about 1.2 million individuals (0.9 million rural, 0.3 million urban). About 23% of the entire population work in 144 tea gardens located in the district, and some of these gardens are also located in urban areas. There are a total of 1362 villages situated in 231 health sub-centres of the district. In urban areas, there are 96 electoral blocks. A total of 169 rural sub-centres (73%) and 11 urban electoral blocks (11%) have tea gardens.¹¹

2.2. Ethics statement

The study protocol was approved by the institutional ethics committee of Assam Medical College, and necessary permissions were obtained in addition from the Joint Director of Health Services and the Assam Branch of the Indian Tea Association. After explaining study procedures, a written Informed consent was sought from all eligible participants, and those consenting were included in the study. If a participant could not read or write, verbal information was provided, and consent was recorded as a thumb impression in the presence of two impartial witnesses. The surveys were preceded by meetings with community leaders to ensure community-wide participation.

2.3. Design

A cross-sectional study was conducted with multistep sampling to select a representative population (rural–urban tea-garden) from the district. In the first stage the list of sub centres having tea estates were enlisted from which four rural and two urban sub centres were selected using computerised random numbers. From the list of eligible population from the tea estates of selected sub centre area the required sample of population were included for study.

2.4. Study participants

All adults living in tea estates, aged 35 years or more, on the electoral lists of their area were eligible for inclusion. The goal was to include a representative sample of such adults from those administrative units (rural sub centres or urban electoral blocks) in the district that had at least one tea garden. From the list of such units, a total of four sub-centres and two electoral blocks were randomly selected. Furthermore, from these

administrative units, electoral lists of all adults living in tea estates aged 35 years or more ($n = 2379$) were used, and 1200 respondents from four rural sub-centres (300 from each) and 300 from the two urban electoral blocks (150 from each) were randomly selected. Of the selected and eligible 1500 individuals, 1231 (82.07%) consented for participation in the study. From the random list of participants enrolled in the first two stages of the study, the first 20% of consecutive participants were invited to join the third stage of the study where sample collection was carried out at the nearest health facility to their village on a holiday so that all could participate in the laboratory based survey.

2.5. Study procedures

The World Health Organizations (WHO) STEPS questionnaire, translated into the local language, was used to collect information in three stages.¹² First, socio-demographic information was collected at households; secondly, the risk factor questionnaire was administered and physical measurement was performed; thirdly, biochemical measurements were obtained from 20% of the total sample. Salt intake was assessed using a 24-h dietary recall. Cumulative salt intake was estimated by adding the estimated salt content of prepared food and beverages (especially salty tea offered at work places for tea-leaf pickers). The person in the household responsible for cooking was asked regarding the use of salt; it was estimated that about a spoonful of salt was used in each meal. Since one levelled standard spoon equals 5 g of salt, the product of the number of spoonsful plus standard weight was the total salt consumed by the family.¹³ Assuming equal salt use by each member, per-capita salt used was estimated as total salt use divided by total family members. Monthly salt consumed by the family was used for triangulation of data.

All the equipment used to measure height, weight, waist and hip circumference and blood pressure were similar at all the centres to ensure uniformity. Height was measured using a stadiometer (to nearest 0.1 cm), weight using calibrated spring weighing machines (to nearest 0.5 kg), waist and hip were measured using non-stretchable tapes (to nearest 0.1 cm) and blood pressure using the Omron SDX (Omron, Inc., Japan) instrument. Standard protocols were used to obtain these measurements. In the third step, fasting blood sugar and lipids were estimated from collected blood sent to the Biochemistry Laboratory of Assam Medical College. Blood sugar, cholesterol, high density lipoprotein (HDL) cholesterol and triglyceride levels were measured using enzyme-based assays. Values of low density lipoprotein (LDL) cholesterol, non-HDL cholesterol and the ratio of total HDL cholesterol were calculated using standard formulae. Diagnostic criteria were used for tobacco use, as well as other coronary risk factors, as specified by WHO.¹² Individuals involved in any significant physical activity at work or during leisure time were classified as active and those with >30 min of activity were classified as moderately active. Hypertension was diagnosed when systolic BP was >140 mmHg and/or diastolic BP >90 mmHg or a person was a known hypertensive. Overweight or obesity was defined as BMI >25 kg/m².¹⁴ Truncal obesity was diagnosed when waist-to-hip ratio (WHR) was >0.95 in men and >0.85 in women or waist circumference was >100 cm in men and >90 cm in

women according to the United States National Cholesterol Education Program (NCEP) guidelines.¹⁵ Dyslipidemia was defined by the presence of high total cholesterol (>200 mg/dl), high LDL cholesterol (>130 mg/dl), low HDL cholesterol (<40 mg/dl in men and <50 mg/dl in women) or high triglycerides (>150 mg/dl) according to the International Diabetes Federation. Diabetes was diagnosed on the basis of either a history of known diabetes or fasting glucose >126 mg/dl.

2.6. Statistical analysis

The data were entered using Epidata, and analysed using SPSS. Prevalence odds were determined to quantify the risk among tea-garden workers. The sample size of 1003 was a priori estimated taking prevalence of hypertension amongst tea-garden workers as 27.7% with 10% relative precision and 95% confidence interval.⁸

3. Results

A total of 1231 individuals participated in the study with a mean age of 46.07 ± 10.26 years. Majority of the studied population were below 45 years age group. A total of 988 (80.3%) participant in the study was illiterate and only 19.7% (243) were literate, in literacy status 83.1% (202) had education up to middle school certificate. The occupational profile of study participants showed that 701 (56.9%) were tea plucker, 257 (20.9%) were manual wage earner, 122 (9.9%) were manual skilled worker, 9 (0.7%) were business and only 1 (0.1%) professional works while 141 (11.5%) were unemployed (Table 1).

Tobacco use was 1107 (89.9%) with 1049 (85.2%) being current users while alcohol use was 858 (69.7%). Inadequate

Table 1 – Demographic profile of the study participants.

Variables	N	Percentage
Age (in years)	35–<45	635
	45–<55	348
	55–<65	162
	65 Above	86
Religion	Hindu	1221
	Christian	9
	Muslim	1
Education level	Illiterate	988
	1–8	202
	9–12	29
	Trade school	5
	College/University	7
Occupation status	Professional	1
	Business	9
	Manual skilled	122
	Non-manual skilled	701
	Manual labour	257
	Unemployed	141
Marital status	Unmarried	20
	Married	937
	Others	274
Owned home	Yes	1174
	No	57

Table 2 – Prevalence of behavioural risk factors of cardiovascular diseases and their association with blood pressure.

Risk factors		Prevalence rate of risk variables	Blood pressure			χ^2 Value	p Value
			Normal (n = 199)	Prehypertension (n = 481)	Hypertension (n = 551)		
Tobacco use	Never used	124 (10.1%)	43 (34.7%)	42 (33.9%)	39 (31.5%)	42.636	0.000
	Formerly used	58 (4.7%)	14 (24.1%)	15 (25.9%)	29 (50.0%)		
	Currently use	1049 (85.2%)	142 (13.5%)	424 (40.4%)	483 (46.0%)		
Alcohol use	Present	858 (69.7%)	91 (10.6%)	312 (36.4%)	455 (53.0%)	102.732	0.000
	Absent	373 (30.3%)	108 (29.0%)	169 (45.3%)	96 (25.7%)		
Physical activity	Mainly sedentary	339 (27.5%)	86 (25.4%)	107 (31.6%)	146 (43.1%)	79.515	0.000
	Mainly walking, including climbing stairs	270 (21.9%)	44 (16.3%)	133 (49.3%)	93 (34.4%)		
	Predominately walking on one level	267 (21.7%)	54 (20.2%)	89 (33.3%)	124 (46.4%)		
Leisure time activity	Heavy physical labour	355 (28.8%)	15 (4.2%)	152 (42.8%)	188 (53.0%)	40.646	0.000
	Mainly sedentary	135 (11.0%)	25 (18.5%)	30 (22.2%)	80 (59.3%)		
	Mild exercise	225 (18.3%)	51 (22.7%)	64 (28.4%)	110 (48.9%)		
Added salt	Moderate exercise	871 (70.8%)	123 (14.1%)	387 (44.4%)	361 (41.4%)	8.702	0.013
	Taken	758 (61.6%)	118 (15.6%)	276 (36.4%)	364 (48.0%)		
Green leafy vegetables intake	Not taken	473 (38.4%)	81 (17.1%)	205 (43.3%)	187 (39.5%)	1.816	0.403
	<3 times/week	807 (65.6%)	137 (17.0%)	306 (37.9%)	364 (45.1%)		
Fruits intake	>3 times/week	424 (34.4%)	62 (14.6%)	175 (41.3%)	187 (44.1%)	2.116	0.347
	<3 times/week	1210 (98.3%)	195 (16.1%)	476 (39.3%)	539 (44.5%)		
High energy food including snacks	>3 times/week	21 (1.7%)	4 (19.0%)	5 (23.8%)	12 (57.1%)	8.874	0.012
	<3 times/week	1204 (97.8%)	189 (15.7%)	473 (39.3%)	542 (45.0%)		
Stress	>3 times/week	27 (2.2%)	10 (37.0%)	8 (29.6%)	9 (33.3%)	18.048	0.000
	Little/none	505 (41.0%)	95 (18.8%)	162 (32.1%)	248 (49.1%)		
	Moderate/severe	726 (59.0%)	104 (14.3%)	319 (43.9%)	303 (41.7%)		

intake of green leafy vegetables (≤ 3 servings/week) was found in 807 (65.6%) and fruits in 1210 (98.3%). Weekly intake of high energy food was found in 176 (58.66%) while added salt intake was found in 758 (61.6%). Physical inactivity (mainly sedentary) was found in 339 (27.5%) while 135 (11.0%) reported mainly sedentary habits during leisure time activity. Prevalence of hypertension was 44.8% (551) with 481 (39.1%) being pre hypertensive.

Association of hypertension with various risk factors is shown in Table 2. While tobacco consumption, alcohol use, physical activity, leisure time activity, stress, and added salt intake were found to be significantly associated with hypertension ($p < 0.05$), no significant association was seen with less intake of fruits and vegetables (Table 2).

Multiple logistic regression analysis showing significant association between educational status, physical activity, stress, high energy food, tobacco use, alcohol, extra salt and diabetes with prehypertension and educational status, physical activity, high energy food, tobacco use, alcohol, extra salt and diabetes with hypertension (Table 3).

4. Discussion

This study was a community based cross-sectional study showed low prevalence of ideal blood pressure (normotensive) and high prevalence of prehypertension and hypertension. In subjects with prehypertension and hypertension there is significantly greater clustering of multiple cardiovascular risk factors. In our study, ever tobacco use was reported by 89.9% out of which 85.2% were currently using tobacco products.

Tobacco consumption was found to be significantly associated with hypertension ($p = 0.000$). Alcohol consumption was reported by 69.7% and it was also significantly associated with hypertension ($p = 0.000$). Regarding dietary habit, 61.6 per cent of the tea garden population were taking extra salt and there was significant association between salt intake and hypertension ($p = 0.013$). Similar findings have been reported in studies across the globe.^{16,17} Given that many CVD risk factors track through adolescence and into adulthood, it is vital that CVD risk be assessed as children progress through puberty and into early adulthood. There is a need to reduce the risk factor prevalence of CVD to address the future epidemic of non-communicable disease amongst this group of population. It is generally agreed that stress aggravates blood pressure and pre disposes the individual to develop hypertension.¹⁸ Taking this as a risk factor, in the present study, moderate to severe stress was found in 59 per cent of the tea garden population and it was significantly associated with hypertension ($p = 0.000$). However, stress was elicited through the oral questionnaire which may have subjective error and hence, a limitation of this study.

This study reinforces the need to urgently address the problem of hypertension amongst tea tribe population with established approaches to public and individual health and should be taken as a corporate sector responsibility by tea garden management. From this study, it is seen that prevalence of behavioural risk factors of cardiovascular diseases was quite high among this group population. Different health promotional activities can be implemented with implementation research for better evidence generation beginning at an early age.

Table 3 – Lifestyle and risk factor associations of prehypertension and hypertension compared to normotensive (logistic regression analysis).

Variables	Blood pressure status	B	Wald	OR (95% CI)	p-Value
Education status (<10 years vs. >10 years)	Normal			1	
	Prehypertension	0.525	5.25	1.69 (1.07–2.65)	0.022
	Hypertension	0.485	4.297	1.62 (1.02–2.56)	0.038
Physical activity (inactive vs. active)	Normal			1	
	Prehypertension	0.612	11.951	0.54 (0.38–0.76)	0.001
	Hypertension	1.104	38.120	0.33 (0.23–0.47)	0.000
Stress (little/none vs. moderate/severe)	Normal			1	
	Prehypertension	0.567	10.815	1.76 (1.25–2.47)	0.001
	Hypertension	0.196	1.348	1.21 (0.87–1.69)	0.246
Low fruits/<(3 vs. >3 times/week)	Normal			1	
	Prehypertension	0.610	0.810	0.54 (0.14–2.05)	0.368
	Hypertension	0.080	0.018	0.92 (0.28–2.94)	0.893
Vegetables intake (<2 vs. >3times/week)	Normal			1	
	Prehypertension	0.214	1.402	0.81 (0.56–1.15)	0.236
	Hypertension	0.211	1.365	0.81 (0.56–1.54)	0.243
High energy food including snacks	Normal			1	
	Prehypertension	1.143	5.609	0.32 (0.12–0.82)	0.018
	Hypertension	1.149	5.849	0.32 (0.12–0.81)	0.016
Smoking and/or tobacco use	Normal			1	
	Prehypertension	1.107	27.439	3.02 (2.00–4.57)	0.000
	Hypertension	1.004	23.656	2.73 (1.82–4.04)	0.000
Alcohol user	Normal			1	
	Prehypertension	0.775	20.379	2.17 (1.55–3.03)	0.000
	Hypertension	1.769	91.692	5.86 (4.08–8.41)	0.000
Extra salt	Normal			1	
	Prehypertension	1.069	21.89	2.91 (1.86–4.55)	0.000
	Hypertension	1.102	24.744	3.01 (1.95–4.64)	0.000
Overweight/obesity (BMI ≥ 25 kg/m ²)	Normal			1	
	Prehypertension	0.467	3.295	0.62 (0.37–1.03)	0.069
	Hypertension	0.222	0.883	1.24 (0.78–1.98)	0.347
Risk factors					
High cholesterol (≥200 mg/dl)	Normal			1	
	Prehypertension	0.564	1.610	1.75 (0.73–4.19)	0.204
	Hypertension	0.216	0.224	1.24 (0.51–3.04)	0.636
High triglycerides (≥150 mg/dl)	Normal			1	
	Prehypertension	0.531	1.773	1.70 (0.77–3.71)	0.183
	Hypertension	0.236	0.409	1.26 (0.56–2.82)	0.655
Diabetes	Normal			1	
	Prehypertension	1.619	4.293	5.05 (1.09–23.36)	0.038
	Hypertension	1.624	4.158	5.07 (1.06–24.16)	0.041

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Conflicts of interest

All authors have none to declare.

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